MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR

Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Re-accredited with 'B+' by NAAC

CRITERION - 1

CURRICULAR ASPECTS

1.3.1 Integration of crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability in Transacting the Curriculum

2017 - 2022

INDEX

LIST OF COURSES ADDRESSING ISSUES RELEVANT TO PROFESSIONAL ETHICS, GENDER, HUMAN VALUES, ENVIRONMENT AND SUSTAINABILITY INTO THE CURRICULUM

DEPARTMENT	NAME OF THE COURSE	CODE
PROFESSIONAL ETHICS		
ENGLISH	Harmony of Prose	EN3CR03
HISTORY	Methods in Archaeology	HY1VOT14
ZOOLOGY	General methodology and perspectives in science	ZY1B01U
	Occupational Zoology	ZY6CRT12
	General perspectives in science and protistan diversity	ZY1CRT01
	Genetics and Biotechnology	ZY6B10U
	Biotechnology, bioinformatics and molecular biology	ZY6CRT11
	Biodiversity and modern systematics	ZY2B02U
	Reproductive and Developmental Biology	ZY6B09U
	Research methodology, biophysics and biostatistics	ZY4CRT04
	General methodology and perspectives in science practical	ZY1B01U (P)
	Evolution, Ethology & Zoogeography Practical	ZY6CRP04
M SC ZOOLOGY	Biostatistics Computer application and research methodology	ZY1CT04
	Biostatistics and research methodology	ZL010104
	Microbiology and biotechnology	ZL010204
INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS	Communication Skills in English	IEN1CC01
B. VOC TOURISM AND HOSPITALITY MANAGEMENT	Soft Skills and Personality Development	BOCG401
	Entrepreneurship Development	BOCG601
	Tourism Ethics, Laws and Regulations	TH4GT02
	Event Management	TH4ST04
	Principles of Management	BOCG301
	Meet and Greet Service	TH2ST05
	Bioenergy	RETTG403
	Energy Conservation Techniques	RETTS503

B.VOC RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT	Industrial Health and Safety	RETTG504
	Energy Management and Auditing	RETTG602

GENDER		
ENGLISH	Women Writing	EN6CR11
	Literary Criticism and Theory	EN5CR08
	Harmony of Prose	EN3CR03
	Methodology for Studying Literature	EN1CR01
	Literature and /as Identity	EN3CC05
	Pearls from the Deep	EN1CC02
HINDI	Poetry Grammar and Translation	HN3CCT03
	Prose and One Act Play	HN1CCT01
	Short Stories and Novel	HN2CCT02
	Drama and Long Poem	HN4CCT04
	Prose and Mass media	HN1CCT01
MALAYALAM	Poetry	ML2CCT02
	Poetry and Drama	ML2CCT08
	Prose	ML4CCT04
ZOOLOGY	Developmental Biology	ZY6CR09
INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS	Short Stories, Poetry and Biography	IML2CC01
	Short Stories and Poems	IHN2CC01
B. VOC TOURISM AND HOSPITALITY MANAGEMENT	Entrepreneurship Development	BOCG601
B. VOC RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT	Project Management and Entrepreneurship	BRCTG601

HUMAN VALUES		
ENGLISH	Environmental Studies and Human Rights	EN5CREN01
	Women Writing	EN6CR11
	Harmony of Prose	EN3CR03
	Literature and /as Identity	EN3CC05
	Illuminations	EN4CC06
B. COM FINANCE AND TAXATION	Environment Management and Human Rights	CO5CRT15
HINDI	Poetry Grammar and Translation	HN3CCT03
	Prose and One Act Play	HN1CCT01
	Short Stories and Novel	HN2CCT02
	Drama and Long Poem	HN4CCT04
	Prose and Mass media	HN1CCT01
MALAYALAM	Poetry and Drama	ML2CCT08
CHEMISTRY	Environment Ecology and Human rights	CH5CRT05
PHYSICS	Environmental Physics and Human Rights	PH5CRT08
MATHEMATICS	Environmental Mathematics and Human Rights	MM5CRT04
ZOOLOGY	Environmental biology and human right	ZY5CRT05
	Nutrition, Health and Lifestyle Management	ZY6CBT04
	Developmental Biology	ZY6CR09
INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS	Short Stories, Poetry and Biography	IML2CC01
	Short Stories and Poems	IHN2CC01
	Environmental Physics and Human Rights	IPH5CR01
B. VOC TOURISM AND HOSPITALITY MANAGEMENT	Human Resource Management	TH5GT03
	Principles of Management	BOCG301
	Meet and Greet Service	TH2ST05

ENVIRONMENT AND SUSTAINABILITY		
ENGLISH	Environmental Studies and Human Rights	EN5CREN01
	Harmony of Prose	EN3CR03
HISTORY	Introduction to Archaeology	HY1VOT13
B. COM FINANCE AND TAXATION	Environment Management and Human Rights	CO5CRT15
HINDI	Prose and One Act Play	HN1CCT01
	Short Stories and Novel	HN2CCT02
	Drama and Long Poem	HN4CCT04
	Prose and Mass media	HN1CCT01
MALAYALAM	Poetry	ML2CCT02
	Poetry and Drama	ML2CCT08
CHEMISTRY	Environment Ecology and Human rights	CH5CRT05
	Chemistry in Everyday Life	CH5OPT01
	Organic Chemistry III	CH5CRT06
PHYSICS	Environmental Physics and Human Rights	PH5CRT08
	Physics in daily life	PH5OPT02
MATHEMATICS	Environmental Mathematics and Human Rights	MM5CRT04
ZOOLOGY	Environmental biology and human right	ZY5CRT05
	Occupational Zoology	ZY6CRT12
	Environmental biology, toxicology and disaster management	ZY5B06U
	Evolution, Ethology & Zoogeography	ZY5CRT07
	Biotechnology, bioinformatics and molecular biology	ZY6CRT11
	Biodiversity and modern systematics	ZY2B02U
	Reproductive and Developmental Biology	ZY6B09U
	Biodiversity and modern systematics practical's	ZY2B02U (P)
	Environmental biology, toxicology and disaster management (Practical)	ZY5B06U(P)
	Environmental biology and toxicology (Practical)	ZY6CRP03

	Evolution, Ethology & Zoogeography Practical	ZY6CRP04
M SC ZOOLOGY		
	Field Ecology	ZL010201
	Ecology, principles and practices	ZY2CT06
INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS	Short Stories, Poetry and Biography	IML2CC01
	Short Stories and Poems	IHN2CC01
	Environmental Physics and Human Rights	IPH5CR01
B. VOC TOURISM AND HOSPITALITY MANAGEMENT	Environmental Studies	BOCG501
B.VOC RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT	Fundamentals of Sustainable Energy and Development	RETTS104
	Water and Waste Water Treatment	RETTG301
	Waste to Energy Conversion Systems	RETTG402
	Bioenergy.	RETTG403
	Energy Storage Systems	RETTS404
	Environmental Studies	RETTG501
	Material Science for Energy Applications	RETTG502
	Energy Conservation Techniques	RETTS503
	Industrial Health and Safety	RETTG504
	Energy Management and Auditing	RETTG602

ADDITIONAL COURSES ADDRESSING PROFESSIONAL ETHICS, GENDER, HUMAN VALUES AND ENVIRONMENT AND SUSTAINABILITY

DEPARTMENT/ INSTITUTION	NAME OF THE COURSE	CODE
PROFESSIONAL ETHICS		
BY THE INSTITUTION	Tailoring	MTCTOR
	Diploma in Computer Application (DCA)	MTCDCA
	Herbal bathing soap making	MTAHBM
	Energy Audit	MTCEA
GENDER		
BY THE INSTITUTION	Tribal Ethnography in India	MTCTEI
HUMAN VALUES		
BY THE INSTITUTION	Nutrition and Dietetics	MTCND
ENVIRONMENT AND SUSTAINABILITY		
BY THE INSTITUTION	Solar Energy Technology	MTCSET
	Green Accounting in Digital Era	MTCGDE

PROFESSIONAL ETHICS

I. DEPARTMENT OF ENGLISH

MAHATMAGANDHIUNIVERSITY

SYLLABIFORCORECOURSES-UGPROGRAMMES

2017ADMISSIONSONWARDS

COURSE3–HarmonyofProse

Course Code	EN3CRT03
Title of the course	HarmonyofProse
Semesterinwhichthecourseistobe taught	3
No. of credits	4
No. of contact hours	90

AIMOFTHECOURSE

The student is given space to maturein the presence of glorious essays, both Western and Non-Western.

OBJECTIVESOFTHECOURSE

On completion of the course, the student shall be:

1. familiarwith varied prose styles of expression.
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSEOUTLINE

Module1 **(18hours)**

Francis Bacon: Of Friendship

Jonathan Swift: TheSpider and the Bee

Joseph Addison: Meditations in WestminsterAbbey

Module2 **(18hours)**

Samuel Johnson: Death of

DrydenCharlesLamb: Dream Children; a

reverie

William Hazlitt: The Fight

Module3 **(18hours)**

Robert Lynd:Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley:The BeautyIndustry

Module4 **(18hours)**

Nirad C. Choudhari: Indian Crowds (extract from *TheAutobiographyofanUnknownIndian*)

AmartyaSen: Sharingthe World

A. K. Ramanujan: A FloweryTree: A Woman'sTale

Module5

(18hours)

KamauBrathwaite: NationLanguage

PicoIyer:In Praise of the Humble Coma

William Dalrymple: TheDancer of Kannur (extract from*NineLives*)

CoreText:*HarmonyofProse*

II. DEPARTMENT OF HISTORY

Semester II

HY1VOT14 - Methods in Archaeology

ModuleI - Exploration and Excavation Methods

Exploration Methods – Manual and Scientific(Field trips can be organized)

Excavation Methods- Vertical, Horizontal and Quadrant

Module II Archaeological Recording

(a) Archaeological Recording

(b) Staff and Equipment for Excavation

(c) Documentation

(d) Publication of the Excavation report

Module III Dating Methods

a) Introduction to Relative dating methods- Seriation,Typology, Stratigraphy

b) Introduction to Absolute dating methods- C-14 Dating, Termoluminescence (TL dating), Dendro chronology, Potassium-Argon, Dating of Bones.

Module IV Conservation and preservation of archaeological remains

a) Aims and methods of Conservation

b) Conservation techniques and methods

Recommended Readings

a) Bintliff, John. 2004. *A companion to Archaeology*. U.K.: Blackwell.
b) Biswas, A. K. 2005. Science in Archaeology and Archaeological materials. New Delhi: D.K. PrintWorld (P) Ltd.
c) Chakrabarti, D.K. 1988. *A History of Indian Archaeology: From the Beginning to 1947*.New Delhi: Munsiram Manoharlal.
d) Drewett.L. Peter. 1999. *Field Archaeology*. London: UCL Press.
e) Fagan, Brian.1994. *In the Beginning: An Introduction to Archaeology*. London.
f) Rajan, K. 2002. *Archaeology: Principles and Methods*. Tanjavur: Mannop Publishers.
g) Raman, K.V.1998. *Principles and Methods of Archaeology*. Chenni: Parthajan
h) Renfrew, Colin and Paul Bahn 2006 .*Archaeological: Theories and Methods and Practice*

III. DEPARTMENT OF ZOOLOGY

SYLLABI

SEMESTER I

ZY1B01U Core Course I

GENERAL METHODOLOGY AND PERSPECTIVES IN SCIENCE

36 hrs
Credits 2

Objectives

- To make aware of the basic philosophy of science, its history, concepts and scope
- To develop proper scientific mind, culture and work habits
- To familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences

Pre-requisite:

- Basic knowledge on various sciences and definitions of scientific terms
- An awareness on role of research in science

PART – I BIOLOGY - THE LIFE SCIENCE **25 Hrs**

Module I. Science and Scientific Studies **(4 hrs)**

Types of knowledge: practical, theoretical, and scientific knowledge.

Information.

What is science; what is not science; laws of science.

Basis for scientific laws and factual truths.

Science as a human activity, scientific temper, empiricism.

Vocabulary of science, science disciplines.

Revolutions in Science and Technology

Core Readings

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey*. University of Chicago Press, Chicago, IL:

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance*. Published by Harvard University Press.

Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge University Press.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology.* Vintage Pub. NY

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions* 3rd ed.: University of Chicago Press, Chicago, IL

Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p 951.

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Publishers, Kottayam.

Module II. What is Biology? (4 hrs)

Life and its manifestations.

History of Biology

Biology in ancient times

Landmarks in the progress of Biology

Branches of Biology

Core Readings

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey.* University of Chicago Press, Chicago, IL:

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance.* Published by Harvard University Press.

Ernst Myer. 1997. *This is Biology: The Science of the living World.* University Press, Hyderabad, India

Ernst Myer. 1997. *This is Biology: The Science of the living World.* University Press, Hyderabad, India

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions* 3rd ed.: University of Chicago Press, Chicago, IL

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Publications,Kottayam.

Module III. Tools and Techniques in Biology (12 hrs)

Scientific drawing -Purpose and principle

Basic understanding on principle and uses of the following:

Microscopy (a) Light microscopy,

Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

- pH Meter

Separation Techniques

- Centrifuge
- Chromatography
- Electrophoresis

Analytical techniques

- Colorimeter
- Spectrophotometer
- X-ray crystallography

Core readings

Aggarwal S.K, 2009 *Foundation Course in Biology* Ane's Students Edition P- 79-93.

Eldon D. Enger, Frederick C. Ross and David Bailey 2008(Eleventh Edition) *Concepts in Biology*. Tata – McGraw Hill, New Delhi

Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p 161-163

Wilson & Walkar 2008 *Principles and Techniques of Biochemistry and Molecular Biology* Cambridge University Press. Chapters 9,10,11,15.

Zoological Society of Kerala Study Material 2002 – *Cell Biology, Genetics & Biotechnology*. Chapter- 2 Tools and Techniques.

Module IV. Animal Collection techniques **(5 hrs)**

- Collection methods, techniques and equipments
  - Plankton
  - Insects
  - Fish
  - Bird
- Preservation techniques – Taxidermy
- Rearing techniques
  - Laboratory and field.

Core Readings

Killick, H.J. 1971. Beginning ecology. Ibadan University Press.

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Pubslishers, Kottayam.

PART II: BIOLOGY AND RESEARCH **(11 hrs)**

Module V. Bioethics **(5 hrs)**

Introduction

Animal rights and animal laws in India.

Prevention of cruelty to animals Act 1960

Wildlife protection act 1972 and Amendments

Biodiversity Act 2003.

Concept of 3 R – conservation (**R**efined- to minimize suffering, **R**educed – to minimize animals, **R**eplaced – modern tools and alternate means)

Animal use in research and education.

Laboratory animal use, care and welfare

Animal protection initiatives

Animal Welfare, Animal Welfare Board, India CPCSEA

Working with Humans, harm, risk, and benefits.Consent.

Special Cases: Children and Vulnerable people, Equality, Anonymity, Confidentiality, Information Storage and dissemination

Human Rights Act-1995, 1998.

Right to information- 2005.

Core Readings

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press. P. 288-299.

Marie, M. 2005. Animal Bioethics: Principles and Teaching Methods Wageningen Academic Publishers

Module VI. Research Methodology (5 hrs)

Scientific method

Research Projects- Steps and process. Types.

Research Communication

Research report writing (Structure of a scientific paper)

Presentation techniques

Project proposal writing

Assignment, seminar, debate, workshop, colloquium, Conference

- Brief description and major differences

Core Readings

Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing. Wiley Eastern Ltd.

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press. Chapters.1-8.

Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.

Ruxton, G.D. and Colegrave, N. 2006. Experimental design for the life sciences. Oxford University Press. Chapters 1-6.

Module VII. Units of measurements (1 hr)

Calculations and related conversions of each:

- Metric system- length; surface; weight
- Square measures
- Cubic measures (volumetric)
- Circular or angular measure

- Concentrations- percent volume; ppt; ppm
- Chemical – molarity, normality
- Temperature- Celsius, centigrade, Fahrenheit

Core readings

D.K. Illustrated Oxford Dictionary.2006 Chapter on Measurements p-968.

Knut Schimidt – Nielsen 2007 *Animal Physiology,* 5th Edition, Appendix -A

Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 Biological science (Third edition Cambridge University press. P-960

Selected Further Readings

Aggarwal. S.K. 2009 Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Books Pvt. Ltd.

Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing. Wiley Eastern Ltd.

Bowler Peter J., and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey*. University of Chicago Press, Chicago, IL:

Day, R.A. 1993. How to write and publish a scientific paper. Cambridge University Press. (Module VI)

Day, R.A. 2000. Scientific English: A guide for Scientists and other Professionals. Universities Press. (Module VI)

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition : Oxford University Press .

Eldon D. Enger ,Frederick C. Ross and David Bailey 2008 (Eleventh Edition) *Concepts in Biology* .Tata-McGraw Hill , New Delhi.(Module VII, II & III)

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Published by Harvard University Press.

Ernst Myer .1997. *This is Biology: The Science of the Living World.* Universities Press, Hyderabad, India

Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge University Press

Gupta K.C, Bhamrah, H.S and G.S.Sandhu 2006.Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.

Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology.* Vintage Pub. NY

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions.* 3rd ed.: University of Chicago Press, Chicago, ILMarie, M. 2005. Animal Bioethics: Principles and Teaching Methods Wageningen Academic Publishers

Michael Roberts,Tim King and Michael Reiss.1994.Practical Biology for Advance Level. Thomas Nelson and Sons Ltd. Surrey, UK.

Ruxton, G.D. and Colegrave, N. 2006. Experinmental design for the life sciences. Oxford University Press.

Sateesh, M.K. 2008 Bioethics and Biosafety; I.K. International Publishing House (Module V)

Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 Biological science (Third edition Cambridge University press

1. Identify and comment on the item provided: (Western blotting / Southern blotting / Northern blotting / PCR)
2. Write down the procedure involved in DNA isolation

BIOINFORMATICS

1. Download/use print out/pictures of genome sequences of any 2 organisms. Identify and mention the characteristic features of both.
2. Download/ use print out/pictures of a protein sequence , identify it & comment on its amino acid composition
3. Download / use print out/pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.

MOLECULAR BIOLOGY

1. Identify and comment on its molecular composition / structural orientation / functional significance (Any tissue / Cell organelles/ DNA, DNA replication, RNA different types using models or diagrams)

V1 SEMESTER. ZY6CRT12
CORE COURSE XII
OCCUPATIONAL ZOOLOGY .
(APICULTURE, VERMICULTURE, QUAIL FARMING & AQUACULTURE)

54 Hrs
Credits 3

Objectives:

1. To equip the students with self employment capabilities.
2. To provide scientific knowledge of profitablefarming.
3. To make the students aware of cottage industries.

Module 1. APICULTURE **18 Hrs**

Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees. Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and dearth period Division of the colony, uniting two colonies, , replacing old queen with new queen, swarming management, monsoon management. Enemies of bees. Diseases of bees,.Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey.Extraction of wax, Uses of honey and wax.Royal jelly, Propolis. Apitherapy, Agencies supporting apiculture.

Activity :Visitto an apiculture unit.
Field visit and report submission - 10 Hrs
Field visit and report submission on any two items are taken for internal evaluation.

MODULE: 2. VERMICULTURE **8 Hrs**

Introduction, Ecological classification of earth worms. Species of earth worms used for vermicultre, Reproduction & life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc. Preparation of vermibed, Maintenance & monitoring, Preparation of vermicompost, Preparation of vermiwash.

Activity : Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit.

MODULE: 3.QUAIL FARMING (*Coturnix coturnix*) **4 Hrs**

Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs, health care, use of quail egg and meat.Sources of quality chicks.

MODULE: 4. AQUACULTURE. **24 Hrs**

Advantages and salient features of aquaculture, Types of Aquaculture, Biotic and abiotic features of water, Importance of algae in aquaculture, Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture Mussel culture Pearl culture. Processing & Preservation.

SEMESTER 1. ZY1CRT0I. CORE COURSE 1.

GENERAL PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY

36 Hrs

Credits 2

Objectives:

- To create an awareness on the basic philosophy of science, concepts and scope
- To understand different levels of biological diversity through the systematic classification
- To familiarize taxa level identification of animals
- To make interest in Protistan diversity
- To impart knowledge on parasitic forms of lower invertebrates.

PART I PERSPECTIVES IN SCIENCE **8Hrs**

Module I Introduction to Scientific Studies **4Hrs**

Types of knowledge: practical, theoretical, and scientific knowledge. What is science, features of science, Deductive and inductive models, scientific temper, empiricism vocabulary of science.

Module II What is Biology? **4 Hrs**

Life and its manifestations, History of Biology: Biology in ancient times Landmarks in the progress of Biology. Branches of Zoology , Scope of Zoology

PART II SYSTEMATICS **10 Hrs**

Module III–Taxonomical Principles and tools

Systematic, Taxonomy, Phylogeny [Brief account] , Approaches to taxonomy, Molecular taxonomy, .Bar coding. Zoological nomenclature, International Code of Zoological Nomenclature (ICZN), Law of Priority. Five Kingdom Classification; Linnaean classification, Basis for Animal kingdom classification [Levels of organization, Symmetry, Coelom]

Identification tools

Taxonomic key. Types: Single access key- Dichotomous [linked and nested] and Polytomous key, Multi access key, Computer aided Interactive Key

Advantages and Disadvantages

PART III: PROTISTAN DIVERSITY **18 Hrs**

Module IV – Kingdom Protista Type: ***Paramecium*** **5 Hrs**

Salient features of KingdomProtista **10 Hrs**

Classification of Protista up to phyla

1. Phylum Rhizopoda :Eg. *Amoeba*
2. Phylum Actinopoda : Eg. *Actinophrys*
3. Phylum Dinoflagellata : Eg. *Noctiluca*
4. Phylum Parabasalia : Eg. *Trychonympha*
5. Phylum Metamonada : Eg. *Giardia*
6. Phylum Kinetoplasta : Eg. *Trypanosoma*
7. Phylum Euglenophyta : Eg. *Euglena*
8. Phylum Cryptophyta : Eg. *Cryptomonas*
9. Phylum Opalinata : Eg. *Opalina*
10. Phylum Bacillariophyta :Eg. Diatoms
11. Phylum Chlorophyta :Eg. *Volvox*
12. Phylum Choanoflagellata :Eg. *Proterospongia*
13. Phylum Ciliophora : Eg. *Balantidium coli*
14. Phylum Sporozoa : Eg. *Plasmodium*
15. Phylum Microsporidia :Eg. *Nosema*
16. Phylum Rhodophyta :Eg. Red Alga

(Mention any five general characters for each phylum. Detailed accounts of examples are not necessary.)

General Topics: **3 Hrs**

1. Parasitic protists (diseases mode of transmission and prophylactic measures) - Entamoeba, Trypanosoma, Plasmodium (detailed account of life cycle),Leishmania .

References

Anderson D.T. 2001Invertebrate Zoology Sec Edition Oxford University Press

Barnes R.D. 1987. Invertebrate Zoology. W. B. Saunders. New York.

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey.* University of Chicago Press, Chicago, IL:

Dhami.P.S. and Dhami J.K. 1979 Invertebrate Zoology. R. Chand and Co. Delhi.

Ekambaranatha Ayyar M. 1990.A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance.* Published by Harvard University Press.

Ervin Schrodinger 1944. What is life? Mind and Matter.Cambridge University Press.

Hyman L. H. The Invertebrate Volumes.Mc Graw Hill.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology.* Vintage Pub. NY

Jordan. E. L., and Verma P.S. 2000. Invertebrate zoology. S. Chand and Co. ltd., New Delhi.

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

Kotpal.R. L., 1988-92; (Protozoa).Rastogi Publishers, Meerut.

Kotpal R. L, Agarval S. K. and R. P. Khetharpal 2002.Modern Textbook of Zoology.

Mayr, E. (1980). Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi)

Parker and Hanswell, 2004, Text Book of Zoology,Vol I (Invertebrate), 7th Edition, A.Z.T,B.S. Publishers and Distributors, New Delhi – 110 051

Pechenik J A (2005) Biology of Invertebrates, (Tata McGraw Hill Publishing Co., NewDelhi.)

Prema A.K., Joseph M.L. and Terrence Rebello V. (Eds) (2011).Invertebrate Diversity of Kerala.Zoological Society of Kerala, Kottayam.

Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Pubslishers, Kottayam.

Thomas A P (Editor) 2010 The Invertebrates, Green leaf publications Kottayam

SEMESTER VI

ZY6B10U CORE COURSE 10
GENETICS AND BIOTECHNOLOGY

54 hrs

Credits 3

Objectives of the Course

1. To emphasize the central role that genetics and biotechnology plays in the life of all organisms.
2. To introduce the student to some of the present and future applications of bio-sciences
3. To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

Part I GENETICS 34 hrs

Module -I Introduction: Scope and importance of genetics, Brief explanation of the following terms- gene, alleles, genotype, phenotype, genome, homozygous and heterozygous, wild type and mutant alleles, dominant and recessive traits, test cross and back cross, reciprocal cross, Mendelism – Mendel's laws , Mendelian traits in man Chromosome theory of heredity. 2 hrs

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 1 &2.

Module –II **Interaction of genes:** Allelic and non Allelic. Allelic- incomplete dominance Co-dominance Non allelic interactions, – complementary 5 hrs

supplementary, epistasis – dominant (feather colour in fowl) and recessive (coat colour in mice) Polygenes (Skin colour inheritance in man) pleiotropism, modifying genes, lethal genes (Brief account with one example each) Multiple alleles(eg) Coat Colour in rabbits. Man ABO blood group Rh factor, Blood group and its inheritance (Genetic problems related to this topic are included in practicals)

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 3 &4.

Module-III	Linkage and recombination of genes based on Morgan's work in Drosophila (Complete and incomplete linkage) .Linkage map Chromosome mapping ./.	3hrs

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 5

Module IV	Sex determination: Chromosome theory of sex determination (sex chromosomes and autosomes) chromosomal mechanism (XX-XO, XX-XY, ZW-ZZ) Barr bodies and Lyon hypotheses : Sex determination in man- role of Y chromosome. Sex determination in honey bees. Genic balance theory. Drosophila- intersex, gynandromorphs. Hormonal Influence on sex determination Environmental influence - Hermaphroditism	3hrs

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 6

5hrs

Module V Mutations, Types of Mutations. Germinal, Sex linked mutations. Chromosomal mutations - structural and numerical changes. Gene mutation (point mutation) Molecular basis of gene mutations – tautomerism- Induced mutations Physical and chemical mutagens

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology

Gardner E.J. & Snustand D.P 1984. *Principles of Genetics* (John Wiley & Sons) New York

Module VI Extra nuclear inheritance (Cytoplasmic inheritance Characteristics: Organella DNA (Mitochondrial and plastid DNA) Kappa particles in paramecium. 2hrs

Core Readings

Vijayakumaran Nair 2006, *Genetics and Molecular Biology*. Continental Publications, Trivandrum.

Module VII **Bacterial genetics**; Bacterial genome Recombination in Bacteria – Bacterial transformation. Transduction, conjugation F mediated sex duction. Resistance transfer factor (RTF) Mechanism of drug resistance in bacteria Transposable genetic elements in bacteria, basic components and mechanisms of transposition in bacteria. 5hrs

Core Readings

Panicker S. Abraham G and Francis G. 2008. *Microbiology and Immunology* Published by Zoological Society of Kerala Chapter 10

Ananthanarayanan & Jayaram Panicker, 2006. *A textbook of Microbiology*. Orient Longman pvt. Ltd.

Module VIII

Human Genetics: Karyotyping- Normal human chromosome complement. Pedigree Analysis Aneuploidy and Non disjunction. Genetic disorders in Man. Chromosomal anomalies Autosomal (eg. Down syndrome, Edward's syndrome and Cridu chat syndrome) Sex chromosomal anomalies (Klinefelter's syndrome, and Turners syndrome) Single gene disorders Gene mutation and disorders (Brief mention) Autosomal single gene disorders (Sickle cell anaemia, brachydactyly; inborn errors of metabolism such as phenyle ketonuria, alkaptonuria). Sex linked inheritance. Definition - characteristics criss-cross inheritance. Haemophilia and colour blindness. Pseudoautosomal genes (incompletely sex-linked genes and holandric genes. Multifactorial disorders - Polygenic traits - Cleft lip and cleft palate. Sex limited and sex influenced traits in man with examples. Prenatal Diagnosis (Amniocentesis) and choriovillus sampling - Ultrasound scanning and Fetoscopy. Genetic counselling, Eugenics and Euthenics. 9hrs

Core Readings

Stern C. 1973. Principles of Human Genetics (W.H. Freeman and

Co.)

Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008

Verma P.S. and Agarwal V.K. 1988 Genetics (S. Chand and Co. New Delhi)

Winchester A.M. 1966. Genetics (Oxford & IBH Publications.

Part II BIOTECHNOLOGY 20hrs

Module IX Definition and scope of Biotechnology (1 hr)

Core Readings

Sudha Gangal- Principles & Practice of Animal Tissue Culture. University Press. Pp- 128-135

Module X Basic aspects of Genetic Engineering. (6hrs)

Tools-Enzymes-Restriction enzymes and DNA ligases.

Vectors-Plasmids and Phage vectors.

Isolation of gene/DNA.

Techniques-Production of recombinant DNA.Briefly mention rDNAtransfer and screening methods.Cloning in host cells.Virus mediated gene transfer,DNA mediated gene transfer.

Module X1 General Techniques in Biotechnology. (5 hrs)

Techniques in gene cloning;PCR technique and DNA Amplification.

Blotting Techniques- Southern Blotting

Northern Blotting

Western Blotting

.Identification of DNA, mRNA, and Protein.

DNA hybridization,Fluorescence *insitu* Hybridization (FISH), Colony hybridization.

DNA finger printing and its applications.

RFLP- markers Applications. Gene libraries, Genomic and cDNA libraries Human DNA library, Construction of genomic library and cDNA library.

Stem cell cultures, Therapeutic cloning, human ES cell cultures, Human EG cell cultures and Human EC cell cultures, Potential uses of stem cells.Animal cell and tissue culture.

Core Readings

Sobti & Sharma 2008 *Essentials of Modern Biology* Ane's Student Edition Chapter 2 p. 89

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology , Published by Zoological Society of Kerala

Wilson & Walker 2008 *Biochemistry and Molecular Biology* 6th edition, Cambridge University Press. Chapter -5

Core Readings

John Ringo 2009 *Fundamental Genetics* Cambridge University Press, Chapter 29.

Sobti & Sharma 2008 *Essentials of Modern Biology* Ane's Student Edition Chapter 2 p. 89

PRACTICAL

MICROBIOLOGY AND IMMUNOLOGY

72 Hrs

2 Credits

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow
2. Preparation of solid and liquid media for microbial cultures.
   (Ingradients, pH and method of preparation) (Demonstration)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
   (b) Liquid Media(1) Nutrient broth (2) Peptone water.
3. Culture methods (Demonstration)
   (a) Streak plate technique and isolation of pure colonies.
   (b) Lawn culture (c) Pour plate culture (d) Liquid culture
4. Examination of microbes in living condition
   Hanging drop method for demonstrating motility of bacteria.
5. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
6. Antibiotic sensitivity test (demonstration only)
7. Streak plating (individual performance)
8. Preparation of a fungal smear – Lactophenol cotton blue staining and mounting
9. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)
10. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man

SEMESTER VI. ZY6CRT11

CORE COURSE XI.

BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

BIOTECHNOLOGY **20 Hrs**

Module I **11Hrs**

Introduction: Scope, Brief History, Scope and Importance

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors-[Plasmids, Phage vectors, Cosmids, Artificial Chromosomes] Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell.Blotting Techniques-Southern, Northern, Western blotting.DNA Finger printing (DNA Profiling) and its application. Molecular markers - RFLP

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine(insulin, growth hormone, gene therapy), Agriculture(GM plants and biopesticides),Environment(bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions.Intellectual Property Rights, Patenting and patent protection.

References

1. Singh B.D Biotechnology 2002. Kalyan Publishers New Delhi.

2. Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford).

SEMESTER II

ZY2B02U Core Course 2

BIODIVERSITY AND MODERN SYSTEMATICS

36 hrs

Credits 2

Objectives:

- To create appreciation on diversity of life on earth
- To understand different levels of biological diversity
- To familiarize taxa level identification of animals
- To learn biodiversity estimation techniques
- To create interest for conservation of biodiversity

Pre requisite:

- Basic knowledge on the living world, plant and animal kingdom
- Knowledge on biodiversity and its conservation
- Knowledge on biological classification and representative organism of major taxa

PART I: BIODIVERSITY **(26 Hrs)**

Module I – Introduction to Biodiversity **(2 hrs)**

Definition

Historical perspective

Concepts –

Nature – environment – biodiversity

Scope and importance

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Thomas AP.,(Editor) 2009 Biodiversity,Scope and Challenges- Green Leaf Publications Kottayam

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module II – Levels of biodiversity **(5 hrs)**

Genetic, Species, Ecosystem

Domesticated, Microbial diversity

Distribution of biodiversity on earth

Tropical, temperate and polar

Landscapes and interactions

Biodiversity hotspots

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future.* W.W. Nortan & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module III – Values of biodiversity **(4 hrs)**

Direct use value

Indirect use value

Non use value

Ecosystem services

Core Readings

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future.* W.W. Nortan & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Module IV – Threats to biodiversity (5 hrs)

Types of threats

Habitat loss, man- wildlife conflict (with case studies)

Invasive species

Pollution

Over exploitation and human population

Climate change

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module V – Biodiversity conservation and management (6 hrs)

Conservation strategies

In situ, ex situ

National parks, Sanctuaries and Biosphere reserves

International efforts

Convention on Biological Diversity (CBD)

IUCN- WCMC, UNEP

Legal measures

Wild life Protection Act, 1972

The Environment Protection Act, 1986

Forest (Conservation) Act1980, 1988

Biodiversity Act 2002

Biodiversity rule 2004

National biodiversity action plan

People's participation – Peoples biodiversity register (PBR)

Local initiatives

Core Readings

A.P.Thomas(Editor)2009 Biodiversity –Scope&Challenges .Green leaf publications .Kottayam

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA

Module VI – Biodiversity estimation – tools and techniques (4 hrs)

Sampling techniques -

Quadrate

Line transect

Measurements

Density

Abundance

Frequency

Biodiversity indices – concepts

Shannon-Weiner, Simpson

Core Readings

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing, MA, USA.

PART II – MODERN TAXONOMY (10 hrs)

Module VII – Taxonomical Principles (6 hrs)

Brief history

Concepts and definition

Approaches of taxonomy

Molecular taxonomy

Importance of classification

Phylogeny and Taxonomy– Tree of Life, bar coding of life

Zoological nomenclature

International Code of Zoological Nomenclature (ICZN)

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

Module VIII – Tools and techniques **(4 hrs)**

Identification Keys

Dichotomous keys (Single access key)

Polytomous key

Multi access key

Advantages and disadvantages

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

Selected Further Readings

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing, MA, USA.

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Daily,G.C. (Ed.), 1997.*Nature's Services : Societal Dependence on Natural Ecosystems*. Island Press, Washington D C.

Forman, R.T and M. Gordaon. 1986. *Landscape Ecology*. John Wiley &Sons, NY, USA.

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi

Karunakaran, C.K. 2003. Politics of vanishing forests in Kerala. Kerala Sastra Sahitya Parishat, Thiruvananthapuram.

Land resource based perspective plan for 2020 AD. Kerala State Land Use Board, Thiruvananthapuram

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future*. W.W. Nortan & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Nair, K.N.S and Parameswaran,P.1976. *Keralathinte Sampath (Wealth of Kerala)*. Kerala Sastra Sahithya Parishad, Trivandrum, Kerala.

Nair, M.P., Pushpangathan, P., Rajasekharan, S.,Narayanan Nair.K. and Dan Mathew. "*Jaivavaividhyam*" (Biodiversity). State Institute of Languages, Thiruvananthapuram

State of the Environment Report, Kerala. (Annual Publication), Kerala State Council for Science, Technology and Environment, Thiruvananthapuram

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Thomas A.P.,(Editor) 2009 Biodiversity scope & challenges. Green Leaf publications Kottayam

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Web Resources

http://www.ncbi.nlm.gov.
http://tolweb.org
http://www.biosis.org
http://ucmp.berkely.edu
http://species.enviroweb.;org
http://iczn.org
http://www.unep.org
http://www.iucn.org
http://www.cbd.org

Turtle/Tortoise - plastron and carapace

5. Study of sections.

Amphioxus T. S. through pharynx/T.S. through intestine

6. Identification:-

General identification-

Identify, classify and describe the following animals by their generic names and 30 % of them by their scientific names.

Protochordata-1, Pisces-5, Amphibia-5, Reptilia- 5, Aves-2, Mammalia-2.

Taxonomic identification with key:-

i) Identification of fishes up to the level of order.

ii) Identification of snakes up to family.

SEMESTER IV. ZY4CRT04

CORE COURSE IV

RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

54 Hrs

3 Credits

Objectives

1. To familiarise the learner the basic concept of scientific method in research process.
2. To have a knowledge on various research designs.
3. To develop skill in research communication and scientific documentation.
4. To create awareness about the laws and ethical values in biology.
5. To equip the students with the basic techniques of animal rearing collection and preservation
6. To help the student to apply statistical methods in biological studies.

RESEARCH METHODOLOGY

Module I **13 Hrs**

Basic concepts of research: Meaning, Objectives, Approaches, Types of research.
Research Process: Scientific method in research (eight steps).
Importance of literature reviewing in defining a problem,
Identifying gap areas from literature review.
Research Communication and scientific documentation: Project proposal writing,
Research report writing, (Structure of a scientific paper), Thesis, dissertation, research article.
Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop,
Colloquium, Conference
Sources of Information: Primary and secondary sources. Library- Books, Journals,
Periodicals, Reviews, Internet.
Search engines Online libraries, e-Books, e-Encyclopedia, Institutional Websites.
Plagiarism

Module II **12 Hrs**

Animal Collection – Tools &techniques

Sampling techniques
- Quadrate
- Line transect

Measurements
- Density
- Abundance
- Frequency

Biodiversity indices – concepts
- Simpson index

Collection methods, techniques and equipments
- Plankton
- Insects
- Fish
- Bird

Preservation techniques – Taxidermy

Rearing techniques

Laboratory and field.

Units of measurements- units, SI system, Equivalent weight, normality, molarity

BIOPHYSICS

Module III **14 Hrs**

Basic understanding on principle and uses of the following:

Microscopy

(a) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polorization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

pH Meter

Separation Techniques: Centrifuge, Chromatography, Electrophoresis

Analytical techniques: Colorimeter, Spectrophotometer, X-ray crystallography

BIOETHICS

Module IV **5 Hrs**

Bioethics : Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act 1960, Biodiversity Act 2003.

Concept of 3 R – conservation (Refined- to minimize suffering, Reduced – to minimize animals, Replaced – modern tools and alternate means), Animal use in research and education.

Laboratory animal use, care and welfare, Animal protection initiatives- Animal Welfare Board of India, CPCSEA, ethical commitment. Working with human: Consent,harm, risk and benefits.

BIOSTATISTICS **10 Hrs**

Module V

Sample & Sampling techniques: Collection of data, classification of data, frequency distribution tables, graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves - Ogives.

Measures of Central Tendency: Mean, Median, Mode (Problem - Direct method only)

Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits and problems on SD).

Correlation: Definition, Types of correlation.(mention in brief)

Test of Hypothesis and Test of Significance: Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis.

References

1. Gupta K.C, Bhamrah, H.S and G.S.Sandhu (2006) Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.
2. Khan and Khanum, (1990) Fundamentals of biostatistics.Press, Chicago,
3. Rastogi, V.B (2009) Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.
4. Ackoff, R.L. (1962) Scientific Method, New York : John Wiley Press.
5. Aggarwal. S.K.(2009) Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Books Pvt. Ltd.
6. Anderson, J, Durston, B.H. and Poole, M. (1992). Thesis and assignment writing. Wiley Eastern Ltd.
7. Best, J.W.and K.V. James, (1986) Research in Education.5th Edn. Prentice- Hall of India Pvt.Ltd.
8. Campell, R. (1990). Statistics for biologists. CBS Publishers and distributors.
9. Day, R.A. (1993). How to write and publish a scientific paper. Cambridge University

41

Press.

10. Day, R.A. (2000) Scientific English: A guide for Scientists and other Professionals. Universities Press.
11. Fischer, R.A.(1960)The Design of Experiment. 7th rev.edn. New York: Hafner Publishing Co.,
12. Hawkins C. and Sorgi, M. (1987). Research: How to plan, speak and write about it. Narosa Publishing House.
13. Killick, H.J. (1971). Beginning ecology. Ibadan University Press.
14. Kleinbaum, D.G. and M.Klein (2009) Survival analysis-Statistics for Biology & Health 2nd Ed. Springer International ed.
15. Knudsen J. W (1966) Biological Techniques: Collecting,Preserving, and Illustrating Plants and Animals.
16. Kothari, C.R. and G.Garg. (2014) Research Methodology. Methods and Techniques. 3rd edn.
17. Marie, M. (2005). Animal Bioethics: Principles and Teaching Methods Wageningen Academic Publishers.
18. Norman T.J. (2007) Bailey Statistical methods in biology, Cambridge University press.
19. Roberts, M. T. King and M. Reiss.(1994) Practical Biology for Advance Level. Thomas Nelson and Sons Ltd. Surrey, UK.
20. Ruxton, G.D. and Colegrave, N. (2006), Experimental design for the life sciences. Oxford University Press.
21. Sateesh, M.K. (2008) Bioethics and Biosafety; I.K. International Publishing House .
22. Taylor D.J. Green N.P.O and Stout G.W. (2008). Biological science (3rd edition- R.S. Oper Ed). Cambridge University press.

42

ZY1B01U [P] Practical I: General Methodology and Instrumentation

36 hours

Credit 1

1. Study of simple and compound light microscopes
2. Micrometry –calibration and measurement of microscopic objects –low power
3. Camera Lucida (draw a few diagrams using Camera Lucida)
4. Paper chromatography (demonstration only)
5. Instrumentation – demonstration (write notes on principle, equipment and its use)
   - pH Meter
   - Colorimeter/ Spectrophotometer
   - Centrifuge
   - Electrophoresis
6. Scientific drawing (representatives from any five taxa)
7. Insect collection and preservation techniques (Group Activity)

SEMESTER VI. ZY6CRT09

CORE COURSE IX

DEVELOPMENTAL BIOLOGY

54 Hrs

3 Credits

Objectives:

1. To achieve a basic understanding of the experimental methods and designs that can be used for future studies and research.
2. To provide the students with the periodicclass discussions of current events in science which will benefitthem in their future studies in the biological/physiological sciences and health-related fields
3. To contribute tocritical societal goal of a scientifically literate citizenry.

Module 1 **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, parturition and lactation.Reproductive health and importance of sex education.

.**Egg types:** Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs.Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy, Parthenogenesis- Different types and significance.

Module II **14 Hrs**

Cleavage: Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation.Concept of germ layers and derivatives.

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (maternal effect genes), Zygotic genes.

Module III **20Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of eye.Metamorphosis of frog, Hormonal and environmental onrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)

Module IV **5Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References

Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper,Stephen L. Hauser, Dan L. Longo, J. Larry Jameson and Joseph Loscalzo; 2008; Harriosns Principles of Internal Medicine; Chruch Livingston 17th Ed.

Balnisky B.I.; 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N..J.; and Kars, G.; 1986. Developmental biology, Mc Graw Hills

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Majumdar N. N -1985 Vetebrate embryology; Tata McGraw-Hill, New Delhi

Melissa A & Gibbs, 2006; A practical Guide to Developmental Biology, Oxford university press (Int. student edition)

Scott F. Gilbert; 2003; Developmental biology; Sinauer Associates Inc.,U.S.; 7th Revised edition.

Vijayakumarn Nair, K. & George, P. V. 2002. A manual of developmental biology, Continental publications , Trivandrum

Taylor D J, Green NPO & G W Stout. (2008) Biological Science third edition. Cambridge university press. Ref pp 748 biology 755

PRACTICAL

DEVELOPMENTAL BIOLOGY

36 Hrs

Credit 1

Model/Chart/ Slide may be used

1. Regeneration in animals
2. Placentation in mammals and their significance.
3. Human intervention in reproduction- contraception & birth control, Abortion – biological aspects, Ethical issues, Infertility, IVF, GIFT, & ZIFT (Intra fallopian transfer gamete/zygote)

Core Readings

Taylor D J, Green NPO & G W Stout. Biological Science (2008) third edition. Cambridge university press. Ref pp 748 biology 755

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module IV **8 hrs**

Teratology / Dysmorphology.

Definition, Teratogen / Teratogenic agents. Ionizing radiation, infection (herpes virus, parvo virus-B 19, rubella virus, syphilis, cytomegalovirus , toxoplasmosis).

Developmental defects

Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR)

Congenital abnormalities (birth defects)

Structural defects (malformation, deformation, disruption) functional defects. (inborn errors of metabolism, mental retardation).

Causes of malformation. (brief accounts.)

Genetic disorders (single gene defects)

Chromosome aberration, aneuploidy (numerical abnormalities.

Structural abnormalities (deletion, insertion and re-arrangements)

Chromosomal mosaicisms

Environmental factors. (external factors)

Chemicals, drugs, hormones and vitamins.

Multifactorial and idiopathic disorders

Core Readings

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Selected Further Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hills

Berry A. K - An introduction to embryology.

Dutta 2007 Obstrestics , Chuch Livingston 17 Ed

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Jain P. C - Elements of developmental biology.

John Rigo Fundamental Genetics Cambridge University Press. 2009

Julio Collado Vides & Relf Hofestadt Gene Regulation and Metabolism Post genomic Computated Approaches, Ane Book 2004

Majumdar N. N - Vetebrate embryology

Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006

Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.

Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum.

Werne A Muller. Dev. Biology, Springer Verlay New York 2008

Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II, Module III)

Suresh.C. Goel. *Principles of Animal Developmental Biology*. Himalaya Publishing House.

Arumugam. N. *Text Book of Embryology.* Saras Publication. (module I, Module II, Module III)

Sastry & Shukal. *Developmental biology.* Rastogi publications (Module I, Module II, Module III)

Web Resources

www.Wikipedia.com. (Module IV)

www.medpedia.com. (Module IV)

IV. MSC ZOOLOGY

ZY1CT04 BIOSTATISTICS, COMPUTER APPLICATION AND RESEARCH METHODOLOGY

90 Hours (40+30+20) **Credit-4**

Objectives:

- To impart concepts, generate enthusiasm and make awareness about the tools/gadgets and accessories of biological research
- To equip the learner to carry out original research in biology
- To help the students to improve analytical and critical thinking skills through problem solving
- To provide hands on training in the use of various tools and techniques suggested in the course

BIOSTATISTICS 40 hrs.

Module 1.Basics of Biostatistics **6 hrs.**

Steps in Statistical Investigation, Data and Variable (Collection, Types, Sources).
Population, Sample, Sampling Methods (Random, Cluster, Stratified and Geographical) and Sampling Errors/Bias.
Organization of Data - Editing, Classification, Tabulation (forming a frequency distribution from raw data and types and characteristics of a Frequency table).
Presentation of Data - Types and Characteristics of Tables and Visual aids – Graphs, Charts, Diagrams, Flow charts, Cartographs.
Statistical Analysis Tools - Parametric and Non-Parametric; Bivariate and Multivariate Analysis.
Interpretation and Forecasting.
Prerequisite: *Statistics and Biostatistics – scope and significance.*

Module II. Measures of Central Tendency **4 hrs.**

Introduction, Characteristics, Merits and Demerits of Mean, Median and Mode.
Calculations/Problems for different data (raw, frequency table).
Harmonic and Geometric Mean (Brief account only).

Module III. Measures of Dispersion **5 hrs.**

Introduction, Characteristics, Merits and Demerits of Range, Quartile Deviation, Mean Deviation and Standard Deviation. Calculations/Problems for frequency table.
Standard Error and Relative Measures of Dispersion, Skewness and Kurtosis (Brief account only).

Module IV. Correlation Analysis **3 hrs.**

...correlation analysis. Problems for Karl Pearson's correlation coefficient

Module VI. Theory of Probability **4 hrs.**

Measures of Probability and Theorems in Probability.Probability distributions – Binomial, Poisson and Normal (Brief Account only).

ModuleVII. Testing of Hypothesis **7 hrs.**

Hypothesis and types, Confidence Interval, Sampling, Methods and Errors.
Tests of significance (For large and small samples – Critical Ratio and P value). Z Test (Problem for small samples), Chi- Square Test (Problem for 2×2 table only).
Student's 't' test (Problem for small samples comparing mean of two variable).
F-test and Analysis of Variance (ANOVA - One way) (Brief account only).
Non-parametric tests: Mc Nemar and Mann Whitney U test (Brief account only).

Module VIII. Vital Statistics **4 hrs.**

Introduction, uses, records and system of classification of vital statistics.
Sample registration system, Sample design, Survey of causes of death and Age classification.
Measures of Vital Statistics and Measures of Population (Mortality rates, Fertility rates).
Life tables (Brief account only).

COMPUTER APPLICATIONS 30 hrs.

Module I. Basics of Computers **6 hrs.**

Types of Computers. Binary Number System, Digital and Analog systems.
Hardware/Software/Firmware. Basics of Computer Functioning- Booting; Formatting; File, File Extensions; Temporary Files; Folder; GUI, Icon; Installation of Programs, Commands, Bios-setup, Date and Time, Memory Partitions, Registry, Default Operations; Defragmentation (Brief account only).

Prerequisite: *Basics of Computers (Characteristics, History and Generations, Components and Organization).*

Module II.Hardware Basics **7 hrs.**

Memory -Classification and Types of memory; memory devices; Units.
Input Devices -Types, working and functions. Output Devices –Types, working and functions.
CPU components - Processors, Mother boards, SMPS, Accessory Cards – Graphic /Sound/ Networking/ Bluetooth/Wifi (Brief account only).
New Generation Computers - Servers, Laptop; Palmtop; Cyborgs; Robotics, Zoobotics (Brief account only).

Module III. Software Basics **7 hrs.**

System Software/Operating System -System Files; Working of OS; DOS, Widows, Linux and UNIX (Brief account only).
Application Software -Programs and Packages, Calculator, MS Paint, MS Word, MS Excel, MS PowerPoint, Publisher, Acrobat Reader, E Book Reader, Explorer, Photoshop.
Virus and Antivirus (Brief account only).
Statistical Software (MS Excel, PH Stat, SPSS).
Databases -MS Access (Brief account only).

Module IV. Computer Language and Programming **5 hrs.**

Computer language -Classification and types, HTML, C and Java
Programming concepts -Algorithm, Codes (Brief account only).

Module V. Networking, Internet and Information Technology **5 hrs.**

Computer Communication -Network Topology, Media of networking, Networking Protocols, PAN, LAN, WAN, MAN, INFLIBNET, Modem and Gateway.

Internet and Internet Services -World Wide Web, Uploading, Downloading, Hosting, Portal, Search Engines, Firewall.

Global Information System -BIOSIS, Medline and Medlars, AGRIS; E Journals and E Books Publishing.

Cyber Crime and Cyber Laws (Brief account only).

RESEARCH METHODOLOGY 20 hrs.

Module I. Science and Life Sciences **2 hrs.**

Basic concepts - Knowledge, Information and Data - Science, Pseudoscience.

Life Science - Definition, Laws, Characteristics.

Scientific temper, Empiricism, Rationalism and Units of measurements.

Module II. Concepts of Research **4 hrs.**

Basic concepts of research -Meaning, Objectives, Motivation and Approaches.

Types of Research (Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/ Empirical.

Research methods versus Methodology, Research and scientific method. Research Process.

Module III. Research Formulation **4 hrs.**

Research formulation -Observation and Facts, Prediction and explanation, Induction, Deduction.

Defining and formulating the research problem, Selecting the problem and necessity of defining the problem.

Literature review -Importance of literature reviewing in defining a problem, Critical literature review, Identifying gap areas from literature review.

Hypothesis -Null and alternate hypothesis and testing of hypothesis -Theory, Principle, Law and Canon.

Module IV. Research Designs **4 hrs.**

Research Design -Basic principles, Meaning, Need and features of good design, Important concepts.

Types of research designs.

Development of a research plan -Exploration, Description, Diagnosis, Experimentation, determining experimental and sample designs.

Data collection techniques.

Module V. Scientific Documentation and Communication **3 hrs.**

Project proposal writing, Research report writing (Thesis and dissertations, Research articles, Oral communications).

Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference.

Module VI. Information Science, Extension and Ethics **3 hrs.**

Sources of Information -Primary and secondary sources.

Library - books, journals, periodicals, reference sources, abstracting and indexing sources, Reviews, Treatise, Monographs, Patents.

Internet -Search engines and software, Online libraries, e-Books, e-Encyclopedia, TED Talk, Institutional Websites.

Intellectual Property Rights - Copy right, Designs, Patents, Trademarks, Geographical indications.

Safety and precaution - ISO standards for safety, Lab protocols, Lab animal use, care and welfare, animal houses, radiation hazards.

Extension: Lab to Field, Extension communication, Extension tools.

Bioethics: Laws in India, Working with man and animals, Consent, Animal Ethical Committees and Constitution.

BIOSTATISTICS AND RESEARCH METHODOLOGY

54 hrs (30+24) 3 hrs/week | Credit – 3

Objectives:

- To impart concepts of statistics and research methodology, and create awareness about the gadgets, tools and accessories of biological research
- To help students improve analytical and critical thinking skills through problem solving
- To enable learners to effectively apply suitable statistical tests in research
- To sensitize students about the ethics involved in research and enable them to come up with innovative research designs
- To equip learners to prepare research papers and project proposals

BIOSTATISTICS **30 hrs**

Module 1 **(9hrs)**

Basics of Biostatistics **(3 hrs)**

Scope and Significance of Biostatistics. Steps in Statistical Investigation, Data and Variable (Collection, Types, Sources).

Statistical Analysis Tools - Parametric and Non-Parametric; Bivariate and Multivariate Analysis. Interpretation and Forecasting.

Measures of Central Tendency – mean, median and mode.

Measures of Dispersion **(6 hrs)**

Introduction, Characteristics. Quartiles and Percentiles. Merits and Demerits of Range, Quartile Deviation, Mean Deviation and Standard Deviation. Relative Measures of Dispersion.

Calculations/Problems for frequency table. Standard error. Skewness and Kurtosis (Brief account only).

Module II **(11hrs)**

Correlation Analysis **(3 hrs)**

Correlation - types and methods of correlation analysis, Problems for Karl Pearson's correlation coefficient and Spearman's rank correlation.

Regression Analysis **(4 hrs)**

Regression and Line of Best Fit, Types and methods of regression analysis.

Graphic Methods (Scatter method, Curve fitting). Algebraic method (Fitting of strait line through regression equation). Comparing correlation and regression.

Probit Analysis (Brief account only).

Theory of Probability **(4 hrs)**

Measures of Probability and Theorems in Probability. Probability distributions – Binomial, Poisson and Normal (Brief Account only).

Module III

Testing of Hypothesis **(10hrs)**

(7 hrs)

Hypothesis and types, Confidence Interval, Sampling, Methods and Errors.
Tests of significance (For large and small samples – Critical Ratio and P value).
Z Test (Problem for small samples), Chi- Square Test – test of independence and goodness of fit (Problem for 2×2 table only).
Student's 't' test (Problem for small samples comparing mean of two variable).
F-test, Analysis of Variance (ANOVA - One way), Kruskal Wallis test (Brief account only).
Mc Nemar and Mann Whitney U test (Brief account only).

Mathematical modeling in Biology **(3hrs)**

Introduction to mathematical modeling. Applications: Medicine - models to predict spread of infectious diseases, drug discovery, Systems Biology – Blue Brain project, Ecology – Lotka Volterra model. Length - Weight Relationship. Von- Bertalanffy's Growth (VBG) Model.
Statistical Software: MS Excel, SPSS; Introduction to 'R' (Basics only). common assignment

RESEARCH METHODOLOGY **24 hrs**

Module IV

Concepts of Research **(12hrs)**

(4 hrs)

Scientific temper, Empiricism and Rationalism. Knowledge, Information and Data. Science and Pseudoscience. Basic concepts of research -Meaning, Objectives, Motivation and Approaches.
Types of Research - Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/Empirical. Research methods versus Methodology, Research Process.

Research Formulation **(4 hrs)**

Research formulation -Observation and Facts, Prediction and explanation, Induction, Deduction. Defining and formulating the research problem, Selecting the problem and necessity of defining the problem. Literature review - Importance of literature review in defining a problem, Critical literature review. Theory, Principle, Law and Canon.

Research Designs **(4 hrs)**

Research Design -Basic principles, Meaning, Need and features of good design. Types of research designs.
Development of a research plan - Exploration, Description, Diagnosis, Experimentation, determining experimental and sample designs. Case-control studies and cohort studies.

Module V **(12 hrs)**

Scientific Documentation and Communication **(6 hrs)**

Structure and components of Scientific Reports – types of Report – Technical Reports and Thesis/dissertations.
Preparing Research papers for journals, Seminars and Conference; Impact factor, Citation Index, h-index. DOI. ISBN & ISSN.
Conventions and strategies of authentication – citation styles, bibliography, referencing and foot notes. Software for managing bibliographies - EndNote.
Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference, Oral presentation, Poster Presentation.

Preparation of Project Proposal. Project funding agencies – UGC, DST, BDT, MoEF. Women Scientists schemes.
Global Information System – BIOSIS, Medline and Medlars, AGRIS, Pubmed, Google Scholar.

Information Science, Extension and Ethics **(6 hrs)**

Sources of Information - Primary and secondary sources.
Library - books, journals, periodicals, reference sources, abstracting and indexing sources, Reviews, Treatise, Monographs.

Online resources – INFLIBNET, e-libraries, e-Books, e-Encyclopedia, e-Journals, e-Thesis, Shodhganga, PG-Pathshala, TED Talk, Institutional Websites. MOOC - SWAYAM, NPTEL.
Networking platforms for researchers - Academia, ResearchGate.
Ethics in research - Plagiarism, Plagiarism checking softwares - Turnitin, Viper, Urkund; Citation and Acknowledgement.
Extension: Lab to Field, Extension communication, Extension tools.

Recommended Text Books/Reference Books

1. Chap T. Le.2003.*Introductory Biostatistics*. John Wiley &Sons, NJ, USA.
2. Clough, P. and C.Nutbrown.2002. *A Student's Guide to Methodology: Justifying Enquiry*. Sage, London.
3. Daniel W.W. 2006. *Biostatistics: A Foundation for Analysis in the Health Sciences* (7th edn). John Wiley & Sons, New York.
4. Freedman D. F., Pisani R. and Purves R. 2011. Statistics. Viva Books, New Delhi.
5. Dharmapalan Biju. 2012. *Scientific Research Methodology*. Narosa Publishing House, New Delhi.
6. Gupta S. P. 2014. Statistical methods for CA foundation course. Sultan Chand & Sons, New Delhi.
7. Kothari C. R. 2009. *Research Methodology: Methods and Techniques* (2ndedn.). NewAge International Publishers, New Delhi.
8. Paul Oliver. 2005. *Writing Your Thesis*. Vistaar Publications.New Delhi.
9. Rajathi A. and P. Chandran, 2010. *SPSS for You*. MJP Publishers, Chennai
10. Samuels M. L., Witmer J. A. and Schaffner A. 2016. Statistics for Life Sciences (5th edn). Pearson Education Inc., New delhi.
11. Sundar Rao P.S.S. and Richard J. 2006. .*Introduction to Biostatistics and Research Methods* (4th edn). Prentice Hall, New Delhi.
12. Zar J. H. 2008. *Biostatistical Analysis* (3rd edn.). Pearson Education Inc., New Delhi

ZL010204 MICROBIOLOGY AND BIOTECHNOLOGY

54 Hours (18+27) (3hrs/week) **Credit- 3**

Objectives:

- To provide an over view of the microbial world, its structure and function
- To understand the fundamental aspects of the basic biology of bacteria and viruses
- To give students an intensive and in-depth learning in the field of biotechnology
- To familiarize the student with emerging field of biotechnology
- To understand the modern biotechnology practices and approaches with an emphasis in technology application, medical, industrial, environmental and agricultural areas and nanomedicine
- To familiarize the students with public policy, biosafety, and intellectual property rights issues related to biotechnology

MICROBIOLOGY 18hrs

Module I (10hrs)

General Characters and Classification of microbes (4 hrs)
General characters of microorganisms- bacteria, virus, fungi, Outline classification of microrganisms
Functional Anatomy of Prokaryotic Cells - Cell structure, plasma membrane, cytoskeleton, cytoplasm, nucleoid, cytoplasmic inclusions. The prokaryotic cell envelope, peptidoglycan structure, gram positive and negative cell walls.Components outside the cell wall: capsules, slime layers, pili and fimbriae, flagella and motility.

Methods in Microbiology (6 hrs)
Culture medium, methods of isolation, pure culture techniques, microbial strain identification – cultural and biochemical, Control of microorganism- physical, chemical and antimicrobial agents.

Module II

Microbial Growth and Interactions (8 hrs)
Nutrient requirements, growth factors, uptake of nutrients by the cell. Growth curve. Physical requirements for bacterial growth and influence of environmental factors on growth. Mirobes in nutrient cycling.
Symbiosis, commensalism. Mutualism between microbes, microbes and plants, microbes and animals. Cooperation, competition, predation, antagonism. Parasitism, plant parasites, animal parasites. Microbial communication system- Quorum sensing, Biofilms.

BIOTECHNOLOGY 36 hrs.

Module III

Recombinant DNA Technology - Tools and Techniques (12 hrs)

Introduction – rDNA and cloning, Restriction enzymes and DNA modifying enzymes.

Vectors: cloning and expression vectors - Plasmids, Ti and Ri plasmids, cosmids, phagemids, bacteriophage, SV40, vectors with combination features; PUC19 and Bluescript vectors, shuttle vectors, viral vectors, BAC and YAC vectors. Adaptors, Linkers
Methods of gene transfer: chemical transfection methods: calcium chloride, PEG, polyplex, DEAE dextran. Physical methods: electroporation, microinjection, particle bombardment, ultrasonication, liposome mediated transfer. Biological methods: use of vectors, Selection and screening of recombinants, insertional activation- blue white screening, Generation of cDNA and genomic library.

Basic techniques in Biotechnology
Polymerase chain Reaction- different types and applications, Gene cloning, Chromosome walking, chromosome jumping, DNA foot printing.
DNA sequencing methods- Maxam and Gilberts chemical degradation method, Sanger and Coulson method, Automated DNA sequencers.
Protein sequencing methods

Module IV

Animal Biotechnology and health care **(12 hrs)**

Cell and Tissue culture: Basic techniques of mammalian cell culture Growth media- types, biology and characterization of cultured cells.Measurement of viability and cytotoxicity, organ culture.
Cryopreservation and maintenance of cell line
Transgenic animals – production and its applications. Gene knockout and gene knock, Site directed mutagenesis, molecular chimeras
Gene therapy:Exvivo, Invivo, Insitu- Cell and tissue engineering, Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon. DNA vaccine
Biosensors and Biochip

Module V. Biotechnology in Industry, Agriculture and Environment **(5 hrs)**
Fermentation technology – Stages of fermentation - Fermentation products (antibiotics, alcohol, amino acids, organic acids, vinegar, vitamins, and fuels). Enzyme engineering and applications. Transgenic plants, Biological nitrogen fixation; Nif genes, Nitrogen fixers – Bio fertilizers (Rhizobium, Azotobacter, Azospirillum, VAM) - Bio pesticides (Bacterial, Fungal, Viral). Terminator gene technology

Module VI

Nanobiotechnology **(3 hrs)**

Introduction, Nanobiotechnological devices, Types and applications of Nanobiosensors, Drug delivery technologies, personalized nanomedicine.

Intellectual Property Rights, Biosafety and Bioethics **(4 hrs)**

Introduction to Intellectual PropertyRights, Types of IP: Patents, Trademarks, Copyrights.
Basics of Patents Types of patents; Indian Patent Act 1970; Recent Amendments, Protection of New GMOs. IPs of relevance to Biotechnology and few Case Studies (Rice, Neem, Curcumin).
Introduction to History of GATT, WTO, WIPO and TRIPS.
Biosafety concepts and issues. Biosafety protocol 2000.
Bioethics: Principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity

V. INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS

IEN1CC01: COMMUNICATION SKILLS IN ENGLISH

COURSE CODE	**IEN1CC01**
TITLE OF THE COURSE	**COMMUNICATION SKILLS IN ENGLISH**
SEMESTER IN WHICH THE COURSE IS TO BE TAUGHT	**1**
NO. OF CREDITS	**4**
NO. OF CONTACT HOURS	**90**

1. AIM OF THE COURSE

- To develop the students' ability to use English language accurately and effectively by enhancing their communication skills.

2. OBJECTIVES OF THE COURSE

- To introduce the students to the speech sounds of English in order to enable them to listen to English and speak with global intelligibility.
- To enable the students to speak English confidently and effectively in a wide variety of situations.
- To help the students to improve their reading efficiency by refining their reading strategies.

3. COURSE OUTLINE

MODULE – I

Speech Sounds **18 hours**

Phonemic symbols - Vowels - Consonants - Syllables - Word stress - Stress in polysyllabic words – Stress in words used as different parts of speech - Sentence stress – Weak forms and strong forms – Intonation – Awareness of different accents: American, British and Indian – Influence of the mother tongue

MODULE – II

Listening **18 hours**

Active listening – Barriers to listening – Listening and note taking– Listening to announcements – Listening to news on the radio and television

MODULE- III

Speaking **36 hours**

Word stress and rhythm – Pauses and sense groups – Falling and rising tones – Fluency and pace of delivery – Art of small talk – Participating in conversations – Making a short formal speech – Describing people, place, events and things – Group discussion skills and telephone skills

MODULE – IV

Reading **18 hours**

Reading: theory and Practice – Scanning - Surveying a textbook using an index - reading with a purpose – making predictions – Understanding text structure – Locating main points – Making inferences - Reading graphics - reading critically – Reading for research

4. CORE TEXT

V.Sasikumar, P Kiranmai Dutt and Geetha Rajeevan, . *Communication Skills in English*. Cambridge University Press and Mahatma Gandhi University.

FURTHER READING

Sl.No	Title	Author	Publisher & Year
1	*A Course in Listening and Speaking I & II*	Sasikumar V.,Kiranmai Dutt and Geetha Rajeevan	New Delhi: CUP, 2007
2	*Study Listening: A Course in Listening to Lectures and Note-taking*	Tony Lynch	New Delhi: CUP, 2008
3	*Study Speaking: A Course in Spoken English for Academic Purposes*	Anderson, Kenneth, Joan Maclean and Tony Lynch	New Delhi: CUP, 2008
4	*Study Reading: A Course in Reading Skills for Academic Purposes*	Glendinning, Eric H. and Beverly Holmstrom	New Delhi: CUP, 2008
5	*Communication Studies*	Sky Massan	Palgrave Macmillan

1

VI. B.VOC TOURISM AND HOSPITALITY MANAGEMENT

SEMESTER 4: BOCG401SOFT SKILLS AND PERSONALITY DEVELOPMENT

No. of credits: 4; No of contact hours: 60 (4 hour per week)

Module – I

Personal Skills: Knowing oneself- confidence building- defining strengths- thinking creatively- personal values-time and stress management.

Module – II

Social Skills: Appropriate and contextual use of language- non-verbal communication- interpersonal skills- problem solving.

Module – III

Personality Development: Personal grooming and business etiquettes, corporate etiquette,social etiquette and telephone etiquette, role play and body language.

Module – IV

Presentation skills: Group discussion- mock Group Discussion using video recording - publicspeaking.

Module – V

Professional skills: Organisational skills- team work- business and technical correspondence-job oriented skills-professional etiquettes.

SEMESTER 6: BOCG601: ENTREPRENEURSHIP DEVELOPMENT

No. of credits: 4; No. of contact hours: 60 (4 hours per week)

Module – I

To make the students understand about entrepreneurs and different classifications. Entrepreneur and etrepreneurship - Definition; traits and features; classification; Entrepreneurs; Women entrepreneurs; Role of entrepreneur in Entrepreneurs in India.

Module – II

Create an awareness about EDP. Entrepreneurial development programme concept; Need for training; phases of EDP; curriculum & contents of Training Programme; Support systems, Target Groups; Institutions conducting EDPs in India and Kerala.

Module – III

General awareness about edeutification of project financing new enterprises. Promotion of a venture; opportunity Analysis Project identification and selection; External environmental analysis economic, social, technological an competitive factors; Legal requirements for establishment of a new unit; loans; Overrum finance; Bridge finance; Venture capital; Providing finance in Approaching financing institutions for loans.

Module – IV

To identify different Discuss opportunities in small business. Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), 0 SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

Module – V

To understand about a project report relating to a small business. Project formulation - Meaning of a project report significance contents formulation planning commissions guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs case studies of entrepreneurs.

SEMESTER 4: TH4GT02: TOURISM ETHICS, LAWS AND REGULATIONS

No. of credits: 4; No. of contact hours: 60 (4 hours per week)

Unit 1

Laws relating to accommodation, travels agencies land tour operation sector. Law land regulations related to airlines and airways, laws related to rail, road transport. DCGA rules and regulation for air transportation in India.

Unit 2

Special permits to restricted areas for foreign tourist in India, restricted area in India for foreign tourists related authorities at these places to obtain permits, permits related to various monasteries and wild life areas and their procedure.

Unit 3

Law and rules designed for adventure Tour operation, special permits for rafting, paragliding, heli-skiing, and angling. Peak booking formalities, IMF rules for mountain expeditions, cancellation of permits and bookings.

Unit 4

Travel insurance and consumer protection act, foreigners act, passport act and visa extension. Ancient Monument Act, RTI, Laws related to environment and wildlife.Safety and security of tourist, tourist police, place of Tourism in the constitution,need of tourism legislation

SEMESTER 3: BOCG301: PRINCIPLES OF MANAGEMENT

No. of credits: 4; No. of contact hours: 60 (4 hours per week)

Objective: This course is a basic introductory and foundational management course. It is designed for students who desire to equip themselves with key knowledge, skills, and competencies in various aspects of management. The course encompasses the core components of management including planning, organizing, leading and controlling the organizations

MODULE – I

Nature and Process of Management: Schools of Management Thought – Management Process School, Human Behavioural School, Decision Theory School, Systems Management School, Contingency School – Managerial Role – Basics of Global Management.

MODULE – II

Planning: Objectives – Types of plans - single use plan and repeated plan – MBO, MBE– strategic planning and formulation. Decision making - types and process of decision making – forecasting.

MODULE – III

Organising: Types of organisation - formal and informal, line and staff, functional – organisation structure and design – span of control, delegation and decentralisation of authority and responsibility – organisational culture and group dynamics.

MODULE – IV

Staffing: Recruitment, Selection, Induction, Training, Maintenance and retrenchment Systems approach to HRM – Performance appraisal and career strategy – HRD - meaning and concept.

MODULE – V

Directing: Motivation – meaning - need for motivation. Theories of motivation - Herzberg and McGregor. Leadership- importance – styles of leadership, Managerial Grid by Blake and Mounton, Leadership as a Continuum by Tannenbaum and Schmidt Path Goal Approach by Robert House (in brief)

Controlling - Concept, Significance, Methods of establishing control.

Books for Reference:

1. Moshal.B.S .*Principles of Management,* Ane Books India,NewDelhi.
2. Bhatia R.C. *Business Organization and Management,* Ane Books Pvt. Ltd.,NewDelhi.
3. Richard Pettinger. *Introduction to Management* , Palgrave Macmillan, NewYork.
4. **Koontz and O'Donnel.** *Principles of Management* ,Tata McGraw-Hill Publishing Co.Ltd. NewDelhi.
5. Terry G.R. *Principles of Management,* D.B.Taraporevala Sons &Co.Pvt.Ltd.,Mumbai.
6. Govindarajan.M and Natarajan S. *Principles of Management*, PHI, NewDelhi.
7. MeenakshiGupta .*Principles of Management*, PHI, NewDelhi.

SEMESTER 2: TH2ST05 MEET & GREET SERVICE

No. of credits: 6; No of contact hours: 90 (6 hours per week)

Unit 1

Role & responsibility, Planning & preparation for meeting customers – rechecking the preparations. Meet & greet methods, developing rapport with customers, reporting escalations – communication with travel agency – Preparation of travel plan _documents provided to customers

Unit 2

Dealing with customers on arrival and departure points_check –in and out of customers_ensure travel terminal procedure_hand over the required documentprompt response to customer emergencies and requirements _escalation matrix_ensure proper luggage handling_accommodation arrangements

Unit 3

Handling guest queries and customer complaints_attitude to be maintained_addressing and spotting the problems of the customer_importance of listening and recognizing the problem_Resolving customers problems_procedure for handling the situation_acknowledge,apologoize,identify and investigate the problem_work out for solutions,provide clear reasons to the customer for their satisfaction

Unit 4

Importance of Effective communication _etiquettes_body language and dress code,gestures,ctiquettes towards customers _product and service presentation_importance of listening-gender and culture wise modes of greeting,ensure immediate reponse and feedback to the customers

References:

1. Barbara Pachter ,Essentials of Business Etiquette : How to Greet, Eat, and Tweet (English, Paperback, Edition: 2013
2. Chaturvedi P.D, Business Communication: Concepts Cases and Applications. Pearson Education.

VII. B.VOC RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

RETTG403: BIOENERGY

No. of credits: 4 **No. of contact hours: 60 (3 hours per week)**

AIM

- To provides an overview of key topics on sustainable bio energy production, including the main biomass systems for bio energy generation and the wide range of bio energy conversion and utilization methods.

OBJECTIVES

- To enable students to analyse the main biomass systems that can be used for biomass energy conversion and utilisation.
- To enable students to develop designs for biomass energy conversion and utilization within the context of a whole systems approach.
- To enable students to critically evaluate the environmental benefits and consequences of biomass energy production.

MODULE 1 **(15 hrs)**

Biomass

Sources and Classification, Chemical composition, properties of biomass, Energy plantations, Size reduction, Briquetting, Drying, Storage and handling of biomass.

MODULE 2 **(15 hrs)**

Biogas

Feedstock for biogas, Microbial and biochemical aspects- operating parameters for biogas production. Kinetics and mechanism- Types of biogas plants

MODULE 3 **(15 hrs)**

Thermochemical conversion of lignocelluloses biomass. Incineration, Processing for liquid fuel production. Pyrolysis -Effect of particle size, temperature, and products obtained. Thermo chemical Principles: Effect of pressure, temperature , steam and oxygen. Fixed and fluidized bed Gasifiers- Partial gasification of biomass by CFB

MODULE 4 **(15 hrs)**

Combustion of woody biomass-Design of equipment-Cogeneration using bagasse- Case studies: Combustion of rice husk.

REFERENCE

Renewable energy sources and emerging technologies by D.P. Kothari, K. C. Singal, Rakesh Ranjan

RETTS503: ENERGY CONSERVATION TECHNIQUES

No. of credits: 6 **No. of contact hours: 90 (5 hours per week)**

AIM

- To develop skill and capacity for effective energy conservation

OBJECTIVES

- To impart knowledge in the domain of energy conservation
- To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment
- To know various types of energy losses and the associated energy efficient technologies for the routinely used thermal and electrical energy systems.

MODULE 1 **(25 hrs)**

Introduction
Energy conservation & its importance - The Energy conservation Act 2001 & its features

Waste Minimization & Resource Conservation
Need of waste minimization - Waste minimization method & its classification - Effects of waste environment & Role of pollution control board - Case study.

MODULE 2 **(25 hrs)**

Energy Conservation Methods in Electrical System

Motors - Power factor improvement techniques - Effects of harmonics - Star-Delta conversion techniques - Variable speed drive (VSD) - Energy conservation in electric furnaces. - Pumps, Compressors, Fans & Blowers - Lighting systems - HVAC systems

MODULE 3 **(20 hrs)**

Energy Conservation In Thermal System

Boiler & furnace - Steam distribution system –HVAC - Waste heat recovery - Insulation of pipes - Condensate recovery - Fuel Handling - Other heat based application - Case Study

MODULE 4 **(20 hrs)**

Energy Conservation in Housing & Commercial Building
In Lighting System - Water heating system - Optimization cooking method - Energy efficient building.

REFERENCES

1. Energy Conservation in the Chemical & Allied Industries; S.K. Awasthi; 1989; South Asian Publishers, New Delhi
2. Energy Management Handbook; Wayne C. Turner; 2001; Fairmont Press
3. Industrial Energy Conservation; Melvin H. Chiogioji; 1979; M. Dekker

ADDITIONALREADING

RETTG504: INDUSTRIAL HEALTH AND SAFETY

No. of credits: 4 **No. of contact hours: 60 (3 hours per week)**

Aim

- To foster a safe and healthy work environment at work.

Objectives:

- To become familiar to occupational environment
- To assure safe and healthful working conditions

MODULE 1 **(15 hrs)**

Occupational Health and Hygiene

Need for developing Environment, Health and Safety systems in workplaces. Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives. International initiatives. Ergonomics and workplace. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria. Effects on humans, control methods andreduction strategies for noise, radiation and excessive stress.

References

1. Jogdand S.N., 1995. Environmental biotechnology and industrial pollution management; Himalaya Publishing House.
2. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005
3. Kumar R. (Editor)., 1997. Environmental pollution and health hazards in India. AshishPublication.
4. Ghosh G.K., 1987. Environmental pollution: a scientific dimension. AshishPublication.

MODULE 2 **(15 hrs)**

Workplace Safety and Safety Systems

Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

References

1. Jogdand S.N., 1995. Environmental biotechnology and industrial pollution management. Himalaya Publishing House.
2. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
3. Ian Paulford., Hugh Flowers., 2006. Environmental Chemistry at a Glance.Blackwell.
4. The Facility Manager's Guide to Environmental Health and Safety by BrianGallant,

MODULE 3 **(15 hrs)**

Techniques of Environmental Safety

Elements of a health and safety policy and methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Industry specific EHS issues.

References

1. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.
3. Khitoliya R.K., 2004, Environmental pollution management and control for sustainable development. S. Chand publication.
4. Bhattiya S.C., 2003. Managing industrial pollution. Mc Millan India Ltd.
5. Trivedi R.K. (Editor). Pollution and Bio monitoring of Indian Rivers. ABDpublication.

MODULE 4 **(15 hrs)**

Education and Training

Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

REFERENCES

1. Reddy, P. K., & Reddy, N. D. (2001). Environmental Education. Hyderabad: Neelkamal publications.
2. Kelu, P. (2000). Environmental education: A conceptual analysis. Calicut: CalicutUniversity.
3. Agarwal, S.P. and Aggarwal, J.C. (1996) Environmental Protection, Education and Development. New Delhi: New Concepts.

RETTG602: ENERGY MANAGEMENT AND AUDITING

No. of credits: 4 **No. of contact hours: 60 (3 hours per week)**

AIM

- To encourage implementation and proper and efficient use of energy

OBJECTIVES

- To minimize energy costs / waste without affecting production & quality
- To minimize environmental effects.

MODULE 1 **(15 hrs)**

Energy Scenario – Introduction -
Types of energy sources - Indian energy scenario-Energy V/s economic growth - Energy Policies, pricing & reforms. - Energy security - Energy strategy for future
Basic of energy & its various forms - Various forms of energy - Terms & definitions used in electrical energy - Terms & definitions used in thermal energy -Energy – Units &Conversion

MODULE 2 **(15 hrs)**

Energy Management & Audit - Definition and Objective of Energy Management - Principle of Energy Management - Energy Management skills - Energy Management Strategies
Energy Audit - Types & Methodology - Energy Audit Reporting format - understanding energy carts - Benchmarking & energy performance - Matching energy usage to requirement - Maximizing System - Fuel & energy Substitution

MODULE 3 **(15 hrs)**

Initializing and Organizing - Managing Energy Management Programmers - Organizing Energy Management Programmers -Initializing Energy Management Programmers - Initializing Planning, Leading, Controlling - Promoting, Monitoring and Reporting.
Energy Action Planning - Key Elements - Force Field Analysis - Energy Policy - Organizing – Location of energy Manager - Top Management Support - Energy Manager: Responsibilities & duties to be assigned under energy conservation Act 2001 - accountability
- Motivation of Employees - Requirements for Energy Action Planning – Information System
- marketing & Communicating - Planning & Training.

MODULE 4 **(15 hrs)**

Energy Audit Instruments - Principal and working of Electrical Measuring Instruments (Voltmeter, ammeter ,Power Factor meter, Tri-vector meters for , Speedometer contact /non-contact type) - Fluegas analyzer , Principal of measurements by Chemical Methods, Electronic Methods, - Temperature Measurement Contact type methods, Non Contact type methods - Pressure and velocity Measurement (Bourdon gauge, Manometers, Anemometer) - Flow Measurement of steam, water and air -Humidity Measurement and leak Detectors

REFERENCE

1. Energy Management Handbook; Wayne C. Turner; 2001; Fairmont Press

GENDER

I. DEPARTMENT OF ENGLISH

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 11 – Women Writing

Course Code	EN6CR11
Title of the course	**Women Writing**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To introduce the theoretical and literary responses by women and the concerns that govern feminist literature.

OBJECTIVES OF THE COURSE

On completion of the course, the students will be able to:
1. critically respond to literature from a feminist perspective.
2. realize how the patriarchal notions pervade in the social and cultural scenario and how feminism exposes these notions.
3. identify how stereotypical representations of women were constructed and how these are subverted by feminist writing

COURSE OUTLINE

Module 1 [Essays] **(36 hours)**

Betty Friedan: The Problem that has No Name (Chapter 1 of *The Feminine Mystique*)
Elaine Showalter: Towards a Feminist Poetics
Patricia Hill Collins: Mammies, Matriarchs and Other Controlling Images (Chapter 4 of *Black Feminist Thought* pp. 79-84

Module 2 [Poetry] **(18 hours)**

Anna Akhmatova: Lot's Wife

Mamta Kalia: After Eight Years of Marriage
Julia Alvarez: Women's Work
Meena Alexander: House of a Thousand Doors
Sutapa Bhattacharya: Draupadi
Kristine Batey: Lot's Wife
Vijayalakshmi: Bhagavatha

Module 3 [Short Fiction] **(18 hours)**

Charlotte Perkins Gilman: The Yellow Wallpaper
Willa Cather: A Wagner Matinee
Isabel Allende: And of the Clay We Created
Sara Joseph: The Passion of Mary

Module 4 [Fiction] **(18 hours)**

Alice Walker: *The Color Purple*

Core Text: *Women Writing*

Literary Criticism and Theory

AIM OF THE COURSE

The course seeks to introduce students to the major signposts in Literary Criticism, Literary Theory and Indian Aesthetics.

OBJECTIVES OF THE COURSE

On completion of the course, the student:

1. will have awareness about the major developments in literary criticism from the ancient times to the twentieth century.

2. will be initiated to the realm of literary theory and major theoretical schools.

3. will have awareness about the chief strains of Indian literary criticism.

4. will be able to analyse short poetical pieces critically.

COURSE OUTLINE

Module 1 [Literary Criticism]

A. Classical Criticism Plato - Aristotle

B. Neoclassical Criticism

Neoclassicism in England - Dryden, Pope, Aphra Behn, Samuel Johnson

C. Romantic criticism

German Idealism - British Romantic criticism: Wordsworth, Coleridge

D. Victorian Criticism Matthew Arnold

(36 hours)

E. From Liberal Humanism to Formalism

The poetics of Modernism: Yeats, Pound, Eliot

Formalism - Russian Formalism: Boris Eichenbaum, Mikhail Bakhtin, Roman Jakobson- New Criticism: John Crowe Ransom, Wimsatt and Beardsley

30

F. Early 20th Century Criticism

F. R. Leavis - Marxist and Left Wing critics - Early feminist critics: Virginia Woolf, Simone de Beauvoir

From M. A. R Habib: Literary Criticism from Plato to the Present: An Introduction. Oxford: Wiley Blackwell, 2011

Module 2 [Literary Theory] (36 hours)

A. Structuralism - Poststructuralism - Deconstruction - Psychoanalysis B. Ideology and Discourse

C. Postmodernism

From Mary Klages: Literary Theory: A Guide for the Perplexed. London: Continuum, 2008.

Module 3 [Indian Aesthetics & Practical Criticism] A. Indian Aesthetics

Rasa - Dhvani - Vakrokti

From G. Balamohan Thampi: Essays on Eastern Aesthetics B. Practical Criticism

(18 hours)

Critical analysis of poetry

Based on Neil McCaw: Close Reading (Chapter 3 of How to Read Texts: A Student Guide to

Critical Approaches and Skills. London: Viva-Continuum, 2008.)

Note: A compulsory question on practical criticism to be included in Section B (5 Marks) of

the Question Paper

MAHATMAGANDHIUNIVERSITY

SYLLABIFORCORECOURSES-UGPROGRAMMES

2017ADMISSIONSONWARDS

COURSE3–HarmonyofProse

Course Code	EN3CRT03
Title of the course	HarmonyofProse
Semesterinwhichthecourseistobe taught	3
No. of credits	4
No. of contact hours	90

AIMOFTHECOURSE

The student is given space to maturein the presence of glorious essays, both Western and Non-Western.

OBJECTIVESOFTHECOURSE

On completion of the course, the student shall be:

1. familiarwith varied prose styles of expression.
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSEOUTLINE

Module1 **(18hours)**

Francis Bacon: Of Friendship

Jonathan Swift: TheSpider and the Bee

Joseph Addison: Meditations in WestminsterAbbey

Module2 **(18hours)**

Samuel Johnson: Death of

DrydenCharlesLamb: Dream Children; a

reverie

William Hazlitt: The Fight

Module3 **(18hours)**

Robert Lynd:Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley:The BeautyIndustry

Module4 **(18hours)**

Nirad C. Choudhari: Indian Crowds (extract from *TheAutobiographyofanUnknownIndian*)

AmartyaSen: Sharingthe World

A. K. Ramanujan: A FloweryTree: A Woman'sTale

Module5

(18hours)

KamauBrathwaite: NationLanguage

PicoIyer:In Praise of the Humble Coma

William Dalrymple: TheDancer of Kannur (extract from*NineLives*)

CoreText:*HarmonyofProse*

Methodology of Literary Studies

AIM OF THE COURSE

The course seeks to introduce the student to the major signposts in the historical evolution of literary studies from its inception to the current postcolonial realm.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be able to discern the following:

1. The emergence of literature as a specific discipline within the humanities.

2. The tenets of what is now known as traditional' approaches and also that of formalism.' 3. The shift towards contextual-political critiques of literary studies.

4. The questions raised by Cultural Studies and Feminism(s)

5. The issues of subalternity and regionality in the literary domain.

COURSE OUTLINE Module 1

Part A:

(18 hours)

W. H. Hudson: —Some Ways of Studying Literature‖ from An Introduction to the

Study of Literature.

Part B: William Shakespeare: Sonnet 116 – —Let Me Not to the Marriage of True Minds‖ Module 2 (18 hours)

Part A: Cleanth Brooks: —The Formalist Critics‖ from the My Credo series: The Kenyon Review

Part B: Emily Dickinson: —Because I could not stop for Death‖ (poem 479)

15

Module 3 (18 hours) Part A: Terry Eagleton: —What is Literature?‖ from Literary Theory: An Introduction.

Part B: Mahasweta Devi: —Kunti and the Nishadin‖ Module 4

Part A: Lois Tyson: —Feminist Criticism‖

Part B: Sara Joseph: —Inside Every Woman Writer‖

Module 5

Part A: Peter Barry: Postcolonial Criticism

(18 hours)

(18 hours)

Part B: 2 Poems in tandem: Mahmoud Darwish: —Identity Card‖ and S. Joseph: —Identity Card‖

Module 6 (18 hours) Part A: Pradeepan Pampirikunnu: —What did Literary Histories Say to You?‖

Part B: Poikayil Appachan: —No Alphabet in Sight‖

Approaching the Course:

Ideally this paper should have a consistent linearity from Module 1 to 6; such a step-by-step progression will help trace the following trajectory effectively: Traditional to Formalist to Political-Contextual to Feminist to Postcolonial to Regional-Subaltern methodologies.

Core Text: Nuances: Methodology of Literary Studies. Macmillan and Mahatma Gandhi University

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 – Literature and/as Identity

Course Code Title of the course Semester in which the course is to be taught	**EN3CC05** **Literature and/as Identity** **3**
No. of credits No. of contact hours	**4** **90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature serves as a platform for forming, consolidating, critiquing and re-working the issue of 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:

1. The subtle negotiations of Indigenous and Diasporic identities with-in Literature.
2. The fissures, the tensions and the interstices present in South Asian regional identities.
3. The emergence of Life Writing and alternate/alternative/marginal identities.

COURSE OUTLINE

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: I See Kashmir from New Delhi at Midnight
M.G. Vassanji: Leaving
Imtiaz Dharker: At the Lahore Karhai
Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) **(18 hours)**

C. V. Velupillai: No State, No Dog
Sadaat Hasan Manto: The Dog of Tetwal
Intizar Hussain: A Chronicle of the Peacocks
Selina Hossain: Double War

Formalism - Russian Formalism: Boris Eichenbaum, Mikhail Bakhtin, Roman Jakobson- New Criticism: John Crowe Ransom, Wimsatt and Beardsley

30

F. Early 20th Century Criticism

F. R. Leavis - Marxist and Left Wing critics - Early feminist critics: Virginia Woolf, Simone de Beauvoir

From M. A. R Habib: Literary Criticism from Plato to the Present: An Introduction. Oxford: Wiley Blackwell, 2011

Module 2 [Literary Theory] (36 hours)

A. Structuralism - Poststructuralism - Deconstruction - Psychoanalysis B. Ideology and Discourse

C. Postmodernism

From Mary Klages: Literary Theory: A Guide for the Perplexed. London: Continuum, 2008.

Module 3 [Indian Aesthetics & Practical Criticism] A. Indian Aesthetics

Rasa - Dhvani - Vakrokti

From G. Balamohan Thampi: Essays on Eastern Aesthetics B. Practical Criticism

(18 hours)

Critical analysis of poetry

Based on Neil McCaw: Close Reading (Chapter 3 of How to Read Texts: A Student Guide to

Critical Approaches and Skills. London: Viva-Continuum, 2008.)

Note: A compulsory question on practical criticism to be included in Section B (5 Marks) of

the Question Paper

MAHATMA GANDHI UNIVERSITY SYLLABI FOR COMMON COURSES - UG PROGRAMMES 2017 ADMISSIONS ONWARDS

Title of the Course: Pearls from the Deep

Semester in which the Course is to be taught 1

No. of Credits 3

No. of Contact Hours 72

COURSE 2 - Pearls from the Deep

AIM OF THE COURSE: To introduce students to the different genres of literature and to the niceties of literary expression.

OBJECTIVES OF THE COURSE: On completion of the course, the student should be able to: 1. appreciate and enjoy works of literature. 2. appreciate the aesthetic and structural elements of literature.

COURSE OUTLINE

Module 1 [Fiction] (18 hours)

Ernest Hemingway: The Old Man and the Sea

Module 2 [One Act Plays] (18 hours)

Susan Glaspell: Trifles Asif Currimbhoy: The Refugee A. A. Milne: The Boy Comes Home

Module 3 [Short Stories] (18 hours)

Guy De Maupassant: Two Friends O. Henry: The Gift of the Magi

K. A. Abbas: Sparrows Flora Annie Steel: Valiant Vicky, the Brave Weaver

Module 4 [Poems] (18 hours)

Rumi: The Chance of Humming

Walter Scott: Lochinvar

John Keats: La Belle Dame sans Mercy

Robert Frost: After Apple Picking

Chinua Achebe: Refugee Mother and Child

Kamala Das: My Grandmother's House

Ted Hughes: Jaguar

Pablo Neruda: Tonight I can Write the Saddest Lines

P. P. Ramachandran: How Simple!

Core Text: Pearls from the Deep. Cambridge University Press and Mahatma Gandhi University

II. DEPARTMENT OF HINDI

SEMESTER III

Paper- 3- कविता, व्याकरण और अनुवाद (Poetry, Grammar & Translation)

कविता/ Poetry (Text Book-काव्य कुसुम)

Course Code-HN3CCT03

1. कबीरदास – दोहा (4)
2. तुलसीदास – पद (2)
3. मीराबाई – पद (2)
4. बिहारी – दोहा (3)
5. जागो फिर एक बार - सूर्यकांत त्रिपाठी निराला
6. वे मुस्काते फूल नहीं – महादेवी वर्मा
7. खेवली – धूमिल
8. छीनने आये हैं वे – सर्वेश्वर दयाल सक्सेना
9. आज़ादी उर्फ गुलामी- ज्ञानेन्द्रपति
10. तुम्हें कुछ करना चाहिए – चंद्रकांत देवताले
11. सबूत – अरुण कमल
12. दिल्ली दरवाज़ा – कुमार विकल
13. जंगल के उजाड में – विनोद कुमार शुक्ल
14. बाज़ार – मंगलेश डबराल
15. बीसवीं शती के अंतिम दिनों का एक आश्चर्य – राजेश जोशी
16. दो हाथियों की लड़ाई – उदयप्रकाश
17. ठंडे पानी की मशीन - एकांत श्रीवास्तव
18. अच्छे आदमी – कुमार अम्बुज

व्याकरण और अनुवाद (Grammar & Translation)

1. सामान्य हिंदी व्याकरण तथा रचना –श्रीकृष्ण पाण्डेय (Page -19-58 & 111-117)

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
कबीरदास तुलसीदास बिहारी मीराबाई	जागो फिर एक बार वे मुस्काते फूल नहीं खेवली छीनने आये हैं वे आज़ादी उर्फ गुलामी	तुम्हें कुछ करना चाहिए सबूत दिल्ली दरवाज़ा जंगल के उजाड में बाज़ार	बीसवीं शती के अंतिम दिनों का एक आश्चर्य दो हाथियों की लड़ाई ठंडे पानी की मशीन अच्छे आदमी
व्याकरण			व्याकरण
अनुवाद			अनुवाद

B.A/ B.Sc Model I (Hindi)

SEMESTER I

Paper- 1- गद्य और एकाँकी (Prose & One Act Plays) (Text Book-साहित्य दर्पण)

Course Code-HN1CCT01

गद्य/ Prose

1. आईये हम वृक्ष देवता की आराधना करें - डॉ. किशोरी लाल व्यास
2. भय -रामचंद्र शुक्ल
3. हिमाच्छादित उत्तुंग शिखर और धुली हरियाली - विजय कुमार सन्देश
4. कफ़न चोर का बेटा -उषा बाला
5. जब मैं फेल हुआ- ए पी जे अब्दुल कलाम
6. जब इंतिज़ार हुसैन अपनी जन्मभूमि आये -अजहर वजाहत

एकाँकी /One Act Plays

1. दीपदान – रामकुमार वर्मा
2. जान से प्यारे – ममता कालिया
3. बहु की विदा – विनोद रस्तोगी
4. सती – जी. के. हरिजीत
5. हरी घास पर घंटे भर – सुरेन्द्र वर्मा

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
आईये हम वृक्ष देवता की आराधना करें	हिमाच्छादित उत्तुंग शिखर और धुली हरियाली	जब मैं फेल हुआ	जब इंतिज़ार हुसैन अपनी जन्मभूमि आये
भय	कफ़न चोर का बेटा	बहु की विदा	हरी घास पर घंटे भर
दीपदान	जान से प्यारे	सती	

SEMESTER II

Paper- 2- कहानी और उपन्यास (Short stories & Novel)

Course Code-HN2CCT02

उपन्यास/ Novel

1. अंतिम साक्षय – चंद्रकांता

कहानी/ Short stories (Text Book-कथा संसार)

1. ईदगाह- प्रेमचंद
2. हीलिबोन की बतखें- अज्ञेय
3. अमरूद का पेड -ज्ञानरंजन
4. जंगल का दाह- स्वयंप्रकाश
5. छुट्टी का दिन- उषा प्रियंवदा
6. बाज़ार में रामधन- कैलाश बनवासी
7. माँ रसोई में रहती है – कुमार अम्बुज

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय
ईदगाह	अमरूद का पेड	छुट्टी का दिन	माँ रसोई में रहती है
हीलिबोन की बतखें	जंगल का दाह	बाज़ार में रामधन	

SEMESTER IV

Paper- 4- नाटक और लंबी कविता (Drama & Long Poem)
Course Code-HN4CCT04

नाटक/ Drama

1. कोणार्क – जगदीश चन्द्र माथुर

लंबी कविता (Long Poem) (Text Book-पांच लंबी कविताएँ)

1. नगई महुरा- त्रिलोचन
2. शहंशाह की नींद – उमाशंकर चौधरी
3. ढाबा – नीलेश रघुवंशी
4. इतनी दूर मत ब्याहना बाबा – निर्मला पुत्तुल
5. जवाहर टनल –अग्निशेखर

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
कोणार्क	कोणार्क	कोणार्क	कोणार्क
नगई महुरा	शहंशाह की नींद	ढाबा	जवाहर टनल
		इतनी दूर मत ब्याहना बाबा	

B.Com Model I

SEMESTER I

Paper- 1- गद्य और संचार मीडिया (Prose & Mass Media)

Course Code-HN1CCT01

गद्य/ Prose (Text Book-साहित्य सागर)

1. नेहरु का रास्ता – माधव हाड़ा
2. जूठन- ओमप्रकाश वाल्मीकी
3. चूहा और मैं- हरिशंकर परसाई
4. अग्नि की उड़ान- ए पी जे अब्दुल कलाम
5. आस्था और रोमांच की यात्रा- पवन चौहान
6. गौरी का गुस्सा-स्वयं प्रकाश

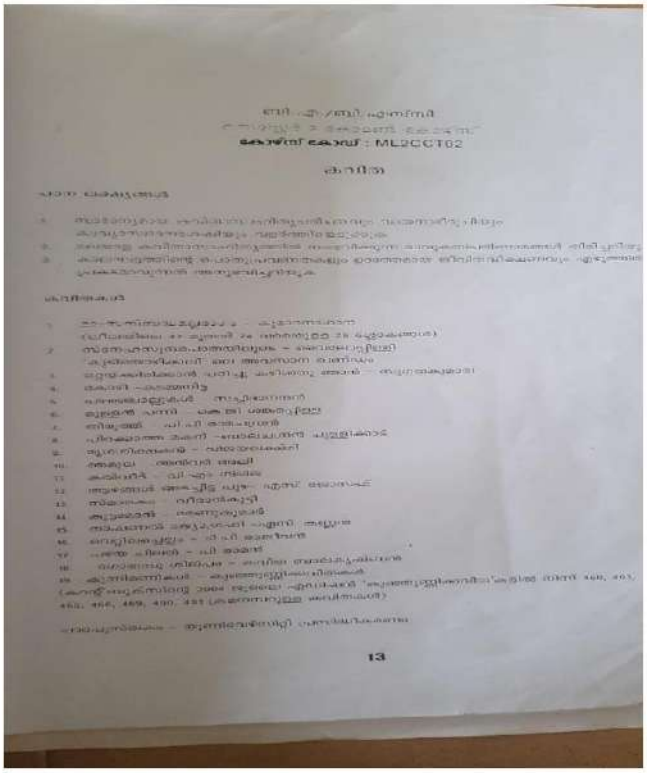
संचार मीडिया (Mass Media) (Text Book-संचार मीडिया एवं व्यावसायिक पत्र लेखन)

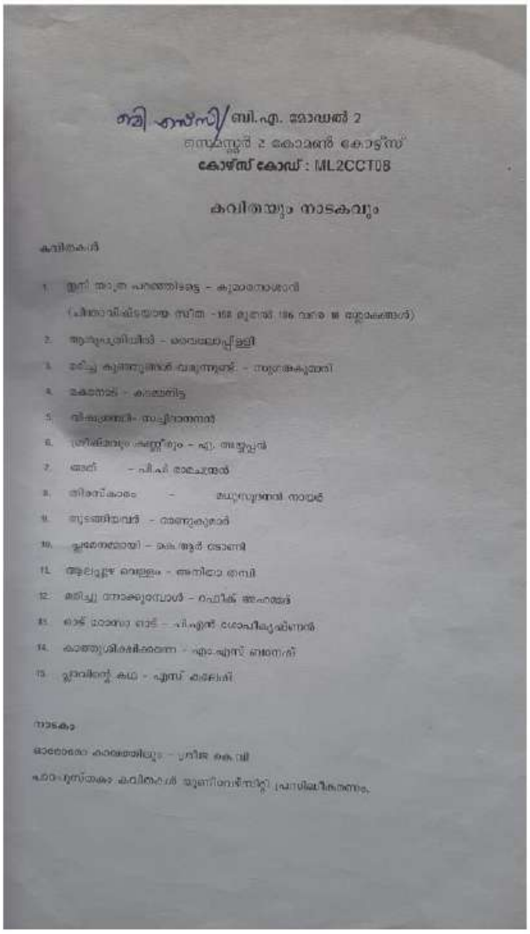
1. दर्शकों को अब भी अच्छे सिनेमा की तलाश – ओमपुरी
2. विज्ञापन और स्त्री – कुमुद शर्मा
3. माध्यम् की तलाश – राही मासूम रज़ा
4. चक दे इण्डिया – रामशरण जोशी

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
नेहरु का रास्ता	चूहा और मैं	आस्था और रोमांच की यात्रा	गौरी का गुस्सा
जूठन	अग्नि की उड़ान		
दर्शकों को अब भी अच्छे सिनेमा की तलाश	विज्ञापन और स्त्री	माध्यम् की तलाश	चक दे इण्डिया

III. DEPARTMENT OF MALAYALAM





ബി.എസ്സി/ബി.എ. മോഡൽ 2
സെമസ്റ്റർ 2 കോമൺ കോഴ്സ്
കോഴ്സ് കോഡ് : ML2CCT08

കവിതയും നാടകവും

കവിതകൾ

1. ഇനി യാത്ര പറഞ്ഞിടട്ടെ – കുമാരനാശാൻ
   (ചിന്താവിഷ്ടയായ സീത – 158 മുതൽ 186 വരെ [illegible] ശ്ലോകങ്ങൾ)
2. ആസ്പത്രിയിൽ – വൈലോപ്പിള്ളി
3. മരിച്ച കുഞ്ഞുങ്ങൾ വരുന്നുണ്ട് – സുഗതകുമാരി
4. മകനോട് – കടമ്മനിട്ട
5. വിശുദ്ധൻ – സച്ചിദാനന്ദൻ
6. ശ്രീബുദ്ധനും ക്രിസ്തുവും – എ. അയ്യപ്പൻ
7. ലോറി – പി.പി. രാമചന്ദ്രൻ
8. തിരസ്കാരം – മധുസൂദനൻ നായർ
9. തുടങ്ങിയവർ – രഞ്ജുകുമാർ
10. പൂക്കാമയി – കെ.ആർ. ടോണി
11. ആലപ്പുഴ വെള്ളം – അനിതാ തമ്പി
12. മരിച്ചു നോക്കുമ്പോൾ – റഫീക് അഹമ്മദ്
13. ഓട് മാഷേ ഓട് – പി.എൻ. ഗോപീകൃഷ്ണൻ
14. കാത്തുശിക്ഷിക്കണേ – എം.എസ്. ബനേഷ്
15. പ്ലാവിന്റെ കഥ – എസ്. കലേഷ്

നാടകം

ഓരോരോ കാലത്തിലും – ശ്രീജ കെ.വി

പാഠപുസ്തകം: കവിതകൾ യൂണിവേഴ്സിറ്റി പ്രസിദ്ധീകരണം.

ബി.എ/ബി.എസ്സി
സെമസ്റ്റർ 4 കോമൺ കോഴ്സ്
കോഴ്സ് കോഡ്: ML4CCT04

മലയാളഗദ്യരചനകൾ

മലയാളഗദ്യത്തിന്റെ ശക്തിയും സാധ്യതയും മനസ്സിലാക്കാൻ പര്യാപ്തമായ ലേഖന[illegible] ജീവിത [illegible] ഓർമ്മക്കുറിപ്പുകളിലൂടെ എഴുത്തുകാരെയും എഴുത്തുകാരെ [illegible] ത്തിയ സമൂഹത്തെയും തിരിച്ചറിയുന്നത് എങ്ങനെയെന്ന് മനസ്സിലാക്കാൻ സാധിക്കുന്നു

1. ലേഖനങ്ങൾ

പുസ്തകം- യൂണിവേഴ്സിറ്റി പ്രസിദ്ധീകരണം

1. കാളിദാസനും കാലത്തിന്റെ ദാസൻ- ജോസഫ് മുണ്ടശ്ശേരി
2. മാതൃഭാഷയിലേക്കുവീണ്ടും- എൻ.വി. കൃഷ്ണവാരിയർ
3. ഞങ്ങൾ നിങ്ങൾക്കു ഭൂമി വിറ്റാൽ- സിയാറ്റിൽ മൂപ്പൻ
4. വാക്കുകളുടെ വിസ്മയം- എം.ടി. വാസുദേവൻ നായർ
5. മാറുന്ന മലയാള സംസാരഭാഷ- ടി.ബി. വേണുഗോപാലപ്പണിക്കർ
6. നമ്മുടെ അടുക്കള തിരിച്ചുപിടിക്കുക- സാറാജോസഫ്
7. കലയും കലാദർശനവും- ഡോ.ജെ.ഉണ്ണികൃഷ്ണപിള്ള
8. ചെമ്പൈ വൈദ്യനാഥഭാഗവതർ സംഗീതത്തിലെ സിംഹനാദം- ഇന്ദിരാമേനോൻ
9. ഈശ്വരപിള്ളയെ ഓർക്കുന്നു- പി.കെ. രാജശേഖരൻ
10. പ്രകാശത്തിന്റെ ആയിരം ശരങ്ങൾ- ജീവൻ ജോബ് തോമസ്
11. പുതിയം- ഡെസ്മണ്ട് മോറിസ്
12. രവിവർമ്മ- വിജയകുമാർ മേനോൻ
13. കേരളസമൂഹവിവർത്തനങ്ങൾ- ഡോ. എൻ. അജയകുമാർ

2. അനുഭവം, ആത്മകഥ

ഓർമ്മകൾ പനംഗസമൂഹംപോലെ- ബി. സരസ്വതി

IV. DEPARTMENT OF ZOOLOGY

SEMESTER VI. ZY6CRT09

CORE COURSE IX

DEVELOPMENTAL BIOLOGY

54 Hrs

3 Credits

Objectives:

1. To achieve a basic understanding of the experimental methods and designs that can be used for future studies and research.
2. To provide the students with the periodicclass discussions of current events in science which will benefitthem in their future studies in the biological/physiological sciences and health-related fields
3. To contribute tocritical societal goal of a scientifically literate citizenry.

Module 1 **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg, Pregnancy, parturition and lactation.Reproductive health and importance of sex education.

.**Egg types:** Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs.Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy, Parthenogenesis- Different types and significance.

Module II **14 Hrs**

Cleavage: Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation.Concept of germ layers and derivatives.

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (maternal effect genes), Zygotic genes.

Module III **20Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of eye.Metamorphosis of frog, Hormonal and environmental onrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)

Module IV **5Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

Developmental defects: Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References

Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper,Stephen L. Hauser, Dan L. Longo, J. Larry Jameson and Joseph Loscalzo; 2008; Harriosns Principles of Internal Medicine; Chruch Livingston 17th Ed.

Balnisky B.I.; 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N..J.; and Kars, G.; 1986. Developmental biology, Mc Graw Hills

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Majumdar N. N -1985 Vetebrate embryology; Tata McGraw-Hill, New Delhi

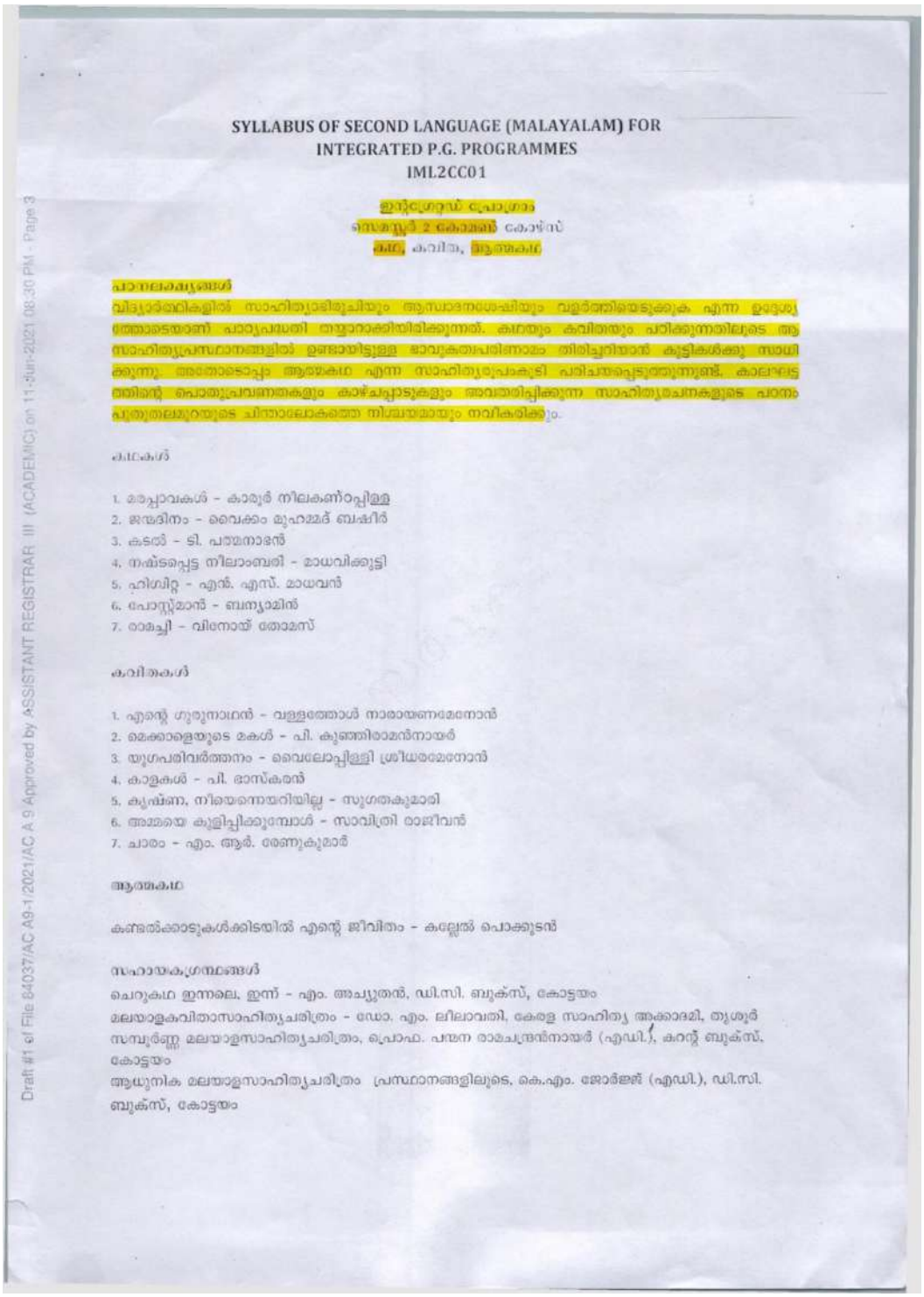
Melissa A & Gibbs, 2006; A practical Guide to Developmental Biology, Oxford university press (Int. student edition)

Scott F. Gilbert; 2003; Developmental biology; Sinauer Associates Inc.,U.S.; 7th Revised edition.

Vijayakumarn Nair, K. & George, P. V. 2002. A manual of developmental biology, Continental publications , Trivandrum

Taylor D J, Green NPO & G W Stout. (2008) Biological Science third edition. Cambridge university press. Ref pp 748 biology 755

V. INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS



SYLLABUS OF SECOND LANGUAGE (MALAYALAM) FOR
INTEGRATED P.G. PROGRAMMES
IML2CC01

ഇന്റഗ്രേറ്റഡ് പ്രോഗ്രാം
സെമസ്റ്റർ 2 കോമൺ കോഴ്സ്
കഥ, കവിത, ആത്മകഥ

പാഠലക്ഷ്യങ്ങൾ
വിദ്യാർത്ഥികളിൽ സാഹിത്യാഭിരുചിയും ആസ്വാദനശേഷിയും വളർത്തിയെടുക്കുക എന്ന ഉദ്ദേശ്യത്തോടെയാണ് പാഠ്യപദ്ധതി തയ്യാറാക്കിയിരിക്കുന്നത്. കഥയും കവിതയും പഠിക്കുന്നതിലൂടെ ആ സാഹിത്യപ്രസ്ഥാനങ്ങളിൽ ഉണ്ടായിട്ടുള്ള ഭാവുകത്വപരിണാമം തിരിച്ചറിയാൻ കുട്ടികൾക്കു സാധിക്കുന്നു. അതോടൊപ്പം ആത്മകഥ എന്ന സാഹിത്യരൂപംകൂടി പരിചയപ്പെടുത്തുന്നുണ്ട്. കാലഘട്ടത്തിന്റെ പൊതുപ്രവണതകളും കാഴ്ചപ്പാടുകളും അവതരിപ്പിക്കുന്ന സാഹിത്യരചനകളുടെ പഠനം പുതുതലമുറയുടെ ചിന്താലോകത്തെ നിശ്ചയമായും നവീകരിക്കും.

കഥകൾ

1. മരപ്പാവകൾ - കാരൂർ നീലകണ്ഠപ്പിള്ള
2. ജന്മദിനം - വൈക്കം മുഹമ്മദ് ബഷീർ
3. കടൽ - ടി. പത്മനാഭൻ
4. നഷ്ടപ്പെട്ട നീലാംബരി - മാധവിക്കുട്ടി
5. ഫിഗ്വിറ്റ - എൻ. എസ്. മാധവൻ
6. പോസ്റ്റ്മാൻ - ബന്യാമിൻ
7. രാമച്ചി - വിനോയ് തോമസ്

കവിതകൾ

1. എന്റെ ഗുരുനാഥൻ - വള്ളത്തോൾ നാരായണമേനോൻ
2. മെക്കാളെയുടെ മകൾ - പി. കുഞ്ഞിരാമൻനായർ
3. യുഗപരിവർത്തനം - വൈലോപ്പിള്ളി ശ്രീധരമേനോൻ
4. കാളകൾ - പി. ഭാസ്കരൻ
5. കൃഷ്ണ, നിയെന്നെയറിയില്ല - സുഗതകുമാരി
6. അമ്മയെ കുളിപ്പിക്കുമ്പോൾ - സാവിത്രി രാജീവൻ
7. ചാരം - എം. ആർ. രേണുകുമാർ

ആത്മകഥ

കണ്ണൽക്കാടുകൾക്കിടയിൽ എന്റെ ജീവിതം - കല്ലേൽ പൊക്കുടൻ

സഹായകഗ്രന്ഥങ്ങൾ
ചെറുകഥ ഇന്നലെ, ഇന്ന് - എം. അച്യുതൻ, ഡി.സി. ബുക്സ്, കോട്ടയം
മലയാളകവിതാസാഹിത്യചരിത്രം - ഡോ. എം. ലീലാവതി, കേരള സാഹിത്യ അക്കാദമി, തൃശൂർ
സമ്പൂർണ്ണ മലയാളസാഹിത്യചരിത്രം, പ്രൊഫ. പന്മന രാമചന്ദ്രൻനായർ (എഡി.), കറന്റ് ബുക്സ്, കോട്ടയം
ആധുനിക മലയാളസാഹിത്യചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ, കെ.എം. ജോർജ്ജ് (എഡി.), ഡി.സി. ബുക്സ്, കോട്ടയം

SYLLABUS OF SECOND LANGUAGE (HINDI) FOR INTEGRATED P.G. PROGRAMMES

IHN2CC01

Syllabus Of Hindi(Common Course) For Integrated Courses

Credit:4

SEMESTER II

कथा और कविता (Short Stories & Poems)

कथा/Short Stories

1.सदगति – प्रेमचन्द

2.बदबू -शेखर जोशी

3.हरी बिन्दी-मृदला गर्ग

4.नो बार-मोहनदास नैमिशराय

5.बाबूलाल तेली – स्वयं प्रकाश

6.केक -असग़र वजाहत

कविता/Poems

1.दोहे (4) -कबीरदास

2.अकाल और उसके बाद-नागार्जुन

3.पानी की प्रार्थना-केदारनाथ सिंह

4.बस्स! बहुत हो चुका -ओमप्रकाश वाल्मीकि

5.स्त्रियाँ -अनामिका

6.जगमगाती रोशनियों से दूर अंधेरों से घिरा आदमी -निर्मला पुतुल

(Module-wise Distribution)

MODULE-I	MODULE-II	MODULE -III	MODULE-IV
सदगति	हरी बिन्दी	बाबूलाल तेली	केक
बदबू	नो बार	पानी की प्रार्थना	स्त्रियाँ
दोहे (4)	अकाल और उसके बाद	बस्स! बहुत हो चुका	जगमगाती रोशनियों से दूर अंधेरों से घिरा आदमी

कबीरदास-दोहे

1.गुरु गोविन्द दोउ खड़े,काके लागूं पाय।

बलिहारी गुरु आपने गोविन्द दियो बताय ॥

2.पोथी पढ़ी पढ़ी जग मुआ,पंडित भया न कोय ।
ढाई आखर प्रेम का,पढ़े सो पंडित होय ॥

3.कबीरा खड़ा बाज़ार में,मांगे सबकी खैर ।
न काहू से दोस्ती,न काहू से वैर ॥

4.तूं तूं करता तूं भया,मुझ मैं रही न हूँ ।
वारी फेरी बलि गई,जित देखों तित तूं ॥

VI. B. VOC TOURISM AND HOSPITALITY MANAGEMENT

SEMESTER 6: BOCG601: ENTREPRENEURSHIP DEVELOPMENT

No. of credits: 4; No. of contact hours: 60 (4 hours per week)

Module – I

To make the students understand about entrepreneurs and different classifications. Entrepreneur and etrepreneurship - Definition; traits and features; classification; Entrepreneurs; Women entrepreneurs; Role of entrepreneur in Entrepreneurs in India.

Module – II

Create an awareness about EDP. Entrepreneurial development programme concept; Need for training; phases of EDP; curriculum & contents of Training Programme; Support systems, Target Groups; Institutions conducting EDPs in India and Kerala.

Module – III

General awareness about edeutification of project financing new enterprises. Promotion of a venture; opportunity Analysis Project identification and selection; External environmental analysis economic, social, technological an competitive factors; Legal requirements for establishment of a new unit; loans; Overrum finance; Bridge finance; Venture capital; Providing finance in Approaching financing institutions for loans.

Module – IV

To identify different Discuss opportunities in small business. Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), 0 SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

Module – V

To understand about a project report relating to a small business. Project formulation - Meaning of a project report significance contents formulation planning commissions guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs case studies of entrepreneurs.

VII. B. VOC RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

BRCTG601: Project Management And Entrepreneurship

No. of credits: 4 **No. of contact hours: 60 (4 hours per week)**

Aim:
To provide an understanding of the key elements in project management as well as the processes and motivations of innovation and entrepreneurship.

Objectives:

- To develop entrepreneurial spirit among students
- To empower students with sufficient knowledge to start up their venture with confidence
- To mould young minds to take up challenges and become employer than seeking employment and to make them aware of the opportunities and support for entrepreneurship in India

MODULE I

Introduction to Entrepreneurship
Meaning and importance
Qualities of an entrepreneur, Functions of an entrepreneur

MODULE II
Classification of Entrepreneurship
Production sector, Service sector, Dealership
Networking and franchising. Micro Small Medium Enterprises (MSME). Steps to establish an enterprise

MODULE III
Project Identification and Management
Identification of project- Sources of project idea, Sources of business idea, Legal protection in India Trademark, Copyright patent, Financing, Subsidy

MODULE IV
Project formulation and report
Formation of a project, Stages in project formulation- Preparation of a project report, Content, Project appraisal

HUMAN VALUES

I. DEPARTMENT OF ENGLIS

Fifth Semester - UG English Language and literature

Syllabus for Core Course - Environmental Studies and Human Rights
(2017 admission onwards)

Module 1: Regional **18 Hours**

1. O N V Kuruppu – A Requiem for Earth
2. Vaikom Muhammed Basheer – The Inheritors of the Earth
3. Swarnalatha Rangarajan and Sreejith Varma- The Plachimada Struggle: A David-and-Goliath Story (extract from 'Introduction' to *Mayilamma*)

Module 2: National **18 Hours**

1. Ruskin Bond – An Island of Trees
2. Indra Munshi – Loss of Land and Livelihood (extract from 'Introduction' to *The Adivasi Question*)
3. Toru Dutt – Our Casuarina Tree
4. Ashish Kaul – Load Shedding

Module 3: Global **18 Hours**

1. Walt Whitman – Give me the Splendid Silent Sun
2. K R Srinivasa Iyengar – An Unfinished Continent
3. Swarnalatha Rangarajan – Swampspeak

Module 4: Environmental Science **18 Hours**

1. Erach Bharucha – Global Warming
2. Erach Bharucha – Environmental Values
3. Aloka Debi – Ecology: Types of Ecosystems
4. Aloka Debi - Waste Management

Module 5: Human Rights **18 Hours**

Unit 1 - Human Rights: An Introduction to Human Rights

Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit. 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Women and children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Core Text: Module 1 to 4- **Nature Anthem: A Textbook on Environmental Studies**

Reference texts for Module 5:

1. Basic Documents in Human Rights: Ian Brownlie
2. Universal Human Rights in Theory and Practice: Jack Donelly
3. Future of Human Rights: Upendra Baxi
4. Understanding Human Rights : An Overview: O P Dhiman
5. Reforming Human Rights: D.P.Khanna
6. Human Rights in India Historical, Social and Political Perspectives: Chiranjivi J Nirmal
7. Human Rights in Post colonial India: Edited by Om Prakash Dwivedi and V G Julie Rajan

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR CORE COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 11 – Women Writing

Course Code	**EN6CR11**
Title of the course	**Women Writing**
Semester in which the course is to be taught	**6**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To introduce the theoretical and literary responses by women and the concerns that govern feminist literature.

OBJECTIVES OF THE COURSE

On completion of the course, the students will be able to:
1. critically respond to literature from a feminist perspective.
2. realize how the patriarchal notions pervade in the social and cultural scenario and how feminism exposes these notions.
3. identify how stereotypical representations of women were constructed and how these are subverted by feminist writing

COURSE OUTLINE

Module 1 [Essays] **(36 hours)**

Betty Friedan: The Problem that has No Name (Chapter 1 of *The Feminine Mystique*)
Elaine Showalter: Towards a Feminist Poetics
Patricia Hill Collins: Mammies, Matriarchs and Other Controlling Images (Chapter 4 of *Black Feminist Thought* pp. 79-84

Module 2 [Poetry] **(18 hours)**

Anna Akhmatova: Lot's Wife

Mamta Kalia: After Eight Years of Marriage
Julia Alvarez: Women's Work
Meena Alexander: House of a Thousand Doors
Sutapa Bhattacharya: Draupadi
Kristine Batey: Lot's Wife
Vijayalakshmi: Bhagavatha

Module 3 [Short Fiction] **(18 hours)**

Charlotte Perkins Gilman: The Yellow Wallpaper
Willa Cather: A Wagner Matinee
Isabel Allende: And of the Clay We Created
Sara Joseph: The Passion of Mary

Module 4 [Fiction] **(18 hours)**

Alice Walker: *The Color Purple*

Core Text: *Women Writing*

MAHATMAGANDHIUNIVERSITY

SYLLABIFORCORECOURSES-UGPROGRAMMES

2017ADMISSIONSONWARDS

COURSE3–HarmonyofProse

Course Code	**EN3CRT03**
Title of the course	**HarmonyofProse**
Semesterinwhichthecourseistobe taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIMOFTHECOURSE

The student is given space to maturein the presence of glorious essays, both Western and Non-Western.

OBJECTIVESOFTHECOURSE

On completion of the course, the student shall be:

1. familiarwith varied prose styles of expression
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSEOUTLINE

Module1 **(18hours)**

Francis Bacon: Of Friendship

Jonathan Swift: TheSpider and the Bee

Joseph Addison: Meditations in WestminsterAbbey

Module2 **(18hours)**

Samuel Johnson: Death of

DrydenCharlesLamb: Dream Children; a

reverie

William Hazlitt: The Fight

Module3 **(18hours)**

Robert Lynd:Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley:The BeautyIndustry

Module4 **(18hours)**

Nirad C. Choudhari: Indian Crowds (extract from *TheAutobiographyofanUnknownIndian*)

AmartyaSen: Sharingthe World

A. K. Ramanujan: A FloweryTree: A Woman'sTale

Module5

(18hours)

KamauBrathwaite: NationLanguage

PicoIyer:In Praise of the Humble Coma

William Dalrymple: TheDancer of Kannur (extract from*NineLives*)

CoreText:*HarmonyofProse*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

COURSE 5 - Literature and/as Identity

Course Code Title of the course Semester in which the course is to be taught	**EN3CC05** **Literature and/as Identity** **3**
No. of credits No. of contact hours	**4** **90**

AIM OF THE COURSE

The course is intended to sensitivise students to the various ways in which literature serves as a platform for forming, consolidating, critiquing and re-working the issue of 'identity' at various levels.

OBJECTIVES OF THE COURSE

On completion of the course, the student should be aware of the following:

1. The subtle negotiations of Indigenous and Diasporic identities with-in Literature.
2. The fissures, the tensions and the interstices present in South Asian regional identities.
3. The emergence of Life Writing and alternate/alternative/marginal identities.

COURSE OUTLINE

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: I See Kashmir from New Delhi at Midnight
M.G. Vassanji: Leaving
Imtiaz Dharker: At the Lahore Karhai
Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) **(18 hours)**

C. V. Velupillai: No State, No Dog
Sadaat Hasan Manto: The Dog of Tetwal
Intizar Hussain: A Chronicle of the Peacocks
Selina Hossain: Double War

Module 3 (Life Writings) **(18 hours)**

Malcolm X: "Nightmare", excerpt from *The Autobiography of Malcolm X.*
Sashi Deshpande: Learning to be a Mother in *Janani – Mothers, Daughters, Motherhood*, (ed.) Rinki Bhattacharya.

Module 4 (Indigenous Identities) **(18 hours)**

Excerpts from *Binti*, the Santhal creation song of cosmology, the *Bhilli Mahabharat* and *Garhwali Songs* in *Painted Words - An Anthology of Tribal Literature* - Edited by G. N. Devy.
Amos Tutuola: *The Palm-Wine Drinkard.* [Excerpt]

Module 5 (Alter Identities) **(18 hours)**

Nathaniel Hawthorne: The Birth Mark
John Henrik Clarke: The Boy Who Painted Christ Black
Ruskin Bond: The Girl on the Train

Core Text: *Literature and/as Identity*

MAHATMA GANDHI UNIVERSITY

SYLLABI FOR COMMON COURSES - UG PROGRAMMES

2017 ADMISSIONS ONWARDS

For Model II Semester IV

COURSE 6 – Illuminations

Course Code	**EN4CC06**
Title of the course	**Illuminations**
Semester in which the course is to be taught	**4**
No. of credits	**4**
No. of contact hours	**90**

AIM OF THE COURSE

To acquaint the learners with different forms of inspiring and motivating literature.

OUTLINE OF THE COURSE

At the end of the course, the student shall be able to:
1. maintain a positive attitude to life.
2. evaluate and overcome setbacks based on the insights that these texts provide.

COURSE OUTLINE

Module 1 [Life Sketches] **(18 hours)**

Helen Keller: Three Days to See
Jesse Owens: My Greatest Olympic Prize
Dominic Lapierre: Mother Teresa

Module 2 [Essays] **(18 hours)**

Lafcadio Hearn: On Reading
Stephen Leacock: Are the Rich Happy?
A.G. Gardiner: On Courage

Module 3 [Speeches] **(18 hours)**

J. K. Rowling: The fringe benefits of failure and the importance of imagination
Malala Yousafzai: Nobel Lecture

Module 4 [Short Stories] **(18 hours)**

Oscar Wilde: The Nightingale and the Rose
George Orwell: The Miser

John Galsworthy: Quality
Paolo Coelho: The Beggar and the Baker

Module 5 [Poems] **(18 hours)**

William Ernest Henley: Invictus
Robert Frost: The Road Not Taken
Kahlil Gibran: Of Good and Evil
Joyce Kilmer: Trees

Core Text: *Illuminations*

II. B. COM FINANCE AND TAXATION

Core Course 15: ENVIRONMENT MANAGEMENT AND HUMAN RIGHTS

(CO5CRT15)
Applicable for B Com Model I, II and III

Instructional Hours: 90 **Credit: 4**

Objectives- To create an awareness regarding natural resources, environmental aspects and management, legislations involved and also provide an awareness on Human Rights

Module I - 20 Hours

Unit 1: Environmental Studies- Environmental Studies-Introduction-Definition-scope and Importance.
Unit 2: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.
Forest resources: Use and over-exploitation, deforestation-General Conservation strategies
Water resources: Use and over-utilization of surface and ground water, water conservation, watershed management, rainwater harvesting , dams-benefits and problems.
Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources,
Food resources : World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources,
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification
Unit 3: Ecosystems- Concept -Structure and function - Energy -Food chains, food webs Ecological pyramids-Introduction, types, features, structure and function

Module II - 25 hours

Unit 1: Biodiversity - Introduction –types and importance- India as a mega-diversity nation- Bio diversity Hot-sports -Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts- concept of threatened fauna , IUCN categorisation and red list - Endangered and endemic species of India,
Conservation - *Insitu* and *exsitu* conservation, protected area concept-National Park, wildlife sanctuary, biosphere reserves and community reserves, botanical gardens and zoos
Global environmental issues- ozone depletion, global warming, greenhouse effect, climate change, acid rain, nuclear accidents
Local environmental issues- landscape alteration, quarrying, sand mining, coastal erosion, degrading of mangroves and wetlands, Ramsar sites
Disaster and Disaster management- floods, earth quakes, cyclone and landslides- Need for disaster management – Disaster Management in India
Unit 2: Pollution- air, water, soil, noise, thermal and nuclear- control measures, role of individuals in prevention of pollution -Issues relating to solid and electronic waste disposal.
Unit 3: Environmental laws in India (*brief overview only- the objectives and key provisions only*) Environment Protection Act, Air (Prevention and control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, issues involved in enforcement of environmental legislation. –
Sustainable development- Concept, , UN and sustainable development goals

Module – III (15 Hours)

Recent developments in the filed of Commerce and Management relating to environment

-Green Accounting- Meaning- History- Scope and Importance- Importance- Advantages and limitations-

Green Banking- Meaning- benefits- coverage- steps in green banking- environmental risks for banks- Green banking initiatives- International initiatives- Initiatives in India-

Green Marketing- Meaning- Need and benefits- Challenges- Green marketing in India- Green washing and consequences-

Eco tourism- significance- eco tourism activities in India- Opportunities and challenges –

Environmental audit- concept- need and scope

Carbon credit and carbon exchanges (over view only) -

Module – IV (12 Hours)

Right to Information Act 2005- Basic terms- Public authority- Competent authority- Appropriate Government- Third Part- Information – record- Right to information- Objectives of the Act-Features of the Act- Obligation of Public authority- Procedure for request of information- time limit- fee- ground of rejection- appeal- exemption from disclosure- Right to access information on specific issues- Banking transactions, insurance transactions, government dealing and related services

Module - V (18 Hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Womenchildren–minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Assignment may include Field study involving

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

III. DEPARTMENT OF HINDI

B.Com Model I

SEMESTER I
Paper- 1- गद्य और संचार मीडिया (Prose & Mass Media)
Course Code-HN1CCT01

गद्य/ Prose (Text Book-साहित्य सागर)

1. नेहरु का रास्ता - माधव हाड़ा
2. जूठन- ओमप्रकाश वाल्मीकी
3. चूहा और मैं- हरिशंकर परसाई
4. अग्नि की उड़ान- ए पी जे अब्दुल कलाम
5. आस्था और रोमांच की यात्रा- पवन चौहान
6. गौरी का गुस्सा-स्वयं प्रकाश

संचार मीडिया (Mass Media) (Text Book-संचार मीडिया एवं व्यावसायिक पत्र लेखन)

1. दर्शकों को अब भी अच्छे सिनेमा की तलाश – ओमपुरी
2. विज्ञापन और स्त्री – कुमुद शर्मा
3. माध्यम् की तलाश – राही मासूम रज़ा
4. चक दे इण्डिया – रामशरण जोशी

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
नेहरु का रास्ता	चूहा और मैं	आस्था और रोमांच की यात्रा	गौरी का गुस्सा
जूठन	अग्नि की उड़ान		
दर्शकों को अब भी अच्छे सिनेमा की तलाश	विज्ञापन और स्त्री	माध्यम् की तलाश	चक दे इण्डिया

SEMESTER III

Paper- 3- कविता, व्याकरण और अनुवाद (Poetry, Grammar & Translation)

कविता/ Poetry (Text Book-काव्य कुसुम)

Course Code-HN3CCT03

1. कबीरदास – दोहा (4)
2. तुलसीदास – पद (2)
3. मीराबाई – पद (2)
4. बिहारी – दोहा (3)
5. जागो फिर एक बार - सूर्यकांत त्रिपाठी निराला
6. वे मुस्काते फूल नहीं – महादेवी वर्मा
7. खेवली – धूमिल
8. छीनने आये हैं वे – सर्वेश्वर दयाल सक्सेना
9. आज़ादी उर्फ गुलामी- ज्ञानेन्द्रपति
10. तुम्हें कुछ करना चाहिए – चंद्रकांत देवताले
11. सबूत – अरुण कमल
12. दिल्ली दरवाज़ा – कुमार विकल
13. जंगल के उजाड में – विनोद कुमार शुक्ल
14. बाज़ार – मंगलेश डबराल
15. बीसवीं शती के अंतिम दिनों का एक आश्चर्य – राजेश जोशी
16. दो हाथियों की लड़ाई – उदयप्रकाश
17. ठंडे पानी की मशीन - एकांत श्रीवास्तव
18. अच्छे आदमी – कुमार अम्बुज

व्याकरण और अनुवाद (Grammar & Translation)

1. सामान्य हिंदी व्याकरण तथा रचना –श्रीकृष्ण पाण्डेय (Page -19-58 & 111-117)

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
कबीरदास तुलसीदास बिहारी मीराबाई	जागो फिर एक बार वे मुस्काते फूल नहीं खेवली छीनने आये हैं वे आज़ादी उर्फ गुलामी	तुम्हें कुछ करना चाहिए सबूत दिल्ली दरवाज़ा जंगल के उजाड में बाज़ार	बीसवीं शती के अंतिम दिनों का एक आश्चर्य दो हाथियों की लड़ाई ठंडे पानी की मशीन अच्छे आदमी
व्याकरण			व्याकरण
अनुवाद			अनुवाद

B.A/ B.Sc Model I (Hindi)

SEMESTER I

Paper- 1- गद्य और एकाँकी (Prose & One Act Plays) (Text Book-साहित्य दर्पण)

Course Code-HN1CCT01

गद्य/ Prose

1. आईये हम वृक्ष देवता की आराधना करें - डॉ. किशोरी लाल व्यास
2. भय -रामचंद्र शुक्ल
3. हिमाच्छादित उत्तुंग शिखर और धुली हरियाली - विजय कुमार सन्देश
4. कफ़न चोर का बेटा -उषा बाला
5. जब मैं फेल हुआ- ए पी जे अब्दुल कलाम
6. जब इंतिज़ार हुसैन अपनी जन्मभूमि आये -अजहर वजाहत

एकाँकी /One Act Plays

1. दीपदान – रामकुमार वर्मा
2. जान से प्यारे – ममता कालिया
3. बहु की विदा – विनोद रस्तोगी
4. सती – जी. के. हरिजीत
5. हरी घास पर घंटे भर – सुरेन्द्र वर्मा

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
आईये हम वृक्ष देवता की आराधना करें	हिमाच्छादित उत्तुंग शिखर और धुली हरियाली	जब मैं फेल हुआ	जब इंतिज़ार हुसैन अपनी जन्मभूमि आये
भय	कफ़न चोर का बेटा	बहु की विदा	हरी घास पर घंटे भर
दीपदान	जान से प्यारे	सती	

SEMESTER II

Paper- 2- कहानी और उपन्यास (Short stories & Novel)
Course Code-HN2CCT02

उपन्यास/ Novel

1. अंतिम साक्षय – चंद्रकांता

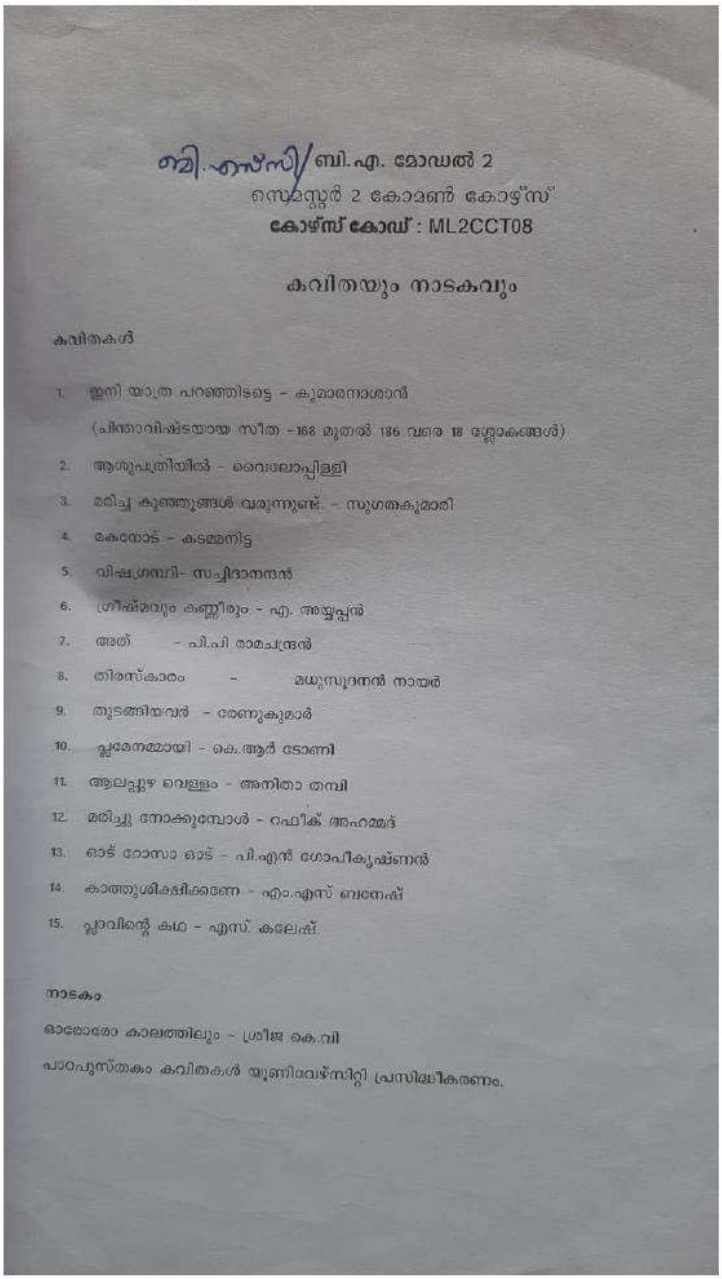
कहानी/ Short stories (Text Book-कथा संसार)

1. ईदगाह- प्रेमचंद
2. हीलिबोन की बतखें- अज्ञेय
3. अमरूद का पेड -ज्ञानरंजन
4. जंगल का दाह- स्वयंप्रकाश
5. छुट्टी का दिन- उषा प्रियंवदा
6. बाज़ार में रामधन- कैलाश बनवासी
7. माँ रसोई में रहती है - कुमार अम्बुज

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय
ईदगाह	अमरूद का पेड	छुट्टी का दिन	माँ रसोई में रहती है
हीलिबोन की बतखें	जंगल का दाह	बाज़ार में रामधन	

IV. DEPARTMENT OF MALAYALAM



എം.എസ്സി/ബി.എ. മോഡൽ 2
സെമസ്റ്റർ 2 കോമൺ കോഴ്സ്
കോഴ്സ് കോഡ് : ML2CCT08

കവിതയും നാടകവും

കവിതകൾ

1. ഇനി യാത്ര പറഞ്ഞിടട്ടെ - കുമാരനാശാൻ
   (ചിന്താവിഷ്ടയായ സീത -168 മുതൽ 186 വരെ 18 ശ്ലോകങ്ങൾ)
2. ആശുപത്രിയിൽ - വൈലോപ്പിള്ളി
3. മരിച്ച കുഞ്ഞുങ്ങൾ വരുന്നുണ്ട്. - സുഗതകുമാരി
4. മകയോട് - കടമ്മനിട്ട
5. വിഷഗ്രന്ഥി- സച്ചിദാനന്ദൻ
6. ശ്രീഷ്മവും കണ്ണീരും - എ. അയ്യപ്പൻ
7. അത് - പി.പി രാമചന്ദ്രൻ
8. തിരസ്കാരം - മധുസൂദനൻ നായർ
9. തുടങ്ങിയവർ - രേണുകുമാർ
10. പ്രേമമായി - കെ.ആർ ടോണി
11. ആലപ്പുഴ വെള്ളം - അനിതാ തമ്പി
12. മരിച്ചു നോക്കുമ്പോൾ - റഫീക് അഹമ്മദ്
13. ഓട് രോസാ ഓട് - പി.എൻ ഗോപീകൃഷ്ണൻ
14. കാത്തുശിക്ഷിക്കണേ - എം.എസ് ബനേഷ്
15. പ്ലാവിന്റെ കഥ - എസ്. കലേഷ്

നാടകം

ഓരോരോ കാലത്തിലും - ശ്രീജ കെ.വി

പാഠപുസ്തകം കവിതകൾ യൂണിവേഴ്സിറ്റി പ്രസിദ്ധീകരണം.

V.

VI. DEPARTMENT OF CHEMISTRY

SEMESTER V

CH5CRT05 - Environment, Ecology and Human Rights

Credits – 4 (72 Hrs)

Environmental Chemistry (54 h)

Objectives: Environmental awareness is to understand the fragility and sensitivity of our environment, in particular the biosphere and the importance of its protection. Promoting environmental awareness is an easy way to become an environmental steward and participate in creating a brighter future for our next generations. The most important goal of this paper is to impart awareness on various environmental aspects, with some glimpses of contemporary issues. This will help them foster a *sense* of responsibility and "*proactive citizenship*".

Module I: Introduction to environmental studies: Natural resources

10 h

Definition, scope and importance of environmental studies for sustainable development, need for public awareness.

Natural Resources: Classification of natural resources; renewable and non-renewable resources:

Natural resources and associated problems;

1.1 Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

1.2 Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

1.3 Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

1.4 Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, industrial farming of livestock and effects on global warming, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, mass production of biodiesel for energy needs and *food security*.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module II: Environment: Pollution and Social Issues

18 h

Fundamental ideas of pollution and pollutant. Cause, effects and preventive measures of various types of pollutions including; air, water, soil, marine, noise and thermal pollutions. Nuclear energy as a source of energy and its hazards. Solid waste management; causes, effects and control mechanisms of urban and industrial wastes. Prevention of pollution: role of individual. Disaster management mechanisms; disaster management of; floods, earthquake, cyclone and landslides.

Movement from unsustainable to sustainable development. Urban crisis related to energy. Water conservation, rain water harvesting, watershed management, Environmental ethics: Issues and possible solutions. Introduction to important green house gases (GHGs), sources of the primary greenhouse gases in Earth's atmosphere including water vapor, carbon dioxide, methane. The lesser GHGs- nitrous oxide, ozone and fluorinated gases. Carbon cycle, CO_2 sources, Keeling curve and Natural 'sinks' for CO_2. Green house effect, climate change,

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global warming, acid rain, ozone layer depletion, role of CFCs in ozone depletion, and its mechanism, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act (EPA). Air (prevention and control of pollution) Act. Water (prevention and control of pollution) Act, Wildlife Protection Act, Forest Conservation Act. Issues involved in the enforcement of environmental legislation. Introduction to the concept of green chemistry, atom economy (with suitable examples) and the twelve principles of green chemistry.

Module III: Population and Environmental issues

8 h

Human population growth, *Malthusian theory (basic idea) and* theory of evolution by natural selection, *Malthusian* catastrophe. Global challenges, *environmental* problems of population growth, impacts on human health and welfare, variation among nations, population explosion and Family Welfare Programme. Socio- economic, and geo-political dimensions of poverty, absolute and relative poverty, poverty scale, variation among nations, international food crisis. Resettlement and rehabilitation of project affected population. Environmental movements in India: Chipko, Silent valley, Bishnois of Rajasthan etc.

Module IV: Ecological Chemistry

18 h

Definition and scope of ecological chemistry, ecological stress posed upon ecosystems by the presence of chemicals. Origin of chemical toxicants; natural sources, and man-made. Organization of chemicals as xenobiotic, essential or nonessential substances. Release of chemicals in the environment, Transport Processes, Classification of transformation processes, biotic and abiotic. Structure- activity relationships in degradation and biodegradation of organic chemicals. Transformation processes including general, hydrolysis, oxidation, reduction, photochemical degradation, microbial degradation, and phytodegradation, environmental fate determining processes, bioavailability, exposure of species to (bio)available fractions, uptake (accumulation), metabolism, biomagnifications, distribution in organisms, and subsequent toxic effects. Risk assessment of chemicals-assessment of contaminated soils.

Persistent organic pollutants (POPs), natural and anthropogenic origin of POCs and characteristic properties; half-lives, K_{ow}, K_{aw} and K_{oa}. Adverse effects of persistent chemicals. Legislation on the use of POPs and twelve persistent organic pollutants. The sources, the uses, some of the physico-chemical properties, the half-lives in the environmental compartments of air, water and soil. Behaviour of the priority persistent organic pollutants identified by the United Nations Economic Commission for Europe (UNECE) including; polychlorinated biphenyls, dieldrin, aldrin, dichlorodiphenyltrichloroethane (DDT), Mirex, Heptachlor and Polychlorinated furans. Agency for Toxic Substances and Disease Registry (ATSDR) list, **the ATSDR 2017 Substance Priority List,** Restriction of Hazardous Substances (RoHS) directive, Material Safety Data Sheet (MSDN), Toxic Substances Control Act (TSCA) and banned/severely restricted chemicals list.

Suggested reference books

1. S. Manahan, *Fundamentals of environmental chemistry*, CRC-Press, 1993.
2. S. Manahan, *Fundamentals of Environmental and Toxicological Chemistry*: Sustainable Science, CRC Press, 2013
3. R.C. Brunner, *Hazardous Waste Incineration*, McGraw Hill Inc., 1989
4. W.P. Cunningham, T.H. Cooper, E Gorhani, and M.T. Hepworth, *Environmental Encyclopedia*, Jaico Publishing House, Mumbai, 2001.
5. A.K. De, *Environmental Chemistry*, Wiley Eastern Ltd.

2

6. V. Subramanian, *A Textbook of Environmental Chemistry*, I.K. International Publishing House Pvt. Ltd. 2011.
7. S.K. Tiwari, *Environmental Science: Volume I and II*, Atlantic Publishers and Distributers Pvt. Ltd., 2011.
8. R. M. Harrison (ed.), *Understanding Our Environment An Introduction to Environmental Chemistry and Pollution*, Royal Society of Chemistry, 1999
9. D. E. Newton, *Chemistry of the Environment*, Facts On File Inc., 2007
10. V. Udai, Modern *Teaching of Population Education*, Anmol Publications Pvt. Ltd., 2005.
11. B. McGuire, Global *Catastrophes: A Very Short Introduction*, Oxford University Press, 2002.
12. A. E. Dessler, E. A. Parson, *The Science and Politics of Global Climate Change*, Cambridge University Press, 2006.
13. J. Firor, J. Jacobsen, *The Crowded and Greenhouse- Population, Climate Change, and Creating a Sustainable World,* Yale University Press, 2002.
14. B. Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming,* Alfred A. Knopf Publisher- New York, 2007.

Further readings

1. S. V. S. Rana, *Essentials of Ecology and Environmental Science*, 5th Edition, Rupa publications, 2013.
2. V.H. Heywood, and R.T. Waston, *Global Biodiversity Assessment*. Cambridge Univ. Press, 1995.
3. H. Jadhav, V.M. Bhosale, *Environmental Protection and Laws*. Himalaya Pub. House, Delhi, 1995.
4. M.L. Mckinney, and R.M. School, *Environmental Science Systems and Solutions*, Web enhanced edition. 1996.
5. P. H., H. Raven, D.M. Hassenzahl, and L. R. Berg, *Environment*, 8th Edn. John Wiley & Sons, 2012.
6. A. Wreford, D. Moran, N. Adger , *Climate Change and Agriculture: impacts, adaptation and mitigation*, OECD publications, 2010.
7. R.S. Boethling D. Mackay, *Handbook of Property Estimation Methods for Chemicals*. Boca Raton, FL, USA: Lewis Publishers, 2000.
8. J.L.M. Hermens C. J. Van Leeuwen *Risk Assessment of Chemicals: An Introduction, Dordrecht*, The Netherlands, Kluwer Academic Press, 1995.
9. D. Mackay, W.Y.,Shiu, K.C. Ma *Physical-Chemical Properties and Environmental Fate, Degradation Handbook*. (CD-ROM), Boca Raton, FL, USA, Chapman & Hall CRC netBASE, CRC, 1999.
10. W. J. G. M. Peijnenburg, *Ecological Chemistry, Environmental and Ecological Chemistry- Vol. III, Encyclopedia of Life Support Systems* (EOLSS).
11. M. Ali, *Climate Change Impacts on Plant Biomass Growth*, Springer Dordrecht Heidelberg, 2013

Special Notes and Suggestions:

The purpose of the paper is to create general awareness on various dimensions of environmental sciences with a special focus on contemporary issues. The BoS in Chemistry recommend case studies or sample surveys (maybe in groups) rather than seminars. Students can undertake an assignment based on any of the following highly relevant and current topic;

- Edutainment film *"Samaksham"*, produced by Mahatma Gandhi University, Kottayam.
- Case Studies on the *important natural resources* of Kerala.

3

- Case Studies on the Indian *mining scams and consequent environmental* damages of; illegal mining in the *Aravali Ranges, Goa, Ganges river bed, Bellary* etc.
- Case Studies on the *disaster management mechanisms* of floods, landslides, earthquake, cyclone etc.
- Case Studies on the water conservation, rain water harvesting, watershed management in a local contest.
- Case studies on environmental movements like Narmada Bachao Andolan, Appiko Movement, Save Ganga Movement etc.

Module - V (18 h)

V.I Human Rights

An Introduction to Human Rights, meaning, concept and development –History of Human Rights- Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR, ICCPR, ICESCR.-Value dimensions of Human Rights

V-II Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission (of) Human Rights?-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

V-III Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights- directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

References and suggested readings

1. H.O. Agarwal, *Implementation of Human Rights Covenants with Special Reference to India*,
2. P. Alston, *The United Nations and Human Rights*, Clarendon Press, London, 1995.
3. Amnesty International, *Political Kings by Governments*, Amnesty International, London, 1983.
4. Bajwa, G.S. and D.K. Bajwa, *Human Rights in India: Implementation and Violations* , D.K. Publishers, New Delhi, 1996.
5. UNESCO, Yearbook on Human Rights.
6. NHRC, Annual Reports since 1993.
7. V.K. Bansal, *Right to Life and Personal Liberty*, Deep and Deep, New Delhi, 1986.
8. M. Banton, *International Action against Racial Discrimination* Clarendon Press, Oxford, 1996.
9. D.D. Basu, Human Rights in Constitutional Law, Prentice Hall, New Delhi, 1994.
10. N.Bava (ed.,) *Human Rights and Criminal Justice Administration in India*, Uppal Publishing House, New Delhi, 2000.
11. UN Centre for Human Rights, *Civil and Political Rights: The Human Rights Committee*, World Campaign for Human Rights, Geneva, 1997.
12. UN Centre for Human Rights, *Discrimination against Women*, World Campaign for Human Rights, Geneva, 1994.
13. UN Centre for Human Rights, Minority Rights, World Campaign for Human Rights, Geneva, , 1998.

4

VII. DEPARTMENT OF PHYSICS

Semester-V

Core Course: VIII

Credit-4 (72 hours)

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental

issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.

- Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.
- To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.
- To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I

Unit 1: Multidisciplinary nature of environmental studies(2 hours)

Definition, scope and importance

Need for public awareness.

Unit 2: Natural Resources:(10 hours)

Renewable and non-renewable resources: Natural resources and associated problems.

a) **Forest resources**: Use and over-exploitation, deforestation, case studies.

Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources**: Use and over-utilization of surface and ground water,

floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources**: Use and exploitation, environmental effects of extracting

and using mineral resources, case studies.

d) **Food resources**: World food problems, changes caused by agriculture and

overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosionand desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable life styles.

Unit 3: Ecosystems **(6 hours)**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

Module II

Unit 1: Biodiversity and its conservation **(8 hours)**

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

Unit 2: Environmental Pollution **(8 hours)**

Definition, Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 3: Social Issues and the Environment (10 hours)

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Module III

Non-renewable and Renewable Energy Sources (10 hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.

Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy (qualitative); Fuel cell.

Module IV

Solar energy **(10 hours)**

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater - Direct and indirect systems- Passive and active systems; Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

Module – V **(8 hours)**

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

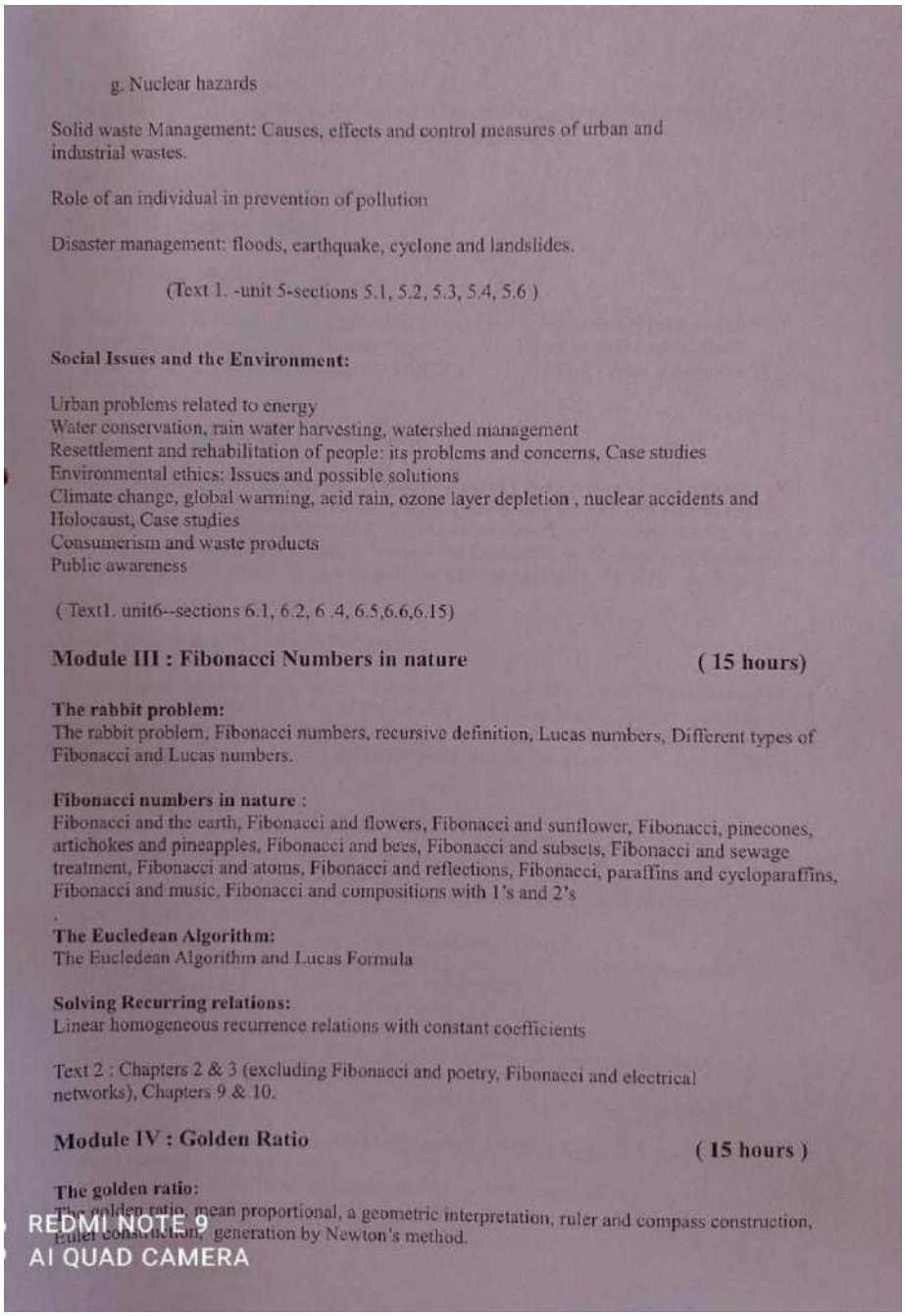
Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment andHuman Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

VIII. DEPARTMENT OF MATHEMATICS



g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Disaster management: floods, earthquake, cyclone and landslides.

(Text 1. -unit 5-sections 5.1, 5.2, 5.3, 5.4, 5.6)

Social Issues and the Environment:

Urban problems related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns, Case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and Holocaust, Case studies
Consumerism and waste products
Public awareness

(Text1. unit6--sections 6.1, 6.2, 6 .4, 6.5,6.6,6.15)

Module III : Fibonacci Numbers in nature **(15 hours)**

The rabbit problem:
The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers.

Fibonacci numbers in nature :
Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's

The Eucledean Algorithm:
The Eucledean Algorithm and Lucas Formula

Solving Recurring relations:
Linear homogeneous recurrence relations with constant coefficients

Text 2 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks), Chapters 9 & 10.

Module IV : Golden Ratio **(15 hours)**

The golden ratio:
The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method.

The golden ratio revisited:
The golden ratio revisited, the golden ratio and human body, golden ratio by origami, Differential equations, Gattei's discovery of goldenratio, centroids of circles,

Text 2 : Chapters 20, 21

Module V : Human rights (18 hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

- To help the students in acquiring the basic knowledge about environment and to inform the students about the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

4 hours/week (Total Hrs: 72) **4 credits**

SYLLABUS

Text Books :

1.Bharucha Erach – Text book of Environmental studies for UG Courses, University Press, II Edition

2. Thomas Koshy : Fibonacci and Lucas numbers with applications, John Wiley & Sons, Inc (2001).

Module I: Environment and its resources (10 hours)

Multidisciplinary nature of environmental studies:
Definition, scope and importance
Need for public awareness.

Natural Resources :
Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Role of individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

(Text 1- unit 1- sections 1.1,1.2,unit 2-sections 2.1,2.2,2.3,2.4)

ModuleII: Environmental Pollution and Social Issues (14 hours)

Pollution- Definition,Causes, effects and control measures of:

a. Air pollution
b.Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution

g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Disaster management: floods, earthquake, cyclone and landslides.

(Text 1. -unit 5-sections 5.1, 5.2, 5.3, 5.4, 5.6)

Social Issues and the Environment:

Urban problems related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns, Case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and Holocaust, Case studies
Consumerism and waste products
Public awareness

(Text1. unit6--sections 6.1, 6.2, 6 .4, 6.5,6.6,6.15)

Module III : Fibonacci Numbers in nature (15 hours)

The rabbit problem:
The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers.

Fibonacci numbers in nature :
Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's

.

The Eucledean Algorithm:
The Eucledean Algorithm and Lucas Formula

Solving Recurring relations:
Linear homogeneous recurrence relations with constant coefficients

Text 2 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks), Chapters 9 & 10.

Module IV : Golden Ratio (15 hours)

The golden ratio:
The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method.

IX. DEPARTMENT OF ZOOLOGY

SEMESTER V. ZY5CRT05

CORE COURSE V

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

54 Hrs

Objectives

To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society

To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.

To teach the basic concepts of toxicology, their impact on human health and remedial measures

To create a consciousness regarding Biodiversity, environmental issues & conservation strategies

To develop the real sense of Human rights – its concepts & manifestations

MODULE 1 ECOSYSTEM 12 Hrs

Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers), Ecological pyramid- number, biomass, energy, **Functions of ecosystem**: Productivity-Food chain-Food web-Energy flow-Laws of Thermodynamics.Types of Ecosystem: Terrestrial-Forest-Grassland-Desert, Aquatic-Marine-Fresh water, Wetland &Biome **Concept of limiting factors:** Liebig's and Shelford's laws of limiting factors.

Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle. **Renewable resources** (solar,wind, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)

MODULE 2 CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions: Positive- Commensalism- Mutualism-Protocooperation, Negative-Predation-Parasitism-Competition-Antibiosis

Characteristics of a community: Species diversity- richness, eveness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.

MODULE 3 BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCC.

National Environmental issues: Deforestation, forest fire, pollution(air, water, soil, noise thermal, nuclear- brief account only) solid waste management, sewage, drinking water crisis and water logging,

Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster

Flood, drought, cyclone, earthquake and landslide (Management and mitigation)

Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands,

Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4 CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves

Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.

Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern

Water conservation- rainwater harvestiong, watershed management

Environment education

Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5 HUMAN RIGHTS 6 Hrs

Introduction, main concepts associated with Human Rights, Different types of human rights, Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References

1. Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.
2. J.B Sharma (2009), Environmental studies' - 3rd Ed. University science Press
3. Misra S.P., Pandy S.N. 2009Essential Environmental Students, Ane books Pvt. Ltd.
4. P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications
5. R.B Singh & Suresh Mishra PaulamiMaiti (1996), Biodiversity – Perception, Peril and Preservation' — PHI Learning , Environmental Law in India: Issues and Responses
6. Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

18. Speight, M.R., Hunter, M.D. & Watt, A.D. 1999. Ecology of Insects- Concepts and Applications. Blackwell Science Ltd., London.

19. Wall, R., Shearer, D. 2001.Veterinary ectoparasites: biology, pathology and control. Blackwell Science.

20. Wall, R., Shearer, D. 1997. Adult flies (Diptera). In: Wall, R., Shearer, D. (eds.): Veterinary Entomology.Chapman & Hall, London.

21. Ward, J.V. 1992. Aquatic Insect Ecology. John Wiley & Sons, Inc., USA.

22. Williams, D.D. &Feltmate, B.W. 1992. Aquatic Insects. C.A.B. International, UK.

23.R Bonita R Beaglehole T Kjellström Basic epidemiology 2nd edition WHO Library Cataloguing-in-Publication Data Bonita ISBN 92 4 154707 3 (NLM classification: WA 105) ISBN 978 92 4 154707 9 © World Health Organization 2006.

ELECTIVE COURSE. ZY6CBT04

4. NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

72 Hrs.

3 Credits

Objectives:

1. To provide students with a general concept of health and the parameters that define health and wellness.

2. To understand principles of nutrition and its role in health.

3. To familiarize the students regarding food safety, food laws & regulations.

4. To provide knowledge and understanding regarding life style diseases.

5. To promote an understanding of the value of good life style practices, physical fitness and healthy food habits for life style disease management.

Module I **15 Hrs**

Nutrition and health: Nutritional requirements of man, classification of major nutrients

including protein,vitamins and minerals, water, role of fibre, biological value of food components, food groups and sources, balanced diet, RDA, BMI, BMR, Calorie intake and expenditure, Healthy eating pyramid, Nutrition in infancy, preschool, school, adolescent, pregnancy, lactation and old age. Nutrition in diseases and special conditions. Food safety: Nutrition education, food sanitation and hygiene, food adulteration and consumer protection.

Module II **18 Hrs**

Understanding of health: Define health, basic concepts, dimensions of health, basic parameters of health care. (Health Parameters: Individual normal standards, devices.1. Blood pressure, 2. Brain activities and sleep, 3.Focus or attention, 4.Pulse, 5. Body temperature, 6. Daily physical activities, 7. Electrocardiogram (ECG), 8.Cardiac fitness 9. Stress, 10. Haematological parameters, 11. BMI

Module III **15 Hrs**

Introduction to Life style diseases

Common life style diseases: Alzheimer's disease and other neural disorders, asthma, cancer, cardio vascular diseases - including hypertension, Atherosclerosis and stroke, chronic obstructive pulmonary disease, Diabetes Mellitus or Type 2 Diabetes, kidney disorders and chronic renal failure, constipation, depression, gastro-intestinal disturbances including diarrhoea and peptic ulcer, liver cirrhosis and other liver diseases, obesity, osteoporosis, occupational lifestyle diseases.

Modern lifestyle disorders: sleeping habits, junk food, poor eating habits, anxiety, food poisoning

Module IV **10 Hrs**

Causes of lifestyle diseases: Defects of modern food habits and unbalanced diet options, food adulteration, environmental pollution, poor life style choices, drug abuse, tobacco smoking, alcohol and drug consumption, lack of adequate exercise, wrong body posture,

disturbed biological clock, stressful environmental conditions

Module V **14 Hrs**

Prevention and control of life style diseases:

Healthy life style habits and practices, healthy eating habits, exercise and fitness, good sleep patterns, a strict no to alcohol, drugs, and other illegal drugs. Uncontrollable factors like age, gender, heredity and race.

Healthy diet: disease prevention through appropriate diet and nutrition, avoiding foods that are high in fats, salt and refined products. Avoid junk food and replace by natural food/ organic food.

Physical exercise: Moderate exercise for fitness of body, walking, stretching, right postures of sitting & standing, relaxation and cutting down of stress, sports, aerobic exercise and yoga.

Health literacy as a public health goal: Awareness programs in schools, colleges and through mass media.

References

1. AAPHERD (1980). Health Related Physical Fitness Test Manual. Published by Association drive Reston Virginia.
2. ACSM (2005). Health Related Physical Fitness Assessment Manual Lippincott Williams and Wilkins USA, 3. Begum, M.R. (2006).A Text Book of Foods, Nutrition and Dietetics. 2nd Edn. Sterling Low Price Edition.Sterling Publishers Private Ltd., New Delhi.
4. Bucher, C.A., (1979). Foundation of Physical Education (5th ed.). Missouri: C.V.Mosby co.
5. Charles B.C.,et.al, C.A., (2004). Concepts of Fitness and Wellness. Boston: McGraw Hill.
6. Delvin, T.M (1997). Text Book of Biochemistry with clinical correlation. 4th Edn. John Wiley and Sons Inc.Ltd.U.K.
7. Evert, A.B. and Boucher J.L., (2014). New Diabetes Nutrition Therapy Recommendations:

SEMESTER VI

ZY6B09U Core course 9

REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

54 hrs
Credits 3

Objectives

1. This will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
2. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

Module 1 **10 hrs**

Introduction

Scope of developmental biology, definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman)

Reproductive Organs and Gametogenesis.

Human reproductive organs and gametogenesis (brief account) significance.

Egg types.

Classification of eggs, based on the amount, distribution and position of yolk. Mosaic, regulative and cleidoic eggs. Influence of yolk on development. Polarity, symmetry and egg content.

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle.

Fertilization

Approach and binding of spermatozoa, activation of the egg, amphimixis. Parthenogenesis (brief account) natural and artificial. Arrhenotoky, Thelytoky, Obligatory and Facultative

Significance

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module II **18 hrs**

Cleavage

Types, planes of cleavage (radial and spiral with examples) Cell lineage (brief account). Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and superficial). Patterns of clevage (radial , bilateral and rotative). Influence of yolk on cleavage.

Blastulation

Blastula formation, Types of blastula (coeloblastula, stereoblastula, Discoblastula, Blastocyst with examples).

Fate maps

Concept of fate maps, construction of fate maps. (artificial and natural). A typical vertebrate fate maps. Significance of fate map.

Gastrulation

Definition, Morphogenetic cell movements (brief account). Epiboly, Emboly (invagination, involution , delamination , convergence, divergence infiltration). Concept of germ layers (brief account) and its derivatives.

Cell differentiation and gene action—with special reference to Drosophila.

Totipotency, Pleuripotency, Unipotency of embryonic cells. Determination and differentiation in embryonic development, Gene action, control of gene expression. (brief accounts)

EMBRYOLOGY OF FROG - Gametes,Fertilization,cleavage, blastulation,fate map,gastrulation,notogenesis ,neurulation,development of nervous system and sense organs(eye only) Metamorphosis (brief account only)

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module III **18 hrs**

Embryology of chick

Structure of egg, fertilization, cleavage, blastulation, gastrulation. Mention brief account of 18 hour chick embryo and 24 hour chick embryo. Extra embryonic membranes in chick.

Human development

Blastocyst, foetal membranes and placenta. Types of placenta (brief account). Classification of placenta based on

Nature of contact.

Mode of implantation.

Histological intimacy of foetal and maternal tissue.

Functions of placenta.

Experimental embryology.

Spemann's constriction experiments, Organizer and embryonic induction. Invitro fertilization (test tube baby) Amniocentesis, Embryo transfer technology, Cloning, Stem cell research.

General Topics

1. Regeneration in animals
2. Placentation in mammals and their significance.
3. Human intervention in reproduction- contraception & birth control, Abortion – biological aspects, Ethical issues, Infertility, IVF, GIFT, & ZIFT (Intra fallopian transfer gamete/zygote)

Core Readings

Taylor D J, Green NPO & G W Stout. Biological Science (2008) third edition. Cambridge university press. Ref pp 748 biology 755

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module IV **8 hrs**

Teratology / Dysmorphology.

Definition, Teratogen / Teratogenic agents. Ionizing radiation, infection (herpes virus, parvo virus-B 19, rubella virus, syphilis, cytomegalovirus , toxoplasmosis).

Developmental defects

Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR)

Congenital abnormalities (birth defects)

Structural defects (malformation, deformation, disruption) functional defects. (inborn errors of metabolism, mental retardation).

Causes of malformation. (brief accounts.)

Genetic disorders (single gene defects)

Chromosome aberration, aneuploidy (numerical abnormalities.

Structural abnormalities (deletion, insertion and re-arrangements)

Chromosomal mosaicisms

Environmental factors. (external factors)

Chemicals, drugs, hormones and vitamins.

Multifactorial and idiopathic disorders

Core Readings

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Selected Further Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hills

Berry A. K - An introduction to embryology.

Dutta 2007 Obstrestics , Chuch Livingston 17 Ed

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Jain P. C - Elements of developmental biology.

John Rigo Fundamental Genetics Cambridge University Press. 2009

Julio Collado Vides & Relf Hofestadt Gene Regulation and Metabolism Post genomic Computated Approaches, Ane Book 2004

Majumdar N. N - Vetebrate embryology

Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006

Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.

Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum.

Werne A Muller. Dev. Biology, Springer Verlay New York 2008

Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II, Module III)

Suresh.C. Goel. *Principles of Animal Developmental Biology*. Himalaya Publishing House.

X. INTEGRATED M. Sc. IN BASIC SCIENCES PHYSICS

SYLLABUS OF SECOND LANGUAGE (MALAYALAM) FOR INTEGRATED P.G. PROGRAMMES
IML2CC01

ഇന്റഗ്രേറ്റഡ് പ്രോഗ്രാം
സെമസ്റ്റർ 2 കോമൺ കോഴ്സ്
കഥ, കവിത, ആത്മകഥ

പഠനലക്ഷ്യങ്ങൾ

വിദ്യാർത്ഥികളിൽ സാഹിത്യാഭിരുചിയും ആസ്വാദനശേഷിയും വളർത്തിയെടുക്കുക എന്ന ഉദ്ദേശ്യത്തോടെയാണ് പാഠ്യപദ്ധതി തയ്യാറാക്കിയിരിക്കുന്നത്. കഥയും കവിതയും പഠിക്കുന്നതിലൂടെ ആ സാഹിത്യപ്രസ്ഥാനങ്ങളിൽ ഉണ്ടായിട്ടുള്ള ഭാവുകത്വപരിണാമം തിരിച്ചറിയാൻ കുട്ടികൾക്കു സാധിക്കുന്നു. അതോടൊപ്പം ആത്മകഥ എന്ന സാഹിത്യരൂപംകൂടി പരിചയപ്പെടുത്തുന്നുണ്ട്. കാലഘട്ടത്തിന്റെ പൊതുപ്രവണതകളും കാഴ്ചപ്പാടുകളും അവതരിപ്പിക്കുന്ന സാഹിത്യരചനകളുടെ പഠനം പുതുതലമുറയുടെ ചിന്താലോകത്തെ നിശ്ചയമായും നവീകരിക്കും.

കഥകൾ

1. മരപ്പാവകൾ - കാരൂർ നിലകണ്ഠപ്പിള്ള
2. ജന്മദിനം - വൈക്കം മുഹമ്മദ് ബഷീർ
3. കടൽ - ടി. പത്മനാഭൻ
4. നഷ്ടപ്പെട്ട നീലാംബരി - മാധവിക്കുട്ടി
5. ഹിഗ്വിറ്റ - എൻ. എസ്. മാധവൻ
6. പോസ്റ്റ്മാൻ - ബന്യാമിൻ
7. രാമച്ചി - വിനോയ് തോമസ്

കവിതകൾ

1. എന്റെ ഗുരുനാഥൻ - വള്ളത്തോൾ നാരായണമേനോൻ
2. മെക്കാളെയുടെ മകൾ - പി. കുഞ്ഞിരാമൻനായർ
3. യുഗപരിവർത്തനം - വൈലോപ്പിള്ളി ശ്രീധരമേനോൻ
4. കാളകൾ - പി. ഭാസ്കരൻ
5. കൃഷ്ണ, നിയെന്നെയറിയില്ല - സുഗതകുമാരി
6. അമ്മയെ കുളിപ്പിക്കുമ്പോൾ - സാവിത്രി രാജീവൻ
7. ചാരം - എം. ആർ. രേണുകുമാർ

ആത്മകഥ

കണ്ടൽക്കാടുകൾക്കിടയിൽ എന്റെ ജീവിതം - കല്ലേൽ പൊക്കുടൻ

സഹായകഗ്രന്ഥങ്ങൾ

ചെറുകഥ ഇന്നലെ, ഇന്ന് - എം. അച്യുതൻ, ഡി.സി. ബുക്സ്, കോട്ടയം
മലയാളകവിതാസാഹിത്യചരിത്രം - ഡോ. എം. ലീലാവതി, കേരള സാഹിത്യ അക്കാദമി, തൃശൂർ
സമ്പൂർണ്ണ മലയാളസാഹിത്യചരിത്രം, പ്രൊഫ. പന്മന രാമചന്ദ്രൻനായർ (എഡി.), കറന്റ് ബുക്സ്, കോട്ടയം
ആധുനിക മലയാളസാഹിത്യചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ, കെ.എം. ജോർജ്ജ് (എഡി.), ഡി.സി. ബുക്സ്, കോട്ടയം

SYLLABUS OF SECOND LANGUAGE (HINDI) FOR INTEGRATED P.G. PROGRAMMES

IHN2CC01

Syllabus Of Hindi(Common Course) For Integrated Courses

Credit:4

SEMESTER II

कथा और कविता (Short Stories & Poems)

कथा/Short Stories

1.सदगति - प्रेमचन्द

2.बदबू -शेखर जोशी

3.हरी बिन्दी-मृदला गर्ग

4.नो बार-मोहनदास नैमिशराय

5.बाबूलाल तेली - स्वयं प्रकाश

6.केक -असग़र वजाहत

कविता/Poems

1.दोहे (4) -कबीरदास

2.अकाल और उसके बाद-नागार्जुन

3.पानी की प्रार्थना-केदारनाथ सिंह

4.बस्स! बहुत हो चुका -ओमप्रकाश वाल्मीकि

5.स्त्रियाँ -अनामिका

6.जगमगाती रोशनियों से दूर अंधेरों से घिरा आदमी -निर्मला पुतुल

(Module-wise Distribution)

MODULE-I	MODULE-II	MODULE -III	MODULE-IV
सदगति	हरी बिन्दी	बाबूलाल तेली	केक
बदबू	नो बार	पानी की प्रार्थना	स्त्रियाँ
दोहे (4)	अकाल और उसके बाद	बस्स! बहुत हो चुका	जगमगाती रोशनियों से दूर अंधेरों से घिरा आदमी

कबीरदास-दोहे

1.गुरु गोविन्द दोउ खड़े,काके लागूं पाय।

SEMESTER 2: TH2ST05 MEET & GREET SERVICE

No. of credits: 6; No of contact hours: 90 (6 hours per week)

Unit 1

Role & responsibility, Planning & preparation for meeting customers – rechecking the preparations. Meet & greet methods, developing rapport with customers, reporting escalations – communication with travel agency – Preparation of travel plan _documents provided to customers

Unit 2

Dealing with customers on arrival and departure points_check –in and out of customers_ensure travel terminal procedure_hand over the required documentprompt response to customer emergencies and requirements _escalation matrix_ensure proper luggage handling_accommodation arrangements

Unit 3

Handling guest queries and customer complaints_attitude to be maintained_addressing and spotting the problems of the customer_importance of listening and recognizing the problem_Resolving customers problems_procedure for handling the situation_acknowledge,apologoize,identify and investigate the problem_work out for solutions,provide clear reasons to the customer for their satisfaction

Unit 4

Importance of Effective communication _etiquettes_body language and dress code,gestures,etiquettes towards customers _product and service presentation_importance of listening-gender and culture wise modes of greeting,ensure immediate reponse and feedback to the customers

References:

1. Barbara Pachter ,Essentials of Business Etiquette : How to Greet, Eat, and Tweet (English, Paperback, Edition: 2013
2. Chaturvedi P.D, Business Communication: Concepts Cases and Applications. Pearson Education.

ENVIRONMENT AND SUSTAINABILITY

I. DEPARTMENT OF ENGLISH

Fifth Semester - UG English Language and literature

Syllabus for Core Course - Environmental Studies and Human Rights (2017 admission onwards)

Module 1: Regional **18 Hours**

1. O N V Kuruppu – A Requiem for Earth
2. Vaikom Muhammed Basheer – The Inheritors of the Earth
3. Swarnalatha Rangarajan and Sreejith Varma- The Plachimada Struggle: A David-and-Goliath Story (extract from 'Introduction' to *Mayilamma*)

Module 2: National **18 Hours**

1. Ruskin Bond – An Island of Trees
2. Indra Munshi – Loss of Land and Livelihood (extract from 'Introduction' to *The Adivasi Question*)
3. Toru Dutt – Our Casuarina Tree
4. Ashish Kaul – Load Shedding

Module 3: Global **18 Hours**

1. Walt Whitman – Give me the Splendid Silent Sun
2. K R Srinivasa Iyengar – An Unfinished Continent
3. Swarnalatha Rangarajan – Swampspeak

Module 4: Environmental Science **18 Hours**

1. Erach Bharucha – Global Warming
2. Erach Bharucha – Environmental Values
3. Aloka Debi – Ecology: Types of Ecosystems
4. Aloka Debi - Waste Management

Module 5: Human Rights **18 Hours**

Unit 1 - Human Rights: An Introduction to Human Rights

Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit. 3- Human Rights National Perspective

MAHATMAGANDHIUNIVERSITY

SYLLABUSFORB.APROGRAMMEINENGLISHLITERATURE

ANDCOMMUNICATIONSTUDIES(MODELIII,DoubleMain)

2017ADMISSIONSONWARDS

Sl No	Semester	Course Code	Title	Hours- Credits
1	I	EN1CCT01	Common Course 1 Fine-tune Your English	5-4
2	I	EN1CST01	English inInformal Situations	4-4
3	I	EN1CRT01	Methodologyof Literary Studies	6-4
4	I	EN1CST02	Conversational Skills	4-4
5	I		Complementary I. Sociology	6-4
6	II	EN2CCT03	Common Course 3 Issues that Matter	5-4
7	II	EN2CRT02	Introducing Language and Literature	4-4
8	II	EN2CST03	Introduction to Communication	6-4
9	II	EN2CST04	Business Communication	4-4
10	II		Complementary II Sociology	6-4
11	III	EN3CST05	Print Media and Journalism	5-4
12	III	EN3CRT03	Harmonyof Prose	5-4
13	III	EN3CRT04	Symphonyof Verse	4-4
14	III	EN3CRT05	Indian Writingin English	5-4
15	III	EN3CMT03	Complementary1-Evolution of LiteraryMovements: The Shapers of Destiny	6-4
16	IV	EN4CST06	Print Media and Journalism 2	5-4
17	IV	EN4CRT05	Modes of Fiction	4-4
18	IV	EN4CRT06	Language and Linguistics	5-4
19	IV	EN4CRT07	Acts on the Stage	5-4
20	IV	EN4CMT04	Complementary2-Evolution of LiteraryMovements:Cross Currents of Change	6-4
21	V	EN5CROPG01 EN5CROPG02 EN5CROPG03	Appreciating Films TheatreStudies English for Careers	4-3
22	V	EN5CRENT01	Environmental Science and Human Rights	5-4
23	V	EN5CST07	Creative Writing and Translation Studies	6-4
24	V	EN5CST08	Mass Communication and Broadcasting	5-4

MAHATMAGANDHIUNIVERSITY

SYLLABIFORCORECOURSES-UGPROGRAMMES

2017ADMISSIONSONWARDS

COURSE3–HarmonyofProse

Course Code	**EN3CRT03**
Title of the course	**HarmonyofProse**
Semesterinwhichthecourseistobe taught	**3**
No. of credits	**4**
No. of contact hours	**90**

AIMOFTIIECOURSE

The student is given space to maturein the presence of glorious essays, both Western and Non-Western.

OBJECTIVESOFTHECOURSE

On completion of the course, the student shall be:

1. familiarwith varied prose styles of expression.
2. aware of eloquent expressions, brevity and aptness of voicing ideas in stylish language.

COURSEOUTLINE

Module1 **(18hours)**

Francis Bacon: Of Friendship

Jonathan Swift: TheSpider and the Bee

Joseph Addison: Meditations in WestminsterAbbey

Module2 **(18hours)**

Samuel Johnson: Death of

DrydenCharlesLamb: Dream Children; a

reverie

William Hazlitt: The Fight

Module3 **(18hours)**

Robert Lynd:Forgetting

Virginia Woolf: A Room of One's Own (an extract)

Aldous Huxley:The BeautyIndustry

Module4 **(18hours)**

Nirad C. Choudhari: Indian Crowds (extract from *TheAutobiographyofanUnknownIndian*)

AmartyaSen: Sharingthe World

A. K. Ramanujan: A FloweryTree: A Woman'sTale

Module5

(18hours)

KamauBrathwaite: NationLanguage

PicoIyer:In Praise of the Humble Coma

William Dalrymple: TheDancer of Kannur (extract from*NineLives*)

CoreText:*HarmonyofProse*

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Women and children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Core Text: Module 1 to 4- **Nature Anthem: A Textbook on Environmental Studies**

Reference texts for Module 5:

1. Basic Documents in Human Rights: Ian Brownlie
2. Universal Human Rights in Theory and Practice: Jack Donelly
3. Future of Human Rights: Upendra Baxi
4. Understanding Human Rights : An Overview: O P Dhiman
5. Reforming Human Rights: D.P.Khanna
6. Human Rights in India Historical, Social and Political Perspectives: Chiranjivi J Nirmal
7. Human Rights in Post colonial India: Edited by Om Prakash Dwivedi and V G Julie Rajan

II. DEPARTMENT OF HISTORY

Semester II

HY1VOT14 - Methods in Archaeology

Module I - Exploration and Excavation Methods

Exploration Methods – Manual and Scientific(Field trips can be organized)

Excavation Methods- Vertical, Horizontal and Quadrant

Module II Archaeological Recording

(a) Archaeological Recording

(b) Staff and Equipment for Excavation

(c) Documentation

(d) Publication of the Excavation report

Module III Dating Methods

a) Introduction to Relative dating methods- Seriation,Typology, Stratigraphy

b) Introduction to Absolute dating methods- C-14 Dating, Termoluminescence (TL dating), Dendro chronology, Potassium-Argon, Dating of Bones.

Module IV Conservation and preservation of archaeological remains

a) Aims and methods of Conservation

b) Conservation techniques and methods

Recommended Readings

a) Bintliff, John. 2004. *A companion to Archaeology*. U.K.: Blackwell.
b) Biswas, A. K. 2005. Science in Archaeology and Archaeological materials. New Delhi: D.K. PrintWorld (P) Ltd.
c) Chakrabarti, D.K. 1988. *A History of Indian Archaeology: From the Beginning to 1947*.New Delhi: Munsiram Manoharlal.
d) Drewett.L. Peter. 1999. *Field Archaeology*. London: UCL Press.
e) Fagan, Brian.1994. *In the Beginning: An Introduction to Archaeology*. London.
f) Rajan, K. 2002. *Archaeology; Principles and Methods*. Tanjavur: Mannop Publishers.
g) Raman, K.V.1998. *Principles and Methods of Archaeology*. Chenni: Parthajan
h) Renfrew, Colin and Paul Bahn 2006 *Archaeological: Theories and Methods and Practice*

III. B. Com Finance and Taxation

Core Course 15: ENVIRONMENT MANAGEMENT AND HUMAN RIGHTS

(CO5CRT15)
Applicable for B Com Model I, II and III

Instructional Hours: 90 **Credit: 4**

Objectives- To create an awareness regarding natural resources, environmental aspects and management, legislations involved and also provide an awareness on Human Rights

Module I - 20 Hours

Unit 1: Environmental Studies- Environmental Studies-Introduction-Definition-scope and Importance.

Unit 2: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation-General Conservation strategies

Water resources: Use and over-utilization of surface and ground water, water conservation, watershed management, rainwater harvesting , dams-benefits and problems.

Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources,

Food resources : World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources,

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Unit 3: Ecosystems- Concept -Structure and function - Energy -Food chains, food webs Ecological pyramids-Introduction, types, features, structure and function

Module II - 25 hours

Unit 1: Biodiversity - Introduction –types and importance- India as a mega-diversity nation- Bio diversity Hot-sports -Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts- concept of threatened fauna , IUCN categorisation and red list - Endangered and endemic species of India,

Conservation - *Insitu* and *exsitu* conservation, protected area concept-National Park, wildlife sanctuary, biosphere reserves and community reserves, botanical gardens and zoos

Global environmental issues- ozone depletion, global warming, greenhouse effect, climate change, acid rain, nuclear accidents

Local environmental issues- landscape alteration, quarrying, sand mining, coastal erosion, degrading of mangroves and wetlands, Ramsar sites

Disaster and Disaster management- floods, earth quakes, cyclone and landslides- Need for disaster management – Disaster Management in India

Unit 2: Pollution- air, water, soil, noise, thermal and nuclear- control measures, role of individuals in prevention of pollution -Issues relating to solid and electronic waste disposal.

Unit 3: Environmental laws in India (*brief overview only- the objectives and key provisions only*) Environment Protection Act, Air (Prevention and control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, issues involved in enforcement of environmental legislation. –

Sustainable development- Concept, , UN and sustainable development goals

Module – III (15 Hours)

Recent developments in the filed of Commerce and Management relating to environment

-Green Accounting- Meaning- History- Scope and Importance- Importance- Advantages and limitations-

Green Banking- Meaning- benefits- coverage- steps in green banking- environmental risks for banks- Green banking initiatives- International initiatives- Initiatives in India-

Green Marketing- Meaning- Need and benefits- Challenges- Green marketing in India- Green washing and consequences-

Eco tourism- significance- eco tourism activities in India- Opportunities and challenges – **Environmental audit**- concept- need and scope

Carbon credit and carbon exchanges (over view only) -

Module – IV (12 Hours)

Right to Information Act 2005- Basic terms- Public authority- Competent authority- Appropriate Government- Third Part- Information – record- Right to information- Objectives of the Act-Features of the Act- Obligation of Public authority- Procedure for request of information- time limit- fee- ground of rejection- appeal- exemption from disclosure- Right to access information on specific issues- Banking transactions, insurance transactions, government dealing and related services

Module - V (18 Hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

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Assignment may include Field study involving

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

IV. DEPARTMENT OF HINDI

B.A/ B.Sc Model I (Hindi)

SEMESTER I

Paper- 1- गद्य और एकाँकी (Prose & One Act Plays) (Text Book-साहित्य दर्पण)

Course Code-HN1CCT01

गद्य/ Prose

1. आईये हम वृक्ष देवता की आराधना करें - डॉ. किशोरी लाल व्यास
2. भय -रामचंद्र शुक्ल
3. हिमाच्छादित उत्तुंग शिखर और धुली हरियाली - विजय कुमार सन्देश
4. कफ़न चोर का बेटा -उषा बाला
5. जब मैं फेल हुआ- ए पी जे अब्दुल कलाम
6. जब इंतिज़ार हुसैन अपनी जन्मभूमि आये -अजहर वजाहत

एकाँकी /One Act Plays

1. दीपदान – रामकुमार वर्मा
2. जान से प्यारे – ममता कालिया
3. बहू की विदा – विनोद रस्तोगी
4. सती – जी. के. हरिजीत
5. हरी घास पर घंटे भर – सुरेन्द्र वर्मा

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
आईये हम वृक्ष देवता की आराधना करें	हिमाच्छादित उत्तुंग शिखर और धुली हरियाली	जब मैं फेल हुआ	जब इंतिज़ार हुसैन अपनी जन्मभूमि आये
भय	कफ़न चोर का बेटा	बहू की विदा	हरी घास पर घंटे भर
दीपदान	जान से प्यारे	सती	

SEMESTER II

Paper- 2- कहानी और उपन्यास (Short stories & Novel)

Course Code-HN2CCT02

उपन्यास/ Novel

1. अंतिम साक्षय – चंद्रकांता

कहानी/ Short stories (Text Book-कथा संसार)

1. ईदगाह- प्रेमचंद
2. हीलिबोन की बतखें- अज्ञेय
3. अमरूद का पेड -ज्ञानरंजन
4. जंगल का दाह- स्वयंप्रकाश
5. छुट्टी का दिन- उषा प्रियंवदा
6. बाज़ार में रामधन- कैलाश बनवासी
7. माँ रसोई में रहती है - कुमार अम्बुज

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय	अंतिम साक्षय
ईदगाह	अमरूद का पेड	छुट्टी का दिन	माँ रसोई में रहती है
हीलिबोन की बतखें	जंगल का दाह	बाज़ार में रामधन	

SEMESTER IV

Paper- 4- नाटक और लंबी कविता (Drama & Long Poem)
Course Code-HN4CCT04

नाटक/ Drama

1. कोणार्क – जगदीश चन्द्र माथुर

लंबी कविता (Long Poem) (Text Book-पांच लंबी कविताएँ)

1. नगई महुरा- त्रिलोचन
2. शहंशाह की नींद – उमाशंकर चौधरी
3. ढाबा – नीलेश रघुवंशी
4. इतनी दूर मत ब्याहना बाबा – निर्मला पुत्तुल
5. जवाहर टनल –अग्निशेखर

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
कोणार्क	कोणार्क	कोणार्क	कोणार्क
नगई महुरा	शहंशाह की नींद	ढाबा	जवाहर टनल
		इतनी दूर मत ब्याहना बाबा	

B.Com Model I

SEMESTER I

Paper- 1- गद्य और संचार मीडिया (Prose & Mass Media)

Course Code-HN1CCT01

गद्य/ Prose (Text Book-साहित्य सागर)

1. नेहरु का रास्ता – माधव हाड़ा
2. जूठन- ओमप्रकाश वाल्मीकी
3. चूहा और मैं- हरिशंकर परसाई
4. अग्नि की उड़ान- ए पी जे अब्दुल कलाम
5. आस्था और रोमांच की यात्रा- पवन चौहान
6. गौरी का गुस्सा-स्वयं प्रकाश

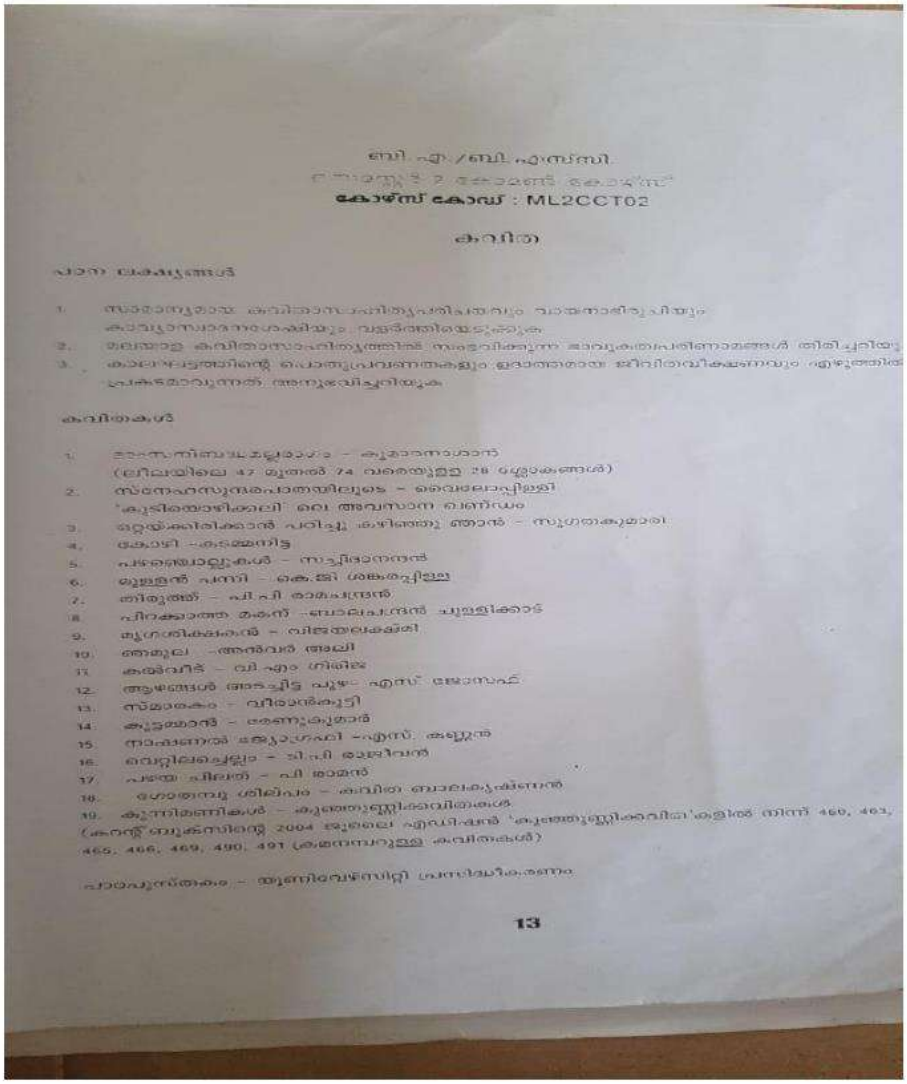
संचार मीडिया (Mass Media) (Text Book-संचार मीडिया एवं व्यावसायिक पत्र लेखन)

1. दर्शकों को अब भी अच्छे सिनेमा की तलाश – ओमपुरी
2. विज्ञापन और स्त्री – कुमुद शर्मा
3. माध्यम् की तलाश – राही मासूम रज़ा
4. चक दे इण्डिया – रामशरण जोशी

(Module-wise Distribution)

MODULE- I	MODULE- II	MODULE- III	MODULE- IV
नेहरु का रास्ता	चूहा और मैं	आस्था और रोमांच की यात्रा	गौरी का गुस्सा
जूठन	अग्नि की उड़ान		
दर्शकों को अब भी अच्छे सिनेमा की तलाश	विज्ञापन और स्त्री	माध्यम् की तलाश	चक दे इण्डिया

V. DEPARTMENT OF MALAYALAM



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കോഴ്സ് കോഡ് : ML2CCT02

കവിത

പഠന ലക്ഷ്യങ്ങൾ

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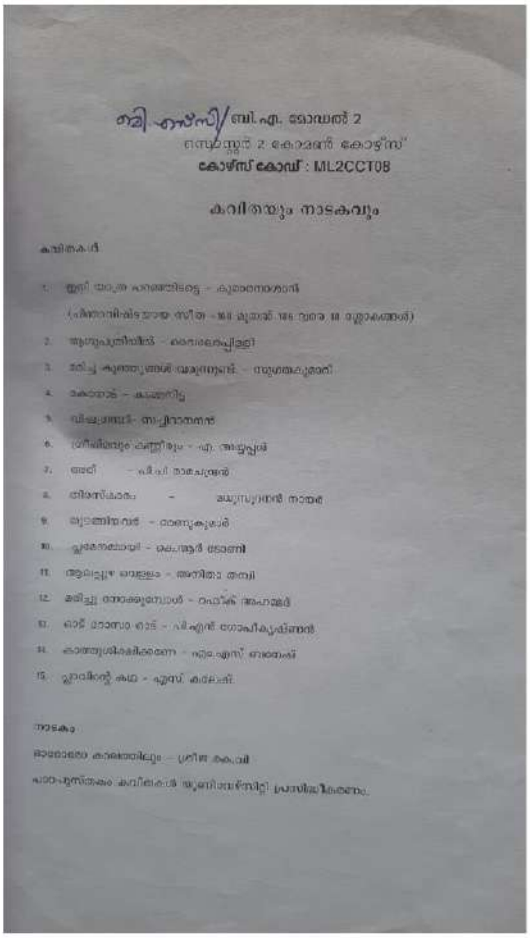
കവിതകൾ

1. [illegible] – കുമാരനാശാൻ
(ലീലയിലെ 47 മുതൽ 74 വരെയുള്ള 28 ശ്ലോകങ്ങൾ)
2. സ്നേഹസുന്ദരപാതയിലൂടെ – വൈലോപ്പിള്ളി
'കുടിയൊഴിക്കലി' ന്റെ അവസാന ഖണ്ഡം
3. ഒറ്റയ്ക്കിരിക്കാൻ പഠിച്ചു കഴിഞ്ഞു ഞാൻ – സുഗതകുമാരി
4. കോടി –കടമ്മനിട്ട
5. പടയൊരുക്കുകൾ – സച്ചിദാനന്ദൻ
6. മുള്ളൻ പന്നി – കെ.ജി ശങ്കരപ്പിള്ള
7. തിരുത്ത് – പി.പി രാമചന്ദ്രൻ
8. പിറക്കാത്ത മകന് –ബാലചന്ദ്രൻ ചുള്ളിക്കാട്
9. മൃഗശിക്ഷകർ – വിജയലക്ഷ്മി
10. തൊലി –അൻവർ അലി
11. കൽവിൽ – വി.എം ഗിരിജ
12. ആഴങ്ങൾ അടച്ചിട്ട പുഴ– എസ് ജോസഫ്
13. സ്ത്രൈണം – വീരാൻകുട്ടി
14. കുട്ടമ്മാൻ – രണുകുമാർ
15. നാഷണൽ ജ്യോഗ്രഫി –എസ്. കണ്ണൻ
16. വെറുമൊരെണ്ണം – വി.പി രാജീവൻ
17. പഴയ പിഴവ് – പി രാമൻ
18. ശൗരസൂ ശില്പം – കവിത ബാലകൃഷ്ണൻ
19. കുനിമണികൾ – കുഞ്ഞുണ്ണിക്കവിതകൾ
(കറന്റ് ബുക്സിന്റെ 2004 ജൂലൈ എഡിഷൻ 'കുഞ്ഞുണ്ണിക്കവിത'കളിൽ നിന്ന് 460, 463, 465, 466, 469, 490, 491 ക്രമനമ്പറുള്ള കവിതകൾ)

പാഠപുസ്തകം – യൂണിവേഴ്സിറ്റി പ്രസിദ്ധീകരണം

13



ബി.എസ്‌സി/ബി.എ. മോഡൽ 2
സെമസ്റ്റർ 2 കോമൺ കോഴ്സ്
കോഴ്സ് കോഡ് : ML2CCT08

കവിതയും നാടകവും

കവിതകൾ

1. [illegible]
   ([illegible])
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible] - പി.പി. രാമചന്ദ്രൻ
8. തിരസ്കാരം - മധുസൂദനൻ നായർ
9. [illegible]
10. [illegible]
11. [illegible] - അനിതാ തമ്പി
12. മരിച്ചു നോക്കുമ്പോൾ - റഫീക്ക് അഹമ്മദ്
13. [illegible] - പി.എൻ. ഗോപീകൃഷ്ണൻ
14. [illegible] - എം.എസ്. ബനേഷ്
15. പ്ലാവിന്റെ കഥ - എസ്. കലേഷ്

നാടകം

[illegible] - ശ്രീജ കെ.വി.

പാഠപുസ്തകം കവിതകൾ യൂണിവേഴ്സിറ്റി പ്രസിദ്ധീകരണം.

VI. DEPARTMENT OF CHEMISTRY

SEMESTER V

CH5CRT05 - Environment, Ecology and Human Rights

Credits – 4 (72 Hrs)

Environmental Chemistry (54 h)

Objectives: Environmental awareness is to understand the fragility and sensitivity of our environment, in particular the biosphere and the importance of its protection. Promoting environmental awareness is an easy way to become an environmental steward and participate in creating a brighter future for our next generations. The most important goal of this paper is to impart awareness on various environmental aspects, with some glimpses of contemporary issues. This will help them foster a *sense* of responsibility and "*proactive citizenship*".

Module I: Introduction to environmental studies: Natural resources

10 h

Definition, scope and importance of environmental studies for sustainable development, need for public awareness.

Natural Resources: Classification of natural resources; renewable and non-renewable resources:

Natural resources and associated problems;

1.1 Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

1.2 Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

1.3 Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

1.4 Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, industrial farming of livestock and effects on global warming, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, mass production of biodiesel for energy needs and *food security*.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module II: Environment: Pollution and Social Issues

18 h

Fundamental ideas of pollution and pollutant. Cause, effects and preventive measures of various types of pollutions including; air, water, soil, marine, noise and thermal pollutions. Nuclear energy as a source of energy and its hazards. Solid waste management; causes, effects and control mechanisms of urban and industrial wastes. Prevention of pollution: role of individual. Disaster management mechanisms; disaster management of; floods, earthquake, cyclone and landslides.

Movement from unsustainable to sustainable development. Urban crisis related to energy. Water conservation, rain water harvesting, watershed management, Environmental ethics: Issues and possible solutions. Introduction to important green house gases (GHGs), sources of the primary greenhouse gases in Earth's atmosphere including water vapor, carbon dioxide, methane. The lesser GHGs- nitrous oxide, ozone and fluorinated gases. Carbon cycle, CO_2 sources, Keeling curve and Natural 'sinks' for CO_2. Green house effect, climate change,

1

global warming, acid rain, ozone layer depletion, role of CFCs in ozone depletion, and its mechanism, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act (EPA). Air (prevention and control of pollution) Act. Water (prevention and control of pollution) Act, Wildlife Protection Act, Forest Conservation Act. Issues involved in the enforcement of environmental legislation. Introduction to the concept of green chemistry, atom economy (with suitable examples) and the twelve principles of green chemistry.

Module III: Population and Environmental issues

8 h

Human population growth, *Malthusian theory (basic idea) and* theory of evolution by natural selection, *Malthusian* catastrophe. Global challenges, *environmental* problems of population growth, impacts on human health and welfare, variation among nations, population explosion and Family Welfare Programme. Socio- economic, and geo-political dimensions of poverty, absolute and relative poverty, poverty scale, variation among nations, international food crisis. Resettlement and rehabilitation of project affected population. Environmental movements in India: Chipko, Silent valley, Bishnois of Rajasthan etc.

Module IV: Ecological Chemistry

18 h

Definition and scope of ecological chemistry, ecological stress posed upon ecosystems by the presence of chemicals. Origin of chemical toxicants; natural sources, and man-made. Organization of chemicals as xenobiotic, essential or nonessential substances. Release of chemicals in the environment, Transport Processes, Classification of transformation processes, biotic and abiotic. Structure- activity relationships in degradation and biodegradation of organic chemicals. Transformation processes including general, hydrolysis, oxidation, reduction, photochemical degradation, microbial degradation, and phytodegradation, environmental fate determining processes, bioavailability, exposure of species to (bio)available fractions, uptake (accumulation), metabolism, biomagnifications, distribution in organisms, and subsequent toxic effects. Risk assessment of chemicals-assessment of contaminated soils.

Persistent organic pollutants (POPs), natural and anthropogenic origin of POCs and characteristic properties; half-lives, K_{ow}, K_{aw} and K_{oa}. Adverse effects of persistent chemicals. Legislation on the use of POPs and twelve persistent organic pollutants. The sources, the uses, some of the physico-chemical properties, the half-lives in the environmental compartments of air, water and soil. Behaviour of the priority persistent organic pollutants identified by the United Nations Economic Commission for Europe (UNECE) including; polychlorinated biphenyls, dieldrin, aldrin, dichlorodiphenyltrichloroethane (DDT), Mirex, Heptachlor and Polychlorinated furans. Agency for Toxic Substances and Disease Registry (ATSDR) list, **the ATSDR 2017 Substance Priority List,** Restriction of Hazardous Substances (RoHS) directive, Material Safety Data Sheet (MSDN), Toxic Substances Control Act (TSCA) and banned/severely restricted chemicals list.

Suggested reference books

1. S. Manahan, *Fundamentals of environmental chemistry*, CRC-Press, 1993.
2. S. Manahan, *Fundamentals of Environmental and Toxicological Chemistry*: Sustainable Science, CRC Press, 2013
3. R.C. Brunner, *Hazardous Waste Incineration*, McGraw Hill Inc., 1989
4. W.P. Cunningham, T.H. Cooper, E Gorhani, and M.T. Hepworth, *Environmental Encyclopedia*, Jaico Publishing House, Mumbai, 2001.
5. A.K. De, *Environmental Chemistry*, Wiley Eastern Ltd.

2

6. V. Subramanian, *A Textbook of Environmental Chemistry*, I.K. International Publishing House Pvt. Ltd. 2011.
7. S.K. Tiwari, *Environmental Science: Volume I and II*, Atlantic Publishers and Distributers Pvt. Ltd., 2011.
8. R. M. Harrison (ed.), *Understanding Our Environment An Introduction to Environmental Chemistry and Pollution*, Royal Society of Chemistry, 1999
9. D. E. Newton, *Chemistry of the Environment*, Facts On File Inc., 2007
10. V. Udai, Modern *Teaching of Population Education*, Anmol Publications Pvt. Ltd., 2005.
11. B. McGuire, Global *Catastrophes: A Very Short Introduction*, Oxford University Press, 2002.
12. A. E. Dessler, E. A. Parson, *The Science and Politics of Global Climate Change*, Cambridge University Press, 2006.
13. J. Firor, J. Jacobsen, *The Crowded and Greenhouse- Population, Climate Change, and Creating a Sustainable World,* Yale University Press, 2002.
14. B. Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming,* Alfred A. Knopf Publisher- New York, 2007.

Further readings

1. S. V. S. Rana, *Essentials of Ecology and Environmental Science*, 5th Edition, Rupa publications, 2013.
2. V.H. Heywood, and R.T. Waston, *Global Biodiversity Assessment*. Cambridge Univ. Press, 1995.
3. H. Jadhav, V.M. Bhosale, *Environmental Protection and Laws*. Himalaya Pub. House, Delhi, 1995.
4. M.L. Mckinney, and R.M. School, *Environmental Science Systems and Solutions*, Web enhanced edition. 1996.
5. P. H., H. Raven, D.M. Hassenzahl, and L. R. Berg, *Environment*, 8th Edn. John Wiley & Sons, 2012.
6. A. Wreford, D. Moran, N. Adger , *Climate Change and Agriculture: impacts, adaptation and mitigation*, OECD publications, 2010.
7. R.S. Boethling D. Mackay, *Handbook of Property Estimation Methods for Chemicals*. Boca Raton, FL, USA: Lewis Publishers, 2000.
8. J.L.M. Hermens C. J. Van Leeuwen *Risk Assessment of Chemicals: An Introduction, Dordrecht*, The Netherlands, Kluwer Academic Press, 1995.
9. D. Mackay, W.Y.,Shiu, K.C. Ma *Physical-Chemical Properties and Environmental Fate, Degradation Handbook*. (CD-ROM), Boca Raton, FL, USA, Chapman & Hall CRC netBASE, CRC, 1999.
10. W. J. G. M. Peijnenburg, *Ecological Chemistry, Environmental and Ecological Chemistry- Vol. III, Encyclopedia of Life Support Systems* (EOLSS).
11. M. Ali, *Climate Change Impacts on Plant Biomass Growth*, Springer Dordrecht Heidelberg, 2013

Special Notes and Suggestions:

The purpose of the paper is to create general awareness on various dimensions of environmental sciences with a special focus on contemporary issues. The BoS in Chemistry recommend case studies or sample surveys (maybe in groups) rather than seminars. Students can undertake an assignment based on any of the following highly relevant and current topic;

- Edutainment film *"Samaksham"*, produced by Mahatma Gandhi University, Kottayam.
- Case Studies on the *important natural resources* of Kerala.

3

- Case Studies on the Indian *mining scams and consequent environmental* damages of; illegal mining in the *Aravali Ranges, Goa, Ganges river bed, Bellary* etc.
- Case Studies on the *disaster management mechanisms* of floods, landslides, earthquake, cyclone etc.
- Case Studies on the water conservation, rain water harvesting, watershed management in a local contest.
- Case studies on environmental movements like Narmada Bachao Andolan, Appiko Movement, Save Ganga Movement etc.

Module - V (18 h)

V.I Human Rights

An Introduction to Human Rights, meaning, concept and development –History of Human Rights- Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR, ICCPR, ICESCR.-Value dimensions of Human Rights

V-II Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission (of) Human Rights?-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

V-III Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights- directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

References and suggested readings

1. H.O. Agarwal, *Implementation of Human Rights Covenants with Special Reference to India*,
2. P. Alston, *The United Nations and Human Rights*, Clarendon Press, London, 1995.
3. Amnesty International, *Political Kings by Governments*, Amnesty International, London, 1983.
4. Bajwa, G.S. and D.K. Bajwa, *Human Rights in India: Implementation and Violations* , D.K. Publishers, New Delhi, 1996.
5. UNESCO, Yearbook on Human Rights.
6. NHRC, Annual Reports since 1993.
7. V.K. Bansal, *Right to Life and Personal Liberty*, Deep and Deep, New Delhi, 1986.
8. M. Banton, *International Action against Racial Discrimination* Clarendon Press, Oxford, 1996.
9. D.D. Basu, Human Rights in Constitutional Law, Prentice Hall, New Delhi, 1994.
10. N.Bava (ed.,) *Human Rights and Criminal Justice Administration in India*, Uppal Publishing House, New Delhi, 2000.
11. UN Centre for Human Rights, *Civil and Political Rights: The Human Rights Committee*, World Campaign for Human Rights, Geneva, 1997.
12. UN Centre for Human Rights, *Discrimination against Women*, World Campaign for Human Rights, Geneva, 1994.
13. UN Centre for Human Rights, Minority Rights, World Campaign for Human Rights, Geneva, , 1998.

4

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CH5OPT – OPEN COURSE

CH5OPT01 - CHEMISTRY IN EVERYDAY LIFE

(Chemical structures are non-evaluative)

Credits – 3 (72 Hrs)

Unit 1: Food Additives **(12 Hrs)**

Food additives – definition. Preservatives, Food colours - permitted and non-permitted, Toxicology. Flavours - natural and synthetic. Artificial sweeteners, Emulsifying agents, Antioxidants, Leavening agents and Flavour enhancers. Importance of food additives. Soft drinks - formulation and health effects. Health drinks. Fast foods and junk foods and their health effects. Food adulteration. Food laws and standards. Food Safety and Standards Act, 2006.

Unit 2: Soaps and Detergents **(10 Hrs)**

Soaps – Introduction. Types of soaps - Toilet soaps, washing soaps. Liquid soap. TFM and grades of soaps. Bathing bars. Cleansing action of soap.

Detergents - Introduction. Types of detergents - anionic, cationic, non-ionic and amphoteric detergents. Common detergent additives. Enzymes used in commercial detergents. Comparison between soaps and detergents. Environmental aspects.

Unit 3: Cosmetics **(10 Hrs)**

Cosmetics - Introduction. General formulation of different types of cosmetics - Dental cosmetics, Shampoos, Hair dyes, Skin products (creams and lotions, lipstick, perfumes, deodorants and antiperspirants), Bath oil, Shaving cream and Talcum powder. Toxicology of cosmetics.

Unit 4: Plastics, Paper and Dyes **(12 Hrs)**

Plastics in everyday life. Plastics and Polymers. Classification of polymers. Brief idea of polymerization. Use of LDPE, HDPE, PP, PVC and PS. Environmental hazards of plastics. Biodegradable plastics. Recycling of plastics. Paper – Introduction. Paper manufacture (basic idea only). Weight and size of paper. Types of paper - News print paper, writing paper, paperboards, cardboards. Environmental impact of paper. International recycling codes, and symbols for identification of plastics. Natural and synthetic dyes with examples (elementary idea only).

Unit 5: Drugs **(9 Hrs)**

Classification of drugs - Analgesics, Antipyretics, Antihistamines, Antacids, Antibiotics and Antifertility drugs with examples. Psychotropic drugs - Tranquilizers, Antidepressants and Stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Unit 6: Chemistry and Agriculture **(12 Hrs)**

Fertilizers – Introduction. Types of fertilizers - Natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio-fertilizers. Plant growth hormones. Pesticides - Introduction. Classification - Insecticides, Fungicides, Herbicides. Excessive use of pesticides - Environmental hazards. Bio pesticides.

Unit 7: Nanomaterials **(7 Hrs)**

Terminology. Scales of nanosystems. Different types of nanoparticles. Applications of nanoparticles in biology and medicine – biological labels, drug and gene delivery, tissue engineering, tumour destruction. Other applications of nanoparticles – electronics, paints, food packaging. Toxicology of nanoparticles.

References:

1. B. Sreelakshmi, *Food Science*, New Age International, New Delhi, 2015.
2. Shashi Chowla; *Engineering Chemistry*, Danpat Rai Publication.
3. B.K. Sharma; *Industrial Chemistry*. Goel Publishing House, Meerut, 2003.
4. C.N.R. Rao; *Understanding Chemistry*, Universities Press.
5. M.K. Jain and S.C. Sharma; *Modern Organic Chemistry*, Vishal Pub. Co., Jalandhar, 2009.
6. A.K. De; *Environmental Chemistry*, New Age International Ltd., New Delhi, 2006.
7. S.S. Dara; *A Textbook of Environmental Chemistry and Pollution Control*, S. Chand & Company Ltd.
8. J.W. Hill; T.W. McCreary and D.K. Kolb; *Chemistry for Changing Times*, Prentice Hall, 12th edn., 2010.
9. V.R.Gowariker; N.V. Viswanathan and J. Sreedhar; *Polymer Science*, 2nd edn., New Age, New Delhi, 2015.
10. D. Sriram and P. Yogeeswari; *Medicinal Chemistry*, 2nd edn. Pearson, 2011.
11. S.L. Tisdale; W.L.Nelson and J.D.Beaton; *Soil Fertility and Fertilizers,* Macmillan Publishing Company, New York, 1990.
12. K.H.Buchel; *Chemistry of Pesticides*, John Wiley & Sons, New York, 1983.
13. P.C. Pall; K. Goel and R.K. Gupta; *Insecticides, Pesticides and Argobased Industries.*
14. T. Pradeep; *Nano- The Essentials*, McGraw Hill Publishing Co., New Delhi, 2007.
15. V.S.Muraleedharan, A. Subramania; *Nanoscience and Nanotechnology*, Ane Books, New Delhi, 2009.
16. K.J. Klabunde; *Nanoscale Materials in Chemistry*, Wiley.
17. Singh, K., *Chemistry in Daily Life;* Prentice Hall of India, New Delhi, 2008.

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CH5CRT07 – PHYSICAL CHEMISTRY - I

Credits – 2 (36 Hrs)

Unit 1: Gaseous State **(12 Hrs)**

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes ofdeviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena and Andrews isotherms of CO_2, critical constants and their calculationfrom van der Waals equation.Virial equation of state, van der Waals equation expressed in virial form.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphical representation – derivation not required) and their importance. Temperaturedependence of these distributions. Most probable, average and rootmean square velocities (no derivation).

Collision properties: Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Relation between mean free path and coefficient of viscosity.

Unit 2: Liquid State **(3 Hrs)**

Intermolecular forces in liquids (qualitative idea only). Surface tension and its measurement by stalagmometer method, factors affecting Surface tension, Viscosity, Poisuelle's equation, Determination of viscosity by Ostwald's viscometer..

Unit 3: Solid State **(12 Hrs)**

The nature of the solid state – anisotropy –Forms of solids. Unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography – Law of constancy ofinterfacial angles, Law of rational indices. Miller indices. X–Ray diffraction bycrystals, Bragg's law.Bragg's X-ray diffractometer method and powder pattern method. Analysis of powder diffraction patterns of NaCl and KCl, density of cubic crystals.

Structure of ionic compounds of thetype AX (NaCl, CsCl, ZnS) and AX2 (CaF2, Na2O) Defects in crystals – stoichiometric and non-stoichiometric defects, extrinsic and intrinsic defects. Electrical conductivity, semiconductors, n-type, p-type, Superconductivity – An introduction.

Liquid crystals and its thermographic behaviour. Classification, structure of nematic and cholestric phases.

Unit 4: Surface Chemistry and Colloidal State **(9 Hrs)**

Adsorption – types, adsorption of gases by solids – factors influencing adsorption – Freundlich adsorption isotherm – Langmuir adsorption isotherm –derivation of Langmuir adsorption isotherm. The BET theory (no derivation) – use of BET equation for the determination of surface area.

Types of solutions – true, colloid and suspensions, Purification of colloids – Ultra filtration and electrodialysis, optical and electrical properties of colloids. Electrical double

layer and zeta potential. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration, sedimentation and streaming potential.

References

1. R P W Atkins, *"Physical Chemistry"*, Oxford University Press
2. R J Silby and R A Alberty, *"Physical Chemistry"*, John Wiley & Sons
3. F Daniels and A Alberty, *"Physical Chemistry"*, Wiley Eastern
4. Puri, Sharma and Pathania, *"Principles of Physical Chemistry"*, Millennium Edition, Vishal Publishing Co
5. Barrow, G.M. *"Physical Chemistry"*,Tata McGraw-Hill (2007).
6. Castellan, G.W. *"Physical Chemistry"*,4th Ed. Narosa (2004).
7. K. L. Kapoor, *"A Textbook of Physical chemistry"*, Volume 1, Macmillan India Ltd.,
8. B. R. Puri, L. R. Sharma, M. S. Pathania, *"Elements of Physical chemistry"*, Vishal Pub. Co.,
9. L V Azaroff, *"Introduction to Solids"*, McGraw Hill.
10. N B Hannay, *"Solid State Chemistry"*, Prentice Hall.
11. A. McQuarrie, J. D. Simon, *"Physical Chemistry – A molecular Approach"*, Viva Books Pvt. Ltd.
12. Anthony R. West, *"Solid State Chemistry and its Applications"*, Wiley Eastern.

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CH5CRT08 – PHYSICAL CHEMISTRY – II
Credits - 3 (36 Hrs)

Unit 1: Quantum Mechanics **(14 Hrs)**

Classical mechanics: Concepts, Radiation phenomena –Blackbody radiation, Photoelectric effect, Compton effect and Atomic spectra. Plank's quantum theory and explanation of the radiation phenomena.de Broglie hypothesis, dual nature of electrons – Davisson and Germer's experiment. Heisensberg's uncertainty principle and its significance.

Postulates of quantum mechanics: Schrodinger wave equation – significance of Ψ, well behaved wave functions, Concept of operators- Operator algebra – Linear and Hermitian operators - Laplacian and Hamiltonian operators – Eigen functions and Eigen values of an operator.

Application of quantum mechanics to simple systems – Particle in 1-D box, normalization of wave function, application to linear conjugated polyene (butadiene).

Introductory treatment of Schrödinger equation for hydrogen atom.– The wave equation in spherical polar coordinates (derivation not required) - Separation of wave equation - Radial and angular functions (derivation not required) – Orbitals. Quantum numbers and their importance, hydrogen like wave functions – radial and angular wave functions, radial distribution curves.

Molecular orbital theory: basic ideas – criteria for forming MO from AOs, construction of molecular orbital by LCAO method for H_2^+ion (elementary idea only), physical picture of bonding and anti bonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics.

Unit 2: Molecular Spectroscopy-I **(12 Hrs)**

Introduction: electromagnetic radiation, regions of the spectrum, interaction ofelectromagnetic radiation with molecules, various types of molecular spectroscopic techniques, Born-Oppenheimer approximation.

Rotation spectroscopy: Introduction to rotational spectroscopy, Rotational energy levels, Selection rules.

Vibrational spectroscopy: Introduction, Selection Rules, Classical equation of vibration, calculation of force constant, concept of anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands. Degrees of freedom for polyatomic molecules, modes of vibration (H_2O and CO_2 as examples), finger print region, Fermi resonance.

Raman spectroscopy: Introduction, Classical and quantum treatment of Raman effect, Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti-Stokes lines: their intensity difference, rule of mutual exclusion.

Unit 3: Molecular Spectroscopy-II **(10 Hrs)**

Electronic spectroscopy: Introduction, selection rule, Franck-Condon principle, electronic transitions, singlet and triplet states, dissociation and predissociation. Polyatomic molecules – qualitative description of σ, π and n- molecular orbitals, their energy levels and the respective transitions. Lambert-Beer's law.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling.

Electron Spin Resonance (ESR) spectroscopy: Principle, hyperfine structure, ESR of simple radical - methyl radical.

References

1. R.K. Prasad, *Quantum Chemistry*, New Age International, 2001
2. Mc Quarrie, J. D. Simon, *Physical Chemistry – A molecular Approach*, Viva Books.
3. I. N. Levine, *Physical Chemistry*, Tata McGraw Hill,
4. Banwell, C. N. &Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*,4th Ed. Tata McGraw-Hill: New Delhi (2006).
5. Manas Chanda, *Atomic structure and Chemical bonding in Molecular Spectroscopy"* Tata McGraw Hill.
6. D. L. Pavia, G. M. Lampman, G. S. Kriz, *Introduction to spectroscopy*, 3rd edn, ThomsonBrooks/Cole, 2001.
7. D. N. Satyanarayana, *Electronic absorption spectroscopy and related techniques*, Universities Press.
8. D.N. Sathyanarayana, Introduction To Magnetic Resonance Spectroscopy ESR, NMR, NQR, IK International, 2009.
9. Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).
10. GurdeepRaj, *Photochemistry*, 6thEdn, Goel Publishing House, 2014
11. Rohatgi-Mukherjee, *Fundamentals of Photochemistry*, New Age International (P) Ltd.
12. Puri, Sharma &Pathania, *Priniciples of Physical Chemistry*, Vishal Publishing Co.
13. N. J. Turro, *Modern Molecular Photochemistry*, 4th Edition University Science Books,Sausalito, 1991.
14. Gurdeep Raj, *"Advanced Physical Chemistry"*, Goel Publishing House

Mahatma Gandhi University, Kottayam

CH5OPT – OPEN COURSE

CH5OPT01 - CHEMISTRY IN EVERYDAY LIFE

(Chemical structures are non-evaluative)

Credits – 3 (72 Hrs)

Unit 1: Food Additives **(12 Hrs)**

Food additives – definition. Preservatives, Food colours - permitted and non-permitted, Toxicology. Flavours - natural and synthetic. Artificial sweeteners, Emulsifying agents, Antioxidants, Leavening agents and Flavour enhancers. Importance of food additives. Soft drinks - formulation and health effects. Health drinks. Fast foods and junk foods and their health effects. Food adulteration. Food laws and standards. Food Safety and Standards Act, 2006.

Unit 2: Soaps and Detergents **(10 Hrs)**

Soaps – Introduction. Types of soaps - Toilet soaps, washing soaps. Liquid soap. TFM and grades of soaps. Bathing bars. Cleansing action of soap.

Detergents - Introduction. Types of detergents - anionic, cationic, non-ionic and amphoteric detergents. Common detergent additives. Enzymes used in commercial detergents. Comparison between soaps and detergents. Environmental aspects.

Unit 3: Cosmetics **(10 Hrs)**

Cosmetics - Introduction. General formulation of different types of cosmetics - Dental cosmetics, Shampoos, Hair dyes, Skin products (creams and lotions, lipstick, perfumes, deodorants and antiperspirants), Bath oil, Shaving cream and Talcum powder. Toxicology of cosmetics.

Unit 4: Plastics, Paper and Dyes **(12 Hrs)**

Plastics in everyday life. Plastics and Polymers. Classification of polymers. Brief idea of polymerization. Use of LDPE, HDPE, PP, PVC and PS. Environmental hazards of plastics. Biodegradable plastics. Recycling of plastics. Paper – Introduction. Paper manufacture (basic idea only). Weight and size of paper. Types of paper - News print paper, writing paper, paperboards, cardboards. Environmental impact of paper. International recycling codes, and symbols for identification of plastics. Natural and synthetic dyes with examples (elementary idea only).

Unit 5: Drugs **(9 Hrs)**

Classification of drugs - Analgesics, Antipyretics, Antihistamines, Antacids, Antibiotics and Antifertility drugs with examples. Psychotropic drugs - Tranquilizers, Antidepressants and Stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Unit 6: Chemistry and Agriculture **(12 Hrs)**

Fertilizers – Introduction. Types of fertilizers - Natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio-fertilizers. Plant growth hormones. Pesticides - Introduction. Classification - Insecticides, Fungicides, Herbicides. Excessive use of pesticides - Environmental hazards. Bio pesticides.

Unit 7: Nanomaterials **(7 Hrs)**

Terminology. Scales of nanosystems. Different types of nanoparticles. Applications of nanoparticles in biology and medicine – biological labels, drug and gene delivery, tissue engineering, tumour destruction. Other applications of nanoparticles – electronics, paints, food packaging. Toxicology of nanoparticles.

References:

1. B. Sreelakshmi, *Food Science*, New Age International, New Delhi, 2015.
2. Shashi Chowla; *Engineering Chemistry*, Danpat Rai Publication.
3. B.K. Sharma; *Industrial Chemistry*. Goel Publishing House, Meerut, 2003.
4. C.N.R. Rao; *Understanding Chemistry*, Universities Press.
5. M.K. Jain and S.C. Sharma; *Modern Organic Chemistry*, Vishal Pub. Co., Jalandhar, 2009.
6. A.K. De; *Environmental Chemistry*, New Age International Ltd., New Delhi, 2006.
7. S.S. Dara; *A Textbook of Environmental Chemistry and Pollution Control*, S. Chand & Company Ltd.
8. J.W. Hill; T.W. McCreary and D.K. Kolb; *Chemistry for Changing Times*, Prentice Hall, 12th edn., 2010.
9. V.R.Gowariker; N.V. Viswanathan and J. Sreedhar; *Polymer Science*, 2nd edn., New Age, New Delhi, 2015.
10. D. Sriram and P. Yogeeswari; *Medicinal Chemistry*, 2nd edn. Pearson, 2011.
11. S.L. Tisdale; W.L.Nelson and J.D.Beaton; *Soil Fertility and Fertilizers*, Macmillan Publishing Company, New York, 1990.
12. K.H.Buchel; *Chemistry of Pesticides*, John Wiley & Sons, New York, 1983.
13. P.C. Pall; K. Goel and R.K. Gupta; *Insecticides, Pesticides and Argobased Industries.*
14. T. Pradeep; *Nano- The Essentials*, McGraw Hill Publishing Co., New Delhi, 2007.
15. V.S.Muraleedharan, A. Subramania; *Nanoscience and Nanotechnology*, Ane Books, New Delhi, 2009.
16. K.J. Klabunde; *Nanoscale Materials in Chemistry*, Wiley.
17. Singh, K., *Chemistry in Daily Life;* Prentice Hall of India, New Delhi, 2008.

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SEMESTER VI

CH6CRT09 - INORGANIC CHEMISTRY

Credits - 3 (54 Hrs)

Unit 1: Coordination Chemistry - I **(7 Hrs)**

Introduction of coordination compounds, Types of ligands – Anionic, cationic and neutral – IUPAC Nomenclature , Isomerism in coordination compounds –Structural isomerism and stereo isomerism . Chelates, chelate effect-Stability of complexes: Inert and labile complexes - Factors influencing stability. Review of Werner's theory and Sidgwick's concept of coordination – EAN rule.

Unit 2: Coordination Chemistry - II **(14 Hrs)**

Bonding theories: Valence bond theory - Geometries of coordination numbers 4 and 6 – Inner orbital and outer orbital complexes- Limitations of VBT. Crystal filed theory - Splitting of *d*-orbitals in octahedral, tetrahedral, tetragonal and square planar complexes - Jahn Teller Effect– Jahn –Teller distortion in Cu(II) complexes. Factors affecting crystal field splitting - CFSE of low spin and high spin octahedral complexes. Spectrochemical series - Explanation of geometry, magnetism and spectral properties - Merits and demerits of Crystal field theory. Molecular orbital theory – evidence for metal ligand covalency- MO diagram for octahedral complexes (with sigma bonds only).

Unit 3: Cooridnation Chemistry III **(6 Hrs)**

Spectral and magnetic properties of complexes – electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$, Calculation of magnetic moments – spin only formula. Reactivity of complexes – Ligand substitution reactions- SN_1 and SN_2 substitution reactions of square plananr complexs- Trans effect and its applications. Application of coordination chemistry in qualitative and quantitative analysis of metal ions such as Cu^{2+}, Zn^{2+}, Ni^{2+} and Mg^{2+}.

Unit 4: Organometallic Compounds **(12 Hrs)**

Definition – Classification based on the nature of metal-carbon bond and on the basis of hapticity. Naming of organometallic compounds. The 18- electron rule and stability – Ferrocene: Preparation, properties and bonding (VBT only). Metal-alkene complexes- – Zeise's salt. Catalytic properties of organometallic compounds - Zeigler Natta catalyst in the polymerization of alkene and Wilkinson catalyst in the hydrogenation of alkene (mechanism not expected). Preparation and properties of mononuclear carbonyls - Structures of $Mo(CO)_6$, $Fe(CO)_5$ and $Ni(CO)_4$. Polynuclear carbonyls, bridged carbonyls and bonding in carbonyls – $Mn_2(CO)_{10}$ and $Fe_2(CO)_9$. EAN of metals in metal carbonys – indication of metal-metal bonding. - Quadruple bond – structure of $Re_2Cl_8^{2-}$.

Unit 5: Bioinorganic Chemistry **(6 Hrs)**

Essential and trace elements in biological systems – Structure and functions of haemoglobin and myoglobin, Vitamin B12 (structure not expected). Electron carriers – cytochromes. Chlorophyll and photosynthesis (mechanism not expected).

Role of alkali and alkaline earth metals in biological systems, Na/K pump. Importance of Ca and Mg. Biological functions and toxicity of metals – Fe, Cu, Zn, Cr, Mn, Ni, Co, Cd, Hg and Pb. Metalloenzymes of zinc and copper, nitrogenase. Treatment of metal toxicity by chelation therapy. Anti cancer drugs – cis platin and carboplatin– Structure and significance.

Unit 6: Boron Compounds **(3 Hrs)**

Preparation, properties and structure of diborane, borazine, boric acid, boron nitride.

Unit 7: Inter-halogen and Noble Gas Compounds **(6 Hrs)**

Interhalogens - classification- general preparation- structures of AB,AB_3, AB_5 and AB_7 types. Reactivity (ClF, ICl_3, ClF_3, IF_5 and IF_7). Comparison of pseudohalogens with halogens. Electropositive character of iodine. Separation of noble gases (charcoal adsorption method). Compounds of noble gases.

References

1. F.A. Cotton and G. Wilkinson, *Advanced Inorganic Chemistry*, 6th Edition, Wiley India Pvt. Ltd., New Delhi, 2009 (Reprint).
2. J.E. Huheey, E.A. Keitler and R.L. Keitler, *Inorganic Chemistry–Principles ofStructure and Reactivity,* 4th Edition, Pearson Education, New Delhi, 2013.
3. D.F. Shriver and P. Atkins, *Inorganic Chemistry*, 5th Edition, Oxford University Press, New York, 2010.
4. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
5. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, 20th Edition, S. Chand and Sons, New Delhi, 2013.
6. Satya Prakash, *Advanced Inorganic Chemistry, Volume 2,* S. Chand and Sons, New Delhi, 2005.
7. J.D. Lee, *Concise Inorganic Chemistry*, 5th Edition, Oxford University Press, New Delhi 2008.
8. R. Gopalan and V. Ramalingam, *Concise Coordination Chemistry,* 1st Edition, Vikas Publishing House, New Delhi, 2001.
9. Wahid U. Malik, G D. Tuli and R.D. Madan, Selected Topics in Inorganic Chemistry, S. Chand and Co., New Delhi, 2010 (Reprint).

Mahatma Gandhi University, Kottayam

SEMESTER VI

CH6CRT10 - ORGANIC CHEMISTRY - IV

Credits - 3 (54 Hrs)

Unit 1: Natural Products **(6 Hrs)**

Terpenoids

Terpenoids – Classification. Isoprene rule. Structure elucidation and uses of citral and geraniol. Natural rubber - structure, latex processing methods, vulcanisation, rubber compounding, mastication and uses.

Alkaloids

Alkaloids - General methods of isolation. Classification. Physiological action and medicinal importance. Structure elucidation and synthesis of coniine, nicotine and piperine.

Unit 2: Lipids **(6 Hrs)**

Introduction to lipids. Classification.

Oils and fats: Biological functions. Extraction and refining. Common fatty acids present in oils and fats. Omega fatty acids. Trans fats and their effect. Hydrogenation, Rancidity. Acid value, Saponification value, Iodine value and RM value.

Biological functions of waxes, phospholipids and glycolipids.

Soaps - Types of soaps. Cleansing action of soaps.

Synthetic detergents - Classification. Detergent additives. Comparison between soaps and detergents. Environmental aspects. ABS and LAS detergents.

Unit 3: Vitamins, Steroids and Hormones **(6 Hrs)**

Vitamins

Vitamins – Classification. Structure, biological functions and deficiency diseases of vitamins A, B_1, B_2, B_3, B_5, B_6, C and D.

Steroids

Steroids – Introduction. Diels' hydrocarbon. Structure and functions of cholesterol. Elementary idea of HDL and LDL.

Hormones

Hormones – Introduction. Examples and biological functions of steroid hormones, peptide hormones and amine hormones (structure not required). Artificial hormones.

Unit 4: Amino Acids, Peptides and Proteins **(8 Hrs)**

Classification of amino acids. Synthesis, ionic properties and reactions of α-amino acids. Zwitterion structure and Isoelectric point.

Polypeptides. Synthesis of simple peptides (upto tripeptides) by N-protecting (benzyloxycarbonyl and *t*-butyloxycarbonyl) & C-activating groups. DCC method. Merrifield's solid phase peptide synthesis.

Classification of proteins. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of proteins. Determination of N-

Mahatma Gandhi University, Kottayam

CH5CRT06 - ORGANIC CHEMISTRY - III

(Reaction mechanisms expected only wherever mentioned)

Credits – 3 (54 Hrs)

Unit 1: Nitrogen Containing Compounds **(15 Hrs)**

Nitro compounds (aliphatic and aromatic):

Preparation: Methods of preparation of nitroalkanes and aromatic nitro compounds.

Reactions: Tautomerism of nitromethane. Reduction products of nitrobenzene in acidic, neutral and alkaline media. Electrolytic reduction and selective reduction of polynitro compounds. Formation of charge transfer complexes.

Amines (aliphatic and aromatic):

Preparation: From alkyl halides, Reduction of nitro compounds and nitriles, Reductive amination of aldehydes and ketones, Gabriel's phthalimide synthesis, Hofmann bromamide reaction (with mechanism).

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2. Separation of a mixture of 1°, 2° and 3° amines using Hinsberg reagent. Stereochemistry of amines. Structural features affecting basicity of aliphatic and aromatic amines. Comparative study of aliphatic and aromatic amines. Schotten – Baumann Reaction (with mechanism). Electrophilic substitution reactions of aniline: Halogenation, nitration and sulphonation. Quaternary amine salts as phase-transfer catalysts.

Diazonium salts:

Preparation: From aromatic amines.

Reactions: Structure and stability of benzene diazonium salts. Conversion to benzene, phenol, chloro, bromo, iodo and fluoro benzenes, nitro benzene and azo dyes. Mechanisms of Sandmeyer and Gatterman reactions. Schiemann and Gomberg reactions. Preparation, structure and uses of Phenyl hydrazine, Diazomethane and Diazoacetic ester. Arndt –Eistert synthesis – Mechanism of Wolff rearrangement.

Unit 2: Heterocyclic Compounds **(8 Hrs)**

Classification and nomenclature. Structure and aromaticity of 5-numbered and 6-membered rings containing one heteroatom. Synthesis and reactions of: Furan, Thiophene, Pyrrole (Paal-Knorr synthesis and Knorr pyrrole synthesis), Pyridine (Hantzsch synthesis), Indole (Fischer's indole synthesis), Quinoline (Skraup synthesis and Friedlander's synthesis) and Isoquinoline (Bischler-Napieralski reaction).

Unit 3: Active Methylene Compounds **(5 Hrs)**

Preparation: Ethyl acetoacetate by Claisen ester condensation.

Reactions: Keto-enol tautomerism. Synthetic uses of ethylacetoacetate, diethyl malonate and ethyl cyanoacetate (preparation of non-heteromolecules only).

Alkylation of carbonyl compounds *via* enamines.

Unit 4: Carbohydrates **(11 Hrs)**

Classification of carbohydrates. Reducing and non-reducing sugars. General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Chain lengthening and chain shortening of aldoses - Kiliani-Fischer synthesis and Wohl degradation. Interconversion of aldoses and ketoses.Linkage between monosaccharides. Structure of the disaccharides sucrose, maltose and cellobiose (excluding their structure elucidation). Reactions and uses of sucrose. Artificial sugars (sweeteners) – sucralose. Structure of the polysaccharides starch and cellulose (excluding their structure elucidation). Industrial applications of cellulose.

Unit 5: Drugs **(5 Hrs)**

Classification of drugs. Structure, therapeutic uses and mode of action (synthesis not required) of Antibiotics: Ampicillin and Chloramphenicaol, Sulpha drugs: Sulphanilamide, Antipyretics: Paracetamol, Analgesics: Aspirin and Ibuprofen, Antimalarials: Chloroquine, Antacids: Ranitidine, Anti- cancer drugs: Chlorambucil and Anti-HIV agents: Azidothymidine (Zidovudine). Psychotropic drugs: Tranquilizers, antidepressants and stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Unit 6: Dyes **(4 Hrs)**

Theories of colour and chemical constitution. Classification of dyes – according to chemical constitution and method of application. Natural and synthetic dyes. Synthesis and applications of: Azo dyes – Methyl orange; Triphenyl methane dyes - Malachite green and Rosaniline; Phthalein dyes – Phenolphthalein and Fluorescein; Indigoid dyes - Indigotin; Anthraquinoid dyes – Alizarin. Edible dyes (Food colours) with examples.

Unit 7: Polymers **(6 Hrs)**

Introduction and classification. Polymerisation reactions - Addition and condensation - Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes. Preparation and applications of plastics – thermosetting (Phenol-formaldehyde, Urea-formaldehyde, Polyurethane) and thermosoftening (Polythene, PVC); Fibres (acrylic, polyamide, polyester). Synthetic rubbers – SBR, Nitrile rubber and Neoprene. Introduction to conducting polymers with examples. Environmental hazards and biodegradability of polymers. Recycling of plastics.

References

1. Morrison, R.T., Boyd, R.N. & Bhattacharjee, S.K. *Organic Chemistry*, 7th ed., Dorling Kindersley (India) Pvt. Ltd (Pearson Education), 2011.
2. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry,* Wiley, 2014.
3. McMurry, J. *Organic Chemistry*, 7th ed. Cengage Learning, 2013.
4. Finar, I.L. *Organic Chemistry* (Vol. 1 & 2), Dorling Kindersley (India) Pvt. Ltd (Pearson Education).
5. Jain, M.K. & Sharma, S.C. *Modern Organic Chemistry*, Vishal Publishing Co. 2010.

VII. DEPARTMENT OF PHYSICS

Semester-V

Core Course: VIII **Credit-4 (72 hours)**

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental

issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy o decision makers.

- Environmental Education helps students to understand how their decisions an actions affect the environment, builds knowledge and skills necessary to addres complex environmental issues, as well as ways we can take action to keep ou environment healthy and sustainable for the future. It encourages charact building, and develops positive attitudes and values.
- To develop the sense of awareness among the students about the environme and its various problems and to help the students in realizing the inter-relationsh between man and environment and helps to protect the nature and natu resources.
- To help the students in acquiring the basic knowledge about environment and t social norms that provides unity with environmental characteristics and crea positive attitude about the environment.

Module I

Unit 1: Multidisciplinary nature of environmental studies(2 hours)

Definition, scope and importance

Need for public awareness.

Unit 2: Natural Resources:(10 hours)

Renewable and non-renewable resources: Natural resources and associated problems.

a) **Forest resources**: Use and over-exploitation, deforestation, case studies.

Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources**: Use and over-utilization of surface and ground water,

floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources**: Use and exploitation, environmental effects of extracting

and using mineral resources, case studies.

d) **Food resources**: World food problems, changes caused by agriculture and

overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosionand desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable life styles.

Unit 3: Ecosystems **(6 hours)**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

Module II

Unit 1: Biodiversity and its conservation **(8 hours)**

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

Unit 2: Environmental Pollution **(8 hours)**

Definition, Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 3: Social Issues and the Environment (10 hours)

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Module III

Non-renewable and Renewable Energy Sources (10 hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.

Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy (qualitative); Fuel cell.

Module IV

Solar energy **(10 hours)**

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater - Direct and indirect systems- Passive and active systems; Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

Module – V **(8 hours)**

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment andHuman Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

Semester-V

Open Course: **Credits-3 (72 Hrs)**

PH5OPT02: Physics in Daily Life

Module I

Unit 1 **(8 hours)**

Fundamental and derived quantities. Units and dimensions,dimensional analysis, order of magnitude, significant figures, errors.

Unit 2 Light **(12 Hours)**

Reflection, refraction, diffraction,interference, scattering(elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Module II

Unit 3 Motion **(12 Hours)**

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.

Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration-examples- banking of curves, centrifugal pump, roller coasters.

Unit 4 Electricity **10 Hours)**

Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Module III

Unit 5 Matter and energy **(18 Hours)**

Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem and applications.

Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.

Waves – transverse and longitudinal waves, sound waves, Doppler Effect.

Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

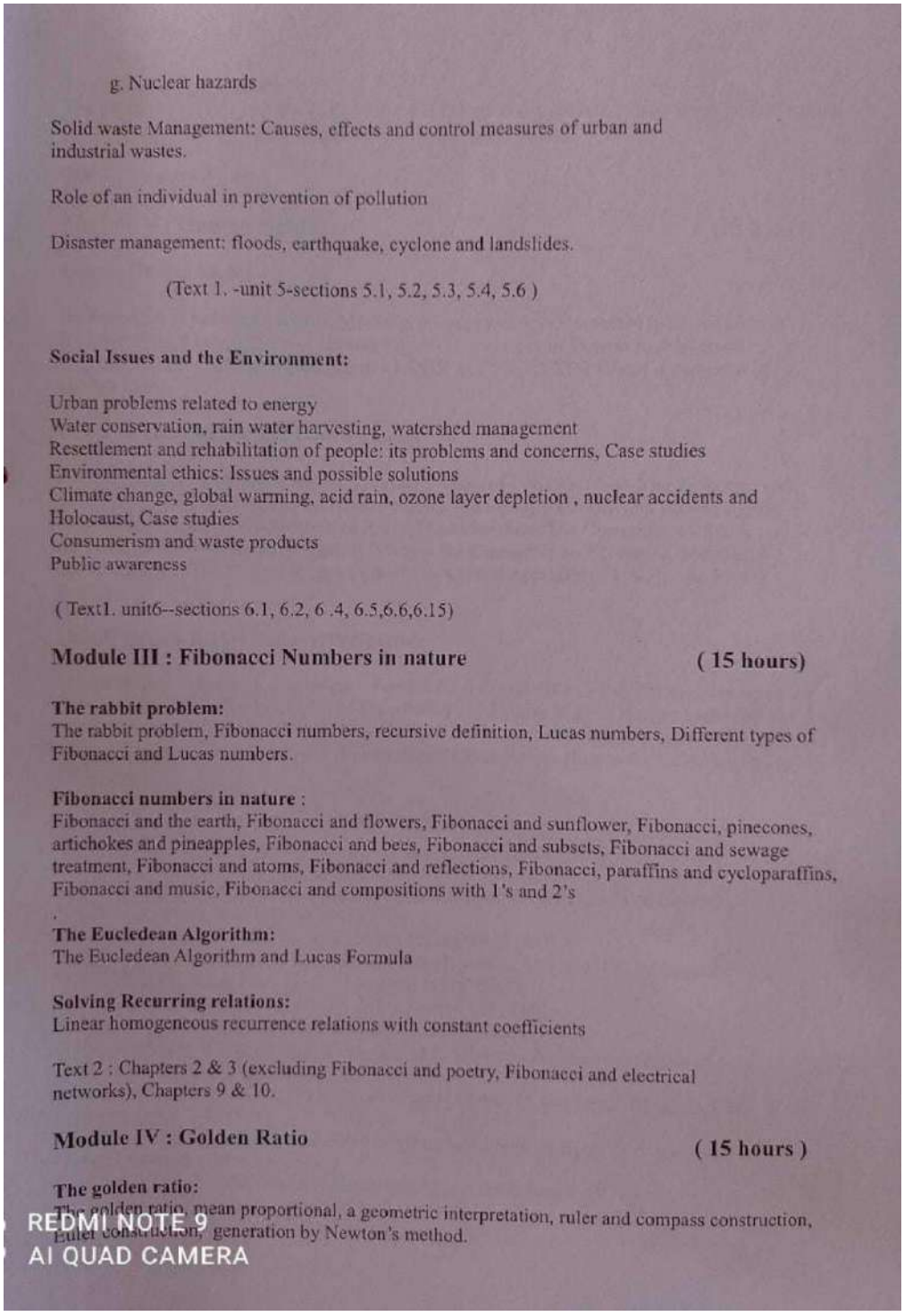
Unit 6 Universe **(12 hours)**

Planets, – solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts

1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics by Paul G Hewitt

VIII. DEPARTMENT OF MATHEMATICS



g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Disaster management: floods, earthquake, cyclone and landslides.

(Text 1. -unit 5-sections 5.1, 5.2, 5.3, 5.4, 5.6)

Social Issues and the Environment:

Urban problems related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns, Case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and Holocaust, Case studies
Consumerism and waste products
Public awareness

(Text1. unit6--sections 6.1, 6.2, 6 .4, 6.5,6.6,6.15)

Module III : Fibonacci Numbers in nature **(15 hours)**

The rabbit problem:
The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers.

Fibonacci numbers in nature :
Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's

The Eucledean Algorithm:
The Eucledean Algorithm and Lucas Formula

Solving Recurring relations:
Linear homogeneous recurrence relations with constant coefficients

Text 2 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks), Chapters 9 & 10.

Module IV : Golden Ratio **(15 hours)**

The golden ratio:
The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method.

The golden ratio revisited:
The golden ratio revisited, the golden ratio and human body, golden ratio by origami, Differential equations, Gattei's discovery of goldenratio, centroids of circles,

Text 2 : Chapters 20, 21

Module V : Human rights (18 hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

- To help the students in acquiring the basic knowledge about environment and to inform the students about the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

4 hours/week (Total Hrs: 72) **4 credits**

SYLLABUS

Text Books :

1.Bharucha Erach – Text book of Environmental studies for UG Courses, University Press, II Edition

2. Thomas Koshy : Fibonacci and Lucas numbers with applications, John Wiley & Sons, Inc (2001).

Module I: Environment and its resources (10 hours)

Multidisciplinary nature of environmental studies:
Definition, scope and importance
Need for public awareness.

Natural Resources :
Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Role of individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

(Text 1- unit 1- sections 1.1,1.2,unit 2-sections 2.1,2.2,2.3,2.4)

ModuleII: Environmental Pollution and Social Issues (14 hours)

Pollution- Definition,Causes, effects and control measures of:

a. Air pollution
b.Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution

g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Disaster management: floods, earthquake, cyclone and landslides.

(Text 1. -unit 5-sections 5.1, 5.2, 5.3, 5.4, 5.6)

Social Issues and the Environment:

Urban problems related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people: its problems and concerns, Case studies
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and Holocaust, Case studies
Consumerism and waste products
Public awareness

(Text1. unit6--sections 6.1, 6.2, 6 .4, 6.5,6.6,6.15)

Module III : Fibonacci Numbers in nature (15 hours)

The rabbit problem:
The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers.

Fibonacci numbers in nature :
Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's

The Eucledean Algorithm:
The Eucledean Algorithm and Lucas Formula

Solving Recurring relations:
Linear homogeneous recurrence relations with constant coefficients

Text 2 : Chapters 2 & 3 (excluding Fibonacci and poetry, Fibonacci and electrical networks), Chapters 9 & 10.

Module IV : Golden Ratio (15 hours)

The golden ratio:
The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method.

IX. DEPARTMENT OF ZOOLOGY

SEMESTER V. ZY5CRT05

CORE COURSE V

ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

54 Hrs

Objectives

To instill the basic concepts of Environmental Sciences, Ecosystems, Natural Resources, Population, Environment and Society

To make the students aware of natural resources, their protection, conservation, the factors polluting the environment, their impacts and control measures.

To teach the basic concepts of toxicology, their impact on human health and remedial measures

To create a consciousness regarding Biodiversity, environmental issues & conservation strategies

To develop the real sense of Human rights – its concepts & manifestations

MODULE 1 ECOSYSTEM 12 Hrs

Basic concepts of ecosystem Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers), Ecological pyramid- number, biomass, energy, **Functions of ecosystem**: Productivity-Food chain-Food web-Energy flow-Laws of Thermodynamics.Types of Ecosystem: Terrestrial-Forest-Grassland-Desert, Aquatic-Marine-Fresh water, Wetland &Biome **Concept of limiting factors:** Liebig's and Shelford's laws of limiting factors.

Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle. **Renewable resources (**solar,wind, hydroelectric, biomass and geothermal) **and Non renewable resources** (mineral and metal ore, fossil fuels)

MODULE 2 CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves

Animal interactions: Positive- Commensalism- Mutualism-Protocooperation, Negative-Predation-Parasitism-Competition-Antibiosis

Characteristics of a community: Species diversity- richness, eveness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche and Guild, Ecological succession, community evolution- climax.

MODULE 3 BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. **Concept and importance of Biodiversity**: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots

Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCC.

National Environmental issues: Deforestation, forest fire, pollution(air, water, soil, noise thermal, nuclear- brief account only) solid waste management, sewage, drinking water crisis and water logging,

Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster

Flood, drought, cyclone, earthquake and landslide (Management and mitigation)

Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands,

Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4 CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves

Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.

Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern

Water conservation- rainwater harvestiong, watershed management

Environment education

Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5 HUMAN RIGHTS 6 Hrs

Introduction, main concepts associated with Human Rights, Different types of human rights, Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References

1. Erach Bharucha 2008 (UGC). Text Book of Environmental Studies of Undergraduate course. University Press.
2. J.B Sharma (2009), Environmental studies' - 3rd Ed. University science Press
3. Misra S.P., Pandy S.N. 2009Essential Environmental Students, Ane books Pvt. Ltd.
4. P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications
5. R.B Singh & Suresh Mishra PaulamiMaiti (1996), Biodiversity – Perception, Peril and Preservation' — PHI Learning , Environmental Law in India: Issues and Responses
6. Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

SEMESTER V. ZY5CRT07

CORE COURSE - V11: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

54 Hrs

Credits 3

Objectives:

- To acquire knowledge about the evolutionary history of earth - living and nonliving
- To acquire basic understanding about evolutionary concepts and theories
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man

PART I - EVOLUTION **30 Hrs**

Module I - Origin of life **8 Hrs**

Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis.

Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment;

Direct evidences of evolution – Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs.

Module II - Theories of organic evolution **9 Hrs**

Lamarckism and its Criticism, Weismann's Germplasm theory, Darwinism and its Criticism, Neo-Darwinism, Theory of De Vries,

Population genetics and evolution: Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect

Module III – Nature of evolution **13 Hrs**

Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous

and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation

Isolation: Types of isolating mechanisms-Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution

Microevolution, Macroevolution (Adaptive radiation -Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse

PART II- ETHOLOGY **14 Hrs**

Module IV – Introduction **1 Hr**

Definition, History and scope of ethology

Module V – Learning, imprinting and behaviour **9 Hrs**

Types of learning with examples; patterns of behaviors – types of rhythms, navigation, homing instinct, hibernation, aestivation; pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior)

Module VI – Social organization **4 Hrs**

Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies

PART III- ZOOGEOGRAPHY **10 Hrs**

Module VII – General Topics **4 Hrs**

Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution; insular fauna – oceanic islands and continental islands,

Module VIII - Zoogeographical realms **6 Hrs**

Palaearctic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line, Biogeography of India with special reference to Western Ghats

References:

EVOLUTION

1. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution.Cold Spring, Harbour Laboratory Press.
2. Barnes, C.W. (1988). Earth, Time and Life. John Wiley &Sons, NewYork

3. Bendall, D. S. (ed.) (1983). Evolution from Molecules to Man. Cambridge University Press, U.K.
4. Bull J.J and Wichman H.A..(2001). Applied Evolution.Annu. Rev. Ecol. Syst. 32:183-217
5. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
6. Chattopadhyay Sajib. (2002). Life Origin, Evolution and Adaptation.Books and Allied (P) Ltd. Kolkata, India.
7. Douglas, J. F (1997). Evolutionary Biology.Sinauer Associates.
8. Goodwin,B. (1996). How the Leopard Changed its Spots: The Evolution of Complexity. Simon & Schuster, NY,USA.
9. Hall, B. K. and Hallgrimsson, B. (2008), Evolution. 4th Edition; Jones and Bartlett Publishers.
10. Coyne J.A. and Allen Orr H. (2004). Speciation, Sinauer Associates
11. Ridley, M. (2004), Evolution 3rd Edition. Blackwell Publishing
12. Rob Desalle and Ian Tattersall (2008). Human Origins: What Bones and Genomes Tell Us about Ourselves. Texas A&M University Press, USA.
13. Strickberger, M.W.2000. Evolution. Jones and Bartlett, Boston.

ETHOLOGY

1. Agarwal. V. K. (2009). Animal Behaviour.S.Chand and Company Pvt. Ltd., New Delhi.
2. Bonner, J.T. (1980). The Evolution of Culture in Animals. Princeton University Press.NJ, USA.
3. David McFarland. (1999). Animal Behaviour. Pearson Education Ltd. Essex, England.
4. Dawkins, M.S. (1995).Unravelling Animal Behaviour. Harlow: Longman.
5. Dunbar, R. (1988). Primate Social Systems. Croom Helm, London.
6. Gundevia J.S. and Singh H.G. (1996), A Text Book of Animal Behaviour. S. Chand and Company Pvt. Ltd., New Delhi.
7. Aubrey M. and Dawkins M.S. (1998). An Introduction to Animal Behaviour. Cambridge University Press,UK.
8. Sherman P.W and Alcock J., (2001) Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA,USA. (Module 10 & 11).
9. Wilson, E.O. (1975). Sociobiology.Harvard University Press, Cambridge, Mass. USA.(Module 9).

ZOOGEOGRAPHY

1. Briggs, J.C. (1996). Global Biogeography. Elsevier Publishers.(Module VI and VII).

PRACTICAL

MICROBIOLOGY AND IMMUNOLOGY

72 Hrs

2 Credits

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow
2. Preparation of solid and liquid media for microbial cultures.
   (Ingradients, pH and method of preparation) (Demonstration)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
   (b) Liquid Media(1) Nutrient broth (2) Peptone water.
3. Culture methods (Demonstration)
   (a) Streak plate technique and isolation of pure colonies.
   (b) Lawn culture (c) Pour plate culture (d) Liquid culture
4. Examination of microbes in living condition
   Hanging drop method for demonstrating motility of bacteria.
5. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
6. Antibiotic sensitivity test (demonstration only)
7. Streak plating (individual performance)
8. Preparation of a fungal smear – Lactophenol cotton blue staining and mounting
9. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)
10. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man

SEMESTER VI. ZY6CRT11

CORE COURSE XI.

BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

BIOTECHNOLOGY **20 Hrs**

Module I **11Hrs**

Introduction: Scope, Brief History, Scope and Importance

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors-[Plasmids, Phage vectors, Cosmids, Artificial Chromosomes] Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell.Blotting Techniques-Southern, Northern, Western blotting.DNA Finger printing (DNA Profiling) and its application. Molecular markers - RFLP

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine(insulin, growth hormone, gene therapy), Agriculture(GM plants and biopesticides),Environment(bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions.Intellectual Property Rights, Patenting and patent protection.

References

1. Singh B.D Biotechnology 2002. Kalyan Publishers New Delhi.

2. Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford).

SEMESTER II

ZY2B02U Core Course 2

BIODIVERSITY AND MODERN SYSTEMATICS

36 hrs

Credits 2

Objectives:

- To create appreciation on diversity of life on earth
- To understand different levels of biological diversity
- To familiarize taxa level identification of animals
- To learn biodiversity estimation techniques
- To create interest for conservation of biodiversity

Pre requisite:

- Basic knowledge on the living world, plant and animal kingdom
- Knowledge on biodiversity and its conservation
- Knowledge on biological classification and representative organism of major taxa

PART I: BIODIVERSITY **(26 Hrs)**

Module I – Introduction to Biodiversity **(2 hrs)**

Definition

Historical perspective

Concepts –

Nature – environment – biodiversity

Scope and importance

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Thomas AP.,(Editor) 2009 Biodiversity,Scope and Challenges- Green Leaf Publications Kottayam

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module II – Levels of biodiversity **(5 hrs)**

Genetic, Species, Ecosystem

Domesticated, Microbial diversity

Distribution of biodiversity on earth

Tropical, temperate and polar

Landscapes and interactions

Biodiversity hotspots

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future.* W.W. Nortan & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module III – Values of biodiversity **(4 hrs)**

Direct use value

Indirect use value

Non use value

Ecosystem services

Core Readings

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future.* W.W. Nortan & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Module IV – Threats to biodiversity **(5 hrs)**

Types of threats

Habitat loss, man- wildlife conflict (with case studies)

Invasive species

Pollution

Over exploitation and human population

Climate change

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module V – Biodiversity conservation and management **(6 hrs)**

Conservation strategies

In situ, ex situ

National parks, Sanctuaries and Biosphere reserves

International efforts

Convention on Biological Diversity (CBD)

IUCN- WCMC, UNEP

Legal measures

Wild life Protection Act, 1972

The Environment Protection Act, 1986

Forest (Conservation) Act1980, 1988

Biodiversity Act 2002

Biodiversity rule 2004

National biodiversity action plan

People's participation – Peoples biodiversity register (PBR)

Local initiatives

Core Readings

A.P.Thomas(Editor)2009 Biodiversity –Scope&Challenges .Green leaf publications .Kottayam

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA

Module VI – Biodiversity estimation – tools and techniques (4 hrs)

Sampling techniques -

Quadrate

Line transect

Measurements

Density

Abundance

Frequency

Biodiversity indices – concepts

Shannon-Weiner, Simpson

Core Readings

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing, MA, USA.

PART II – MODERN TAXONOMY (10 hrs)

Module VII – Taxonomical Principles (6 hrs)

Brief history

Concepts and definition

Approaches of taxonomy

Molecular taxonomy

Importance of classification

Phylogeny and Taxonomy– Tree of Life, bar coding of life

Zoological nomenclature

International Code of Zoological Nomenclature (ICZN)

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

Module VIII – Tools and techniques (4 hrs)

Identification Keys

Dichotomous keys (Single access key)

Polytomous key

Multi access key

Advantages and disadvantages

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.

Selected Further Readings

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing, MA, USA.

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Daily,G.C. (Ed.), 1997.*Nature's Services : Societal Dependence on Natural Ecosystems*. Island Press, Washington D C.

Forman, R.T and M. Gordaon. 1986. *Landscape Ecology*. John Wiley &Sons, NY, USA.

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi

Karunakaran, C.K. 2003. Politics of vanishing forests in Kerala. Kerala Sastra Sahitya Parishat, Thiruvananthapuram.

Land resource based perspective plan for 2020 AD. Kerala State Land Use Board, Thiruvananthapuram

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future*. W.W. Nortan & Company, NY.

SEMESTER VI

ZY6B09U Core course 9

REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

54 hrs
Credits 3

Objectives

1. This will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
2. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

Module 1 **10 hrs**

Introduction

Scope of developmental biology, definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman)

Reproductive Organs and Gametogenesis.

Human reproductive organs and gametogenesis (brief account) significance.

Egg types.

Classification of eggs, based on the amount, distribution and position of yolk. Mosaic, regulative and cleidoic eggs. Influence of yolk on development. Polarity, symmetry and egg content.

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle.

Fertilization

Approach and binding of spermatozoa, activation of the egg, amphimixis. Parthenogenesis (brief account) natural and artificial. Arrhenotoky, Thelytoky, Obligatory and Facultative

Significance

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module II **18 hrs**

Cleavage

Types, planes of cleavage (radial and spiral with examples) Cell lineage (brief account). Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and superficial). Patterns of clevage (radial , bilateral and rotative). Influence of yolk on cleavage.

Blastulation

Blastula formation, Types of blastula (coeloblastula, stereoblastula, Discoblastula, Blastocyst with examples).

Fate maps

Concept of fate maps, construction of fate maps. (artificial and natural). A typical vertebrate fate maps. Significance of fate map.

Gastrulation

Definition, Morphogenetic cell movements (brief account). Epiboly, Emboly (invagination, involution , delamination , convergence, divergence infiltration). Concept of germ layers (brief account) and its derivatives.

Cell differentiation and gene action—with special reference to Drosophila.

Totipotency, Pleuripotency, Unipotency of embryonic cells. Determination and differentiation in embryonic development, Gene action, control of gene expression. (brief accounts)

EMBRYOLOGY OF FROG - Gametes,Fertilization,cleavage, blastulation,fate map,gastrulation,notogenesis ,neurulation,development of nervous system and sense organs(eye only) Metamorphosis (brief account only)

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module III **18 hrs**

Embryology of chick

Structure of egg, fertilization, cleavage, blastulation, gastrulation. Mention brief account of 18 hour chick embryo and 24 hour chick embryo. Extra embryonic membranes in chick.

Human development

Blastocyst, foetal membranes and placenta. Types of placenta (brief account). Classification of placenta based on

Nature of contact.

Mode of implantation.

Histological intimacy of foetal and maternal tissue.

Functions of placenta.

Experimental embryology.

Spemann's constriction experiments, Organizer and embryonic induction. Invitro fertilization (test tube baby) Amniocentesis, Embryo transfer technology, Cloning, Stem cell research.

General Topics

1. Regeneration in animals
2. Placentation in mammals and their significance.
3. Human intervention in reproduction- contraception & birth control, Abortion – biological aspects, Ethical issues, Infertility, IVF, GIFT, & ZIFT (Intra fallopian transfer gamete/zygote)

Core Readings

Taylor D J, Green NPO & G W Stout. Biological Science (2008) third edition. Cambridge university press. Ref pp 748 biology 755

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vetebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module IV **8 hrs**

Teratology / Dysmorphology.

Definition, Teratogen / Teratogenic agents. Ionizing radiation, infection (herpes virus, parvo virus-B 19, rubella virus, syphilis, cytomegalovirus , toxoplasmosis).

Developmental defects

Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR)

Congenital abnormalities (birth defects)

Structural defects (malformation, deformation, disruption) functional defects. (inborn errors of metabolism, mental retardation).

Causes of malformation. (brief accounts.)

Genetic disorders (single gene defects)

Chromosome aberration, aneuploidy (numerical abnormalities.

Structural abnormalities (deletion, insertion and re-arrangements)

Chromosomal mosaicisms

Environmental factors. (external factors)

Chemicals, drugs, hormones and vitamins.

Multifactorial and idiopathic disorders

Core Readings

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Selected Further Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hills

Berry A. K - An introduction to embryology.

Dutta 2007 Obstrestics , Chuch Livingston 17 Ed

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Jain P. C - Elements of developmental biology.

John Rigo Fundamental Genetics Cambridge University Press. 2009

Julio Collado Vides & Relf Hofestadt Gene Regulation and Metabolism Post genomic Computated Approaches, Ane Book 2004

Majumdar N. N - Vetebrate embryology

Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006

Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.

Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum.

Werne A Muller. Dev. Biology, Springer Verlay New York 2008

Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II, Module III)

Suresh.C. Goel. *Principles of Animal Developmental Biology*. Himalaya Publishing House.

X. MSC ZOOLOGY

ZL010201 FIELD ECOLOGY

72 Hours (4 hrs./Week) **Credit – 4**

Objectives:

- To provide the knowledge of animal adaptations to a variety of environment
- To learn the different aspects of population and its interactions
- To understand the natural resources and manmade issues on environment and its management

Module I

Animal and Physical Environment **(18 hrs)**

Effect of cold and hot temperature on organisms. Global warming and change of species phenologies. Effect of soil development on nutrient level. Herbivore population and plant nutrient level. Availability of O_2 and Co_2 on growth and distribution of organisms. Water availability and abundance of organism. Significance of salt concentration in soil and water. Effect of soil and water pH on distribution of organisms.
Cybernetic nature of ecosystem, homeostasis and feedback systems.
Animals and nutrient acquisition – herbivory, carnivory, omnivory, detritus feeding.
Animal adaptations to thermal environment – thermal balance, poikilotherms, homeotherms, heterotherms. Animal adaptations to moisture environment – maintenance to water balance, response to drought and flooding. Animal adaptations to light environment.

Prerequisite: Ecosystem concept – structure and function, Productivity, Food chain and food web, Energy flow

Module II

Population Ecology **(15 hrs)**

Properties – patterns of dispersion, dispersal movements, age structure, sex ratio, life table, survivorship curve, density, population growth-exponential and logistic growth, time lags, carrying capacity. Population growth and global warming.
Density dependent and density independent influences. Population fluctuations and cycle.
Extinction – deterministic extinction and stochastic extinction.
Life history strategies – Reproductive strategies, *r* and *k* selection.
Human population growth. Concept of ecological foot print.
Population regulation – dispersal, social dominance, territoriality: types of territory, territorial defence, floaters, home range.
Aggregation, Allee's principle, Isolation
Metapopulation – Concept, Structure

Module III **(17 hrs)**

Population Interactions: Competition and Predation **(10 hrs)**

Interspecific competition – Competitive Exclusion Principle, Resource partitioning and utilization. Niche, Niche overlap, Niche width, Niche responses-niche compression and niche shift. Character replacement. Ecological and evolutionary effects of competition.
Predation – Antipredator adaptations.
Foraging theory – optimal diet, foraging efficiency, risk-sensitive foraging.
Animal prey defence – chemical defence, warning coloration and mimicry, cryptic colouration, armor and defence, behavioural defence, predatory sanitation.
Predator offence – hunting tactics, cryptic coloration and mimicry in predators, adaptations of hunting. Cannibalism, Intraguild predation (IGP).

Population Interactions: Parasitism and mutualism **(7 hrs)**

Characteristics and life-cycle of parasite, host response to parasitism –biochemical, abnormal growth, sterility, behavioural change, mate selection. Social parasitism – Brood parasitism and kleptoparasitism.
Types of defence against parasites by host. Invasive parasite. Parasitism and climate change. Non-native parasite and biological control.
Mutualism – Origin and types. Dispersive mutualism, defensive mutualism, resource based mutualism. Mutualistic relationship of human with crops.

Module IV

Applied Ecology **(10 hrs)**

Air, water, soil and radioactive pollution – Sources, causes and consequences. Disposal of radioactive waste. Ecological indicators.
Concept of waste – types and sources of solid waste. Health and environmental implications. E-waste-types and management aspect. Environmental biotechnology and solid waste management – aerobic and anaerobic systems. Concept of bioreactors in waste management. Liquid wastes and Sewages.
Scope of bioremediation. Phytoremediation, bio-augmentation, biofilms, bio filters, bio scrubbers and trickling filters.

Module V

Resource Ecology **(12 hrs)**

Currents status of forest resources and deforestation in India. Fresh water sources, water scarcity and water conservation measures. Wet lands, its importance, reclamation and conservation measures. Sand mining and its impacts.
Energy resources – solar, fossil fuels, hydro, tidal, wind, geothermal and nuclear. Recent issues in energy production and utilization. Green technology and sustainable development. Depletion of natural resources and its impacts on life.
Ecosystem monitoring – GIS and its application, Role of remote sensing in ecology. Environmental Impact Assessment (EIA)-Tools and technique. Ecosystem modelling (Brief account only).

Recommended Text Books/Reference Books

Abbasi, S.A. and Ramasami, E.V 1998. Biotechnological Methods of Pollution Control. Oxford University Press, Hyderabad.

ZY 2CT06 ECOLOGY: PRINCIPLES AND PRACTICES

90 Hours (5hrs/week) **Credit- 4**

Objectives:

- To provide an understanding on the basic theories and principles of ecology
- To help study various disciplines in ecology
- To learn current environmental issues based on ecological principles
- To gain critical understanding on human influence on environment

Module I. Ecology and Environment **15 hrs.**

Physical Environment- biotic and abiotic interactions. Concept of Homeostasis;Concepts of habitats- host as habitat, niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.

Cybernetic nature of ecosystem, stability through feedback control and through redundancy of components; resistance and resilience stability.Gaia hypothesis.

Concept of limiting factors- Liebig's law, Shelford's law.

Ecological indicators.

Prerequisite: *Definition, history and scope of ecology, sub divisions of ecology, Ecology Vs Environmental science.*

Module II. Ecosystem - Structure and Function **15 hrs.**

Ecosystem and Landscapes, pathways in ecosystem, energy in the environment-Laws of thermodynamics, energy flow in the ecosystem. Primary productivity, Biomass and productivity measurement.Food chain, food web, trophic levels. Ecological efficiencies, Ecological pyramids,Biogeochemical cycles- patterns and types (CNP).

Tropical versus Temperate Ecology.

Module III. Population Ecology **15 hrs.**

Population group properties, density and indices of relative abundance,Concept of rate.

Natality and mortality. Population age structure, Growth forms and concept of carrying capacity.

Population fluctuations, density dependent and density independent controls.Life history strategies, *r & k* selection.

Population structure, aggregation, Allee's principle, isolation, dispersal and territoriality.

Population interactions- types, positive and negative, interspecific and intraspecific interactions.Ecological and evolutionary effects of competition.

Concept of metapopulation. Levin's model of metapopulation. Comparison of Metapopulation and Logistic population model. Metapopulation structure.

Module IV.Community Ecology **10 hrs.**

Concept of community - community structure and attributes, ecotone and edge effect.Development and evolution of the ecosystem, concept of climax.Species diversity in community and it's measurement- Alpha diversity,Simpson's diversity index, Shannon index, Fisher's alpha, rarefaction. Beta diversity- Sorensen's similarity index,Whittaker's index, Evenness, Gamma diversity, Guild and its functioning in the community.

Drivers of species diversity loss and conservation.

Prerequisite:*Community interactions*

Module V. Resource Ecology **15 hrs.**

Natural Resources: Soil-soil formation, physical and chemical properties of soil. significance of soil fertility.Mineral resources with reference to India. Impact of mining on environment; Forest resources-deforestation,forest scenario of India. Aquatic resources - Freshwater and water scarcity, water conservation measures - case studies from India; Wetlands and its importance, international initiatives for wetland conservation - Ramsar sites. Sand mining and its impacts. Wetland reclamation- causes and consequences. Depletion of resources and impacts on quality of life.

Energy Resources- solar, fossil fuels, hydro, tidal, wind, geothermal and nuclear.Energy use pattern in different parts of the world, recent issues in energy production and utilization; Energy audit, Green technology and sustainable development.

Ecosystem monitoring- GIS, Physics of remote sensing, role of remote sensing in ecology, GPS and its application; EIA- tools and techniques, Ecosystem Modelling (Brief account only).

Module VI. Applied Ecology **10 hrs.**

Environmental Pollution-types, causes and consequences.Concept of waste, types and sources of solid wastes including e-waste; Environmental biotechnology and solid waste management- aerobic and anaerobic systems. Concept of bioreactors in waste management. Liquid wastes and sewage. Bioremediation- need and scope of bioremediation in cleaning up of environment. Phytoremediation, bio-augmentation, biofilms, biofilters, bioscrubbers and trickling filters.

Radiation Biology - natural and man-made sources of radioactive pollution; radioisotopes of ecological importance; effects of radioactive pollution; nuclear disasters (two case studies), Disposal of radioactive wastes.

Toxicology- Principles, toxicants- types, dose and effects, toxicity of heavy metals.

Module VII. Biogeography and Conservation **10 hrs.**

Major terrestrial Biomes, theory of island biogeography, bio-geographical zones of India; Western Ghats and its significance.

Principles and major approaches to conservation and environmental management.Role of UN- conventions, protocols; Climate change and the emerging discussions – mitigation and adaptation; Role of UNFCC and IPCC. Country specific laws- mention major environmental/ conservation laws and rules in India-Wildlife Protection Act 1972 amended 1991, Forest Conservation Act, 1980, Air (Prevention and Control of Pollution) Act 1981, Water (Prevention and Control of Pollution) Act 1974, amended 1988, The Environment Protection Act, 1986 and Rules, 1991. The Biological Diversity Act 2002, Rules 2004.

Restoration Ecology- need and policies, case studies and success stories - global and national; Global environmental problems and debates - past and present; Participatory resource management, community reserves, sacred groves, biovillages.

Role of Intergovernmental and Non-governmental organizations in conservation-IUCN, WCMC,WRI,WWF, CI and Green Peace.National and Local NGOs.

***Prerequisite:** Ecological foot print, carbon footprint, carbon credit and eco-taxes.*

REFERENCES

Abbasi, S.A. and Ramasami, E.V.1998.*Biotechnological Methods of Pollution Control*. Oxford University Press, Hyderabad.

Benton, A.H. and Werner, W.E. 1976. *Field Biology and Ecology*. Tata McGraw Hill, New Delhi.

Boitani, L and T.K.Fuller.2000.*Research Techniques in Animal Ecology*. Columbia University Press, USA

Daniel,C.D. 2010.*Environmental Science*.(8th edn).Jones and Bartlett Publishers.

Mani,M.S. *Ecology and Biogeography in india*.1974. Dr.W. Junk, The Hague.

Misra, S P and Pandey S. N.2009. *Essential Environmental Studies*. Ane BooksPvt. Ltd.

XI. B.VOC TOURISM AND HOSPITALITY MANAGEMENT

SEMESTER 5: BOCG501: ENVIRONMENTAL STUDIES
No. of credits: 4; No. of contact hours: 60 (4 hours per week)

AIM

To bring about an awareness of a variety of environmental concerns

OBJECTIVES

To create a pro-environmental attitude and a behavioral pattern in society that is based on creating sustainable lifestyles

To acquire knowledge of pollution and environmental degradation.

MODULE 1

Multidisciplinary nature of environmental studies Definition, scope and importance-Need for public awareness. Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.

MODULE 2

Ecosystems Concept of an ecosystem-Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem : Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation Introduction – Definition : genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts., Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE 3

Environmental Pollution Definition ,Cause, effects and control measures of :- Air pollution-Water pollution-Soil pollution Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards Solid waste Management : Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies, Disaster management : floods, earthquake, cyclone and landslides. Human Population and the Environment Population growth, variation among nations-Population explosion – Family Welfare Programme-Environment and human health-Human Rights-Value Education-HIV/AIDS-Women and Child Welfare- Role of Information Technology in Environment and human health-Case Studies.

MODULE 4

Social Issues and the Environment From Unsustainable to Sustainable development-Urban problems related to energy-Water conservation, rain water harvesting, watershed management-Resettlement and rehabilitation of people; its problems and concerns-Case Studies

Environmental ethics : Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Case Studies. Wasteland reclamation-Consumerism and waste products-Environment Protection Act-Air (Prevention and Control of Pollution) Act-Water (Prevention and control of Pollution) Act-Wildlife Protection Act-Forest Conservation Act-Issues involved in enforcement of environmental legislation-Public awareness

XII. B.VOC RENEWABLE ENERGY TEHNOLOGY AND MANAGEMENT

RETTS104: FUNDAMENTALS OF SUSTAINABLE ENERGY & DEVELOPMENT

No. of credits: 6 **No. of contact hours: 90 (5 hours per week)**

Aim:
Provide an overview of the different renewable energy technologies and their applications.

Objectives:

- Understand the difference between renewable and non-renewable energies
- Create awareness in understanding the types of renewable energy benefits of harvesting renewable energy
- Understand the characteristics and operations of each type of renewableenergy
- Become aware of the importance of renewable energy generation

MODULE 1 **(15hrs)**

Introduction to Energy Sources

Energy sources and their availability- Conventional energy sources- Renewable energy sources- Need of renewable energy sources

Reference

1. Non-conventional energy sources; G.D. Rai; 2011; Fifth Edition, Khanna Publishers

MODULE 2 **(25hrs)**

Solar Energy

Potential of Solar Energy-solar radiation and Measurement-types of solar energy collectors -Solar water heating systems- Solar air heating and cooling systems -Solar thermal electric conversion-Solarphotovoltaic system -Other applications of solar energy like distillation, pumping, furnace, green house.

References

1. Non-conventional energy sources; G.D. Rai; 2011; Fifth Edition, KhannaPublishers
2. Non-conventional Energy Sources and Utilization (Energy Engineering); R.K. Rajput; 2012; First Edition.; S. Chand & Company Ltd.

MODULE 3 **(25hrs)**

Biomass and Biogas energy

Introduction – usable forms of biomass, their composition and fuel properties -Biomass conversion technologies- Biomethanation: Phases in biogas production, Parameters affecting biogas Production - Classification of biogas plants – Types of biogas plants- Methods for maintaining biogas production

Reference

- Non-conventional energy sources; G.D. Rai; 2011; Fifth Edition, KhannaPublishers.
- Solar Thermal and Biomass Energy; G. Lorenzini, C. Biserni & G. Flacco; 2010; First Edition; WIT Press, UK.

MODULE 4 **(25hrs)**

Wind Energy

Scope for Wind energy in India- Basic principles of wind energy conversion- Site selection considerations- Basic components of wind energy conversion system -Types of wind machines- Performance of Wind machines- Application of Wind Energy- Solar wind hybrid system

Other sources of sustainable energy

Tidal Energy- Geothermal Energy- Magneto hydrodynamic energy- Chemical energy sources -Hydrogen Energy

References

1. Non-conventional energy sources; G.D. Rai; 2011; Fifth Edition, KhannaPublishers
2. Non-conventional Energy Sources and Utilization (Energy Engineering); R.K. Rajput; 2012; First Edition.; S. Chand & Company Ltd.

RETTG301: WATER AND WASTEWATER TREATMENT

No. of credits: 4 **No. of contact hours: 60 (4 hours per week)**

AIM

- To provide the students general awareness on water management, necessity and techniques for wastewater treatment

OBJECTIVES

- To introduce basic unit processes involved in drinking water and waste water treatment.
- To make the students aware of the necessity of water management in the present scenario

MODULE 1 **(20 hrs)**

Water Quality and Purification

Physical, chemical and biological parameters of water- Water Quality requirement – Potable water standards -Wastewater Effluent standards -Water quality indices.

Physical processes-chemical processes and biological processes -Primary, Secondary and Tertiary treatment -Unit operations-unit processes.

Reference

1. Physicochemical processes for water quality control, Weber, W.J., John Wiley and sons, New York, 1983
2. American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater, APHA, Washington D.C. (chapter 2, 3 & 4)

MODULE 2 **(15 hrs)**

Sedimentation and Disinfection

Types, Aeration and gas transfer, Coagulation and flocculation, coagulation processes - stability of colloids - destabilization of colloids transport of colloidal particles, Clariflocculation.

Theory of Disinfection - Factors affecting disinfection, Disinfection - chlorine dioxide; chloramines; ozonation; UV radiation.

MODULE 3 **(15 hrs)**

Filtration

Theory of granular media filtration; Classification of filters; slow sand filter and rapid sand filter; mechanism of filtration; modes of operation and operational problems; negative head and air binding; dual and multimedia filtration, pressure filters, principle of working and design.

Reference

1. Water & Waste Water Engineering by Fair and Gayer.
2. Water and Wastewater Treatment: A Guide for the Nonengineering Professional, Joanne E. Drinan, Frank Spellman. (Chapter 7). CRC Press, Taylor and Francis.

MODULE 4 **(10 hrs)**

Miscellaneous Methods

Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Microfiltration, Nano-filtration, Ultrafiltration and Electrodialysis.

RETTG402: WASTE TO ENERGY CONVERSION SYSTEMS

No. of credits: 4 **No. of contact hours: 60 (3 hours per week)**

AIM

- To keep the knowledge of students upgraded with the current thoughts and newer technology options along with their advances in the field of the utilization of different types of wastes for energy production.

OBJECTIVES

- To understand the various waste generation sources and their management.
- To know the various waste to energy conversion technologies.
- To understand various impacts like health and environment issues and significance of different technologies.
- To get acquainted with commercial aspects of waste to energy.

MODULE 1 **(15 hrs)**

Introduction: Introduction to waste and waste processing, Definitions, sources, types and composition of various types of wastes; Characterization of Municipal Solid Waste (MSW) , Industrial waste and Biomedical Waste (BMW), Waste collection and transportation; Waste processing-size reduction, Separation; Waste management hierarchy, Waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), Recycling processes of solid waste.

MODULE 2 **(15 hrs)**

Waste Treatment and Disposal: Aerobic composting, Incineration, different type of incineration; medical and pharmaceutical waste incinerations, Landfill classification, types, methods and sittingconsideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for landfill gases, Rules related to the handling, treatment and disposal of MSW and BMW in India.

MODULE 3 **(15 hrs)**

Waste to Energy Conversion Technologies: Sources of energy generation, incineration, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting.

Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solidfuel, industrial waste, agro residues, landfill gas generation and utilization.

MODULE 4 **(15 hrs)**

Environmental and Commercial Aspects of Waste to Energy: Present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages, Environmental and health impacts of incineration and other waste to energy conversion systems, case studies of commercial waste to energy plants, Strategies for reducing environmental impacts.

REFERENCES:

1. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and

RETTS404: ENERGY STORAGE SYSTEMS

No. of credits: 4 **No. of contact hours: 60 (4 hours per week)**

AIM

- To understand the fundamental theory of energy storage technologies

OBJECTIVES

- To make the students understand the key energy storage technologies work, and novel developments in energy storage technology research.
- Understand how storage technologies solve real-world problems at domestic, city and grid scales.

MODULE 1 **(10 hrs)**

Energy Storage: Need of energy storage- Different modes of Energy Storage- Mechanical Energy Storage Electrical Storage- Chemical Storage- Electromagnetic energy storage- Thermal Energy Storage.

Reference

1. Non-conventional energy sources; G.D.Rai; 2011; Fifth Edition, Khanna Publishers

MODULE 2 **(20 hrs)**

Electrochemical, electrical and magnetic energy storage systems: Primary and Secondary Batteries- Solid-State and Molten Solvent Batteries- Lead acid batteries- Nickel Cadmium Batteries, Advanced Batteries-Superconducting Magnet Energy Storage (SMES) Systems- Capacitors-Supercapacitor-Electrochemical Double Layer Capacitor (EDLC)

Reference

1. Handbook of batteries; David Linden & Thomas B. Reddy; 2002; Third Edition; McGraw-Hill Companies, Inc.
2. Energy Storage; Robert A. Huggins; 2010; Springer

MODULE 3 **(10 hrs)**

Sensible heat storage (SHS): Mediums for SHS- Stratified storage systems- Rock-bed storage systems- Thermal storage in buildings- Energy storage in aquifers

Reference

1. Solar Thermal Energy Storage; H.P. Garg, S.C. Mullick and A. K. Bhargava; 1985;Springer

MODULE 4 **(20 hrs)**

Latent Heat Thermal Energy Storage (LHTES): Phase Change Materials (PCMs)- Selection criteria of PCMs- Solar thermal LHTES systems Energy conservation through LHTES systems- LHTES systems in refrigeration and air conditioning systems

Reference

1. Solar Thermal Energy Storage; H.P. Garg, S.C. Mullick and A. K. Bhargava; 1985;Springer

BOCG501: ENVIRONMENTAL STUDIES

No. of credits: 4 No. of contact hours: 60 (4 hours per week)

AIM

- To bring in proper awareness among the students on Environmental Issues

OBJECTIVES

- To built a pro-environmental attitude and a behavioral pattern in society based on sustainable lifestyles
- To impart basic knowledge on pollution and environmental degradation.

MODULE 1 **(15 hrs)**

Introduction to Environment Science : Development and Environment
Human Population and the Environment : Population growth, variation among nations-Population explosion –Case Studies.
Sustainable Development – Concept, Policies, Initiatives and Sustainability strategies, Human Development Index, Gandhian Principles on sustainability.

Natural systems

Earth –structure, soil formation- factors affecting, soil types
Atmosphere – structure and composition
Hydrosphere – Oceans, rivers, estuaries, Lakes etc.
Physical environment of aquatic systems

Resource utilization and its impacts on environment

Renewable and non-renewable resources
Forest resources : Use and over-exploitation, Timber extraction, mining, dams and their effects on forest and associated biota.
Water resources : Use and over-utilization of surface and ground water, conflicts over water, River valley projects and their environmental significance- Case studies – Sardar Sarovar
Mineral resources : Use and exploitation, environmental impacts of extraction and use of mineral resources, case studies – sand mining, metal mining, coal mining etc.
Food resources : World food issues, changes caused by - overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, and salinity. Case studies
Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
Land resources : Land as a resource, land degradation, soil erosion and desertification.

MODULE 2 **(15 hrs)**

Ecosystems

Concept of an ecosystem-Structure and function of an ecosystem-Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids.

Ecological interactions Types, characteristic features, structure and function of the following ecosystem : Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Significance of wetland ecosystem – Classification, Ecology and Biogeochemistry. Threats and Management

Biodiversity and its conservation

Introduction – Definition : genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts., Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.People's participation in biodiversity conservation- Biodiversity Register;Global Climate change and Biodiversity.

MODULE 3

Environmental Pollution **(15 hrs)**

Air pollution: sources- mobile, stationary, fugitive; type of pollutants- primary and secondary air pollutants, Smog- classical smog and photochemical smog, Acid rain; Ozone depletion; impacts of air pollutants on environment; control measures.

Water pollution: Sources- Point and non-point sources; Types – chemical, biological and physical; impacts on the environment; water quality – water quality standards ; control measures.

Soil pollution: sources and impacts

Noise pollution: sources, impacts on health, management strategies

Thermal pollution andNuclear pollution - sources and impacts

Solid wastes – types, sources, impacts on Environment.

Municipal Solid waste Management: Essential steps- source segregation , collection ,Processing and Disposal of residues.

Environmental Pollution - case studies

Natural ad anthropogenic Disasters and their management : floods, earthquake, cyclone and landslides.

MODULE 4

History of environment protection **(15 hrs)**

Silent spring, Ramsar Convention, Stockholm conference, Montreal protocol, Kyoto protocol, earth summit, Rio+10, Rio+20

Brundtland commission Report, Sustainable development

Environmental movements in India

Global initiatives for Environmental protection

Environmental education –basics

Tblisi conference,

Environment Management Systems

Environment Information Systems

Environmental Impact assessment (EIA) – definition and significance, EIA notification; National and state level Authorities; role of public in EIA of a development project

Social Issues and the Environment

Environmental movements

From Unsustainable to Sustainable development-Urban problems related to energy-

Water conservation- Rain water harvesting; Watershed management
Environmental ethics : Issues and possible solutions.
Environmental Economics
Green house effect and Climate change
Natural and Anthropogenic disasters
Disaster Management
Wasteland reclamation-Consumerism and waste products-
Environmental Laws – General introduction; Major laws in India.Environment Protection Act-Air (Prevention and Control of Pollution) Act-Water (Prevention and control of Pollution) Act-Wildlife Protection Act-Forest Conservation Act-Issues involved in enforcement of environmental legislation-Public awareness

TEXT BOOK

Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education - Erach Bharucha for University Grants Commission

Further activities

- Field work
- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural/ Solid waste dump yards
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to lecture hours)

RETTG502: MATERIAL SCIENCE FOR ENERGY APPLICATIONS

No. of credits: 4 **No. of contact hours: 60 (3 hours per week)**

AIM

- To introduce the students to basics of materials science and engineering.

OBJECTIVES

- To learn about the properties of various materials and special coatings andapplications.
- To understand the testing of materials behavior suitable for application in solar energy systems and environmental impact on solar system materials and corrosionprotection.

MODULE 1 **(15 hrs)**

Fundamental Principles of Materials Science: Electronic and Atomic Structures, Atomic Bonding in Solids, Crystal Structure, Microstructure, Solidification, Alloys, Semiconductors, Ceramics, Polymers.

MODULE 2 **(15 hrs)**

Properties of Materials: Superconductivity and Applications. Mechanical, Optical , Thermal Electrical and Magnetic Properties of Metals, Alloys, Semiconductors, Polymers, Glass, Nanomaterials and Magnetic Materials.

MODULE 3 **(15 hrs)**

Testing of Materials: Concepts of Stress and Strain, Hooke's Law, Tension, Compression and Shear. Stress-strain Diagram and Thermal Stresses. Elasticity in Metals and Polymers, Plastic Deformation, Yield Stress, Shear Strength, Strengthening Mechanisms.

MODULE 4 **(15 hrs)**

Effects on Materials: Environmental Effects - Corrosion, Erosion, Thermal Stress and Weathering Properties of Solar Materials, Effect of Temperature, Fracture Behavior of Various Materials, Failure Analysis of Solar Materials.

REFERENCES

1. Ramamrutam S., "Strength of Materials" , 16th edition, Danpat Rai Publications,2010
2. Callister W.D.., Materials Science and Engineering 6th edition, Wiley India,2009
3. Sheckel ford J., F. Muralidham M.K., "Introduction to Materials Science for Engineers", 6th edition, Pearson, 2007.
4. RaghavanV., " Materials Science and Engineering", Prentice-Hall India, 2007.
5. Askeland D.R., " Science and Engineering of Materials" , 4th edition, Thomson,2003.
6. Bala subramaniam R., " Callister's Materials Science and Engineering", Wiley India,2007.
7. Ben G. Streetman, Solid State electronic devices, Prentice-Hall of India Pvt. Ltd., New Delhi,1995.

ADDITIONAL COURSES

I. PROFESSIONAL ETHICS

➢ TAILORING

Organizer	Mar Thoma College for Women, Perumbavoor
Beneficiary	34 Students
Year	2018-2019
Scope	To develop skills for a self-employment course.
Coordinator	Ms. Serene Anna Sam Assistant Professor Department of Commerce, Mar Thoma College for Women
Duration	30 hours
Venue	Classroom
Objective	To provide knowledge & training in Tailoring
Outcome	Enabled students to cut and stitch dresses on their own.

Module I

Introduction to the course – Use of tools & equipment used in tailoring trade · Sewing terminology · Taking correct body measurements · Basic hand & machine stitches · Designing, drafting & pattern making · Layout & fabric estimation · Cutting, tailoring & finishing of garments for children, ladies & gents. · Alteration, defects & remedies to fitting problems. · Processes of quality centrol, packaging, labeling, marking, costing & promotion. Machine Operation - Different parts of machine and their functions. - Safety precautions - Proper maintenance and oiling - Operating machine - Removing parts and

practice in refixing - Adjusting the parts for proper functioning - Practice in cleaning and oiling. Tools and Equipments used in tailoring Description of various tools used in tailoring - Drafting tools: - Cutting Tools: - Stitching tools: Practice in using - Different Scissors - Shapper, L Scale, Art Curve, Tracing wheel - Thimble etc.

Module II :
Trade Terminology - Specific terms used in drafting, cutting & stitching - Practice in using proper terms. Measurement Taking - Use of tape for measurement - Proper / correct measurement taking, Precautions - Use of L scale for measurement - Sequence of measurement - Practice in using tape - Taking measurement - Sequencing of measurement. - Use of L scale.

Module III :
Drafting / Pattern Making - Need for drafting and pattern making - Method of preparing draft - Preparing pattern cutting - Simple drafting - Pattern making - Paper pattern cutting 6. Basic Stitching - Hand stitches - Machine stitches - Decorative stitches - Preparation of sample pieces of stitches Construction Skills - Knowledge about: - Seams, Drafts, Tucks, Pleats, Buttons Hole, Buttons Hooks and snage, Eye, Titch buttons - Preparation of sample pieces using all construction skills.

Module IV :
Selection of Cloth - Selection of right type of fabric for a particular garment - Identification of different types of fabric. Estimation of Cloth - How to estimate cloth for garments - Estimation by giving various measurements. Simple Cutting and Stitching - How to mark the measurements on cloth before cutting - Leaving margin for inlays and turnings - Skills in Stitching - Marking with different measurement - Cutting the cloth as per marking, leaving margin for inlays and turnings. - Practice in stitching on paper for straight zigzig, round etc. –

➢ DIPLOMA IN COMPUTER APPLICATION (DCA)

Programme	**Certificate course in Diploma in Computer Application**
Organizer	**Institute of Human Resources Development (IHRD)**
No. of students enrolled	23
Year	**2020**
Duration	**6 months**
Scope	Diploma in Computer Application [DCA] is a 6 month short term program that provides an in-depth understanding of computer applications, equips students with practical and technical skills, and imparts knowledge on various computer tools and applications that are used in day-to-day life.
Course in charge	Jency K J
Objective	DCA, Diploma in Computer Applications, is a 6 month diploma course in the field of Computer Applications which involves the study of numerous computer applications such as MS Office, Internet Applications, Operating System, Database Management System (DBMS),Tally, HTML among other subjects.
Outcome	By completing a DCA course, candidates will be able to: • Acquire confidence in using computer techniques available to users. • Understanding the basic components of computers and terminology. • Understand data, information, and file management. • Create documents using Word processor, Spreadsheet, and Presentation Software. • Understanding computer networks, the Internet, and they will also learn about browsing the internet, content search, and email. • Use a computer to improve existing skills and learn new skills.

Module 1 – Computer Fundamentals
Introduction to Computer - Familiarity with the basic components of computers and computer terminology - Characteristics of computer, e-governance, multimedia etc.

Concept of Hardware and Software - Block diagram - functional units - Input, Output, Memory, CPU. (2 hrs)
IO-Devices - Familiarization of IO-Devices - Keyboard, mouse (optical, wireless), scanners – Monitor - Type of monitors(LED,TFT)-Pixel, Resolution - LCD projector – Printers -Type of printers - Dot matrix, Inkjet, Laser, Thermal. (4 hrs) Memory - Primary memory - RAM, ROM, Flash memory - Secondary Storage - Hard disk - concept of track, sector, cylinder, Storage capacity, SMART(concept only), Hard disk types - SATA,SCSI, SAS - Optical storage devices - CD, DVD - Flash disk. (2 hrs)
CPU – Microprocessor - concept of ALU and control unit - familiarization of latest processors (Intel, AMD etc.), Multi core processors – Wordlength , Clock Speed,Concept of Cache memory.(2 hrs)

Module 2 - Windows
Introduction to GUI Based Operating System - GUI based operating system - File Management
Operating system Overview – Definition - Functions-as a resource manager, as an Interface - CUI,GUI - Structure of OS - Kernel, Shell - POST and Bootstrapping. (2hrs)
Windows - Shell commands - (DATE, TIME, DIR, COPY, REN, DEL,MD, CD, RD, TYPE),
Files and Folder manipulation - create, copy, move, rename, delete - Sharing of folder and printer - Managing user accounts. (6hrs)

Module 3 –GNU/Linux
Concept of open source software –GNU/Linux – Different distribution of Linux - Features of Linux - login, Shell commands in linux (ls, date, cp, mv, rm, mkdir, rmdir, cd, cat, man, who) - Files and folder manipulation in Linux GUI - User management - Concept of Linux directory structure. (5hrs)
Comparison of Windows and Linux operating systems.(2hrs)

Module 4 - PC Hardware
Identification of Hardware components - motherboard, processor, memory (DDR3,DDR4), HDD, DVD writer, Graphic system(AGP,PCI Express) - SMPS - NIC (2hrs)
Ports - parallel, USB, PS/2, audio ports, Ethernet. (1hrs) Device Driver installation (Printers, scanners) (3 hrs)
Device connectivity - Ethernet, Bluetooth, wireless, mobile connectivity, modem.Sample system specification for home, office and special purpose computers. (4hrs)

Module 5 - OS Installation
Configuring system - Hard disk Partitioning – formatting - CMOS setup – Display and audio configuration. (2hrs) Case study of OS installation (windows, Ubuntu Linux) - Service pack – OS

➢ HERBAL BATHING SOAP MAKING

Organizer	Department of Botany
Associating partner	Department of Zoology
Beneficiary	40 students from zoology department
Year	2021
Scope	Handmade herbal bathing bar making and selling
Coordinator	Keerthi Sasidhran, Guest lecturer, Mar Thoma College For Women, Perumbavoor
Duration	30 Sessions (Theory +Workshop)

Module 1-10hrs

Soap, action, contents, biochemistry, PH value, TFM, (General account on soaps**)**

Module 2-10hrs

Types of soaps (chemical soaps, Glycerin soaps, Transparent soaps, liquid soaps, laundry soaps)

Handmade soap making

Cold processed(cp)

Hot processed(hp)

Melt and pour(mnp)

(Brief account on making, storage expiry)

Module 3-10hrs

Preference of mnp soaps

Additives, curing period, safety of skin (Antiacne, hydration, antibacterial properties)

Bathing bars, Demerits and comparing of different soaps –Sweating of soaps, expiry, expense, handling of lye

Pedagogy- Instructor - led

➢ CERTIFICATE COURSE IN ENERGY AUDIT

Programme	**Certificate course in Energy Audit**
Organizer	**Department of Physics**
No. of students enrolled	15
Year	**2021-22**
Duration	36 hours
Scope	The Certificate Course in energy audit is designed to provide students with the skills and knowledge necessary to understand and analyse the power consumption in domestic and industrial sector.
Course in charge	Dr. Anupama P
Objective	By the completion of the course the student will be able to • Understand Energy management, energy audit and BEE regulation •understand different source of energy •understand energy saving methods at home, institution and industries •understand solar PV power plants and main components used
Outcome	After the completion of this course, the students will be able to: Calculate the energy consumed in domestic and industrial sectors. Know how to reduce the use of energy.

Syllabus

Unit 1 (10 hours)

1ntroduction to energy management and energy audit, Sources of Energy, Need of energy conservation. Power generation, transmission and distribution. Energy and utilities, Input and output power, Losses, Star rating in equipment, energy saving methods in industries, high efficiency drives, VFD, energy saving in compressed air system, waste heat recovery systems, green mobility

Unit 2 (5 hours)

Types of equipment in a utility, Refrigerator, Washing machine, Mixer grinder, Specification, star rating, lightings, Consumption of energy, Energy calculation from different loads, Tariff structure in Kerala, Solar PV systems, invertor, Battery, maintenance of battery, maintenance of solar PV system.

Unit 3 (5 hours)

Energy Management, Key elements for successful energy management. Effective energy management, Positive and negative forces to reduce energy consumption. Energy audit, Types of energy audit, Report on energy audit, Production factor, Instruments and meters for energy audit, BEE Regulations 2008 related with energy audit. Familiarisation of data collection form and report preparation methods

Practical (16 hours)

1. Energy audit in participant house and prepare reports (Individual activity)
2. Energy audit in the institution and prepare audit reports (Group activity))
3. Energy audit in one of the industries and prepare audit reports (Group activity)

II. GENDER

➢ TRIBAL ETHNOGRAPHY IN INDIA

Organizer	Department of History, Museology and Archaeology
Beneficiary	35 Students of the Department of History, Museology and Archaeology
Year	2021
Scope	Communication and IT skills
Coordinator	Dr. Bibin Kuriakose, Assistant Professor, Department of History, Mar Thoma College for Women, Perumbavoor
Duration	40 hours
Venue	II BA History Class
Objective	To enhance English communication skills and IT skills
Outcome	Enhanced listening, speaking, reading, writing & IT skills

Module I Tribal Studies an Introduction
Introduction to Tribal Studies: Nature, Scope, Relevance- Emergence and Growth Tribal Studies in India-Approaches to study the tribes-Colonialism and tribes in India
Module II Tribal Ethnicity and Heritage
colonial discourses on tribes-shifting cultivation-agrarian practices-traditional herbal practices -hunting and dietary practices-creation of the forest department and legislations-impacts-taming of the hill population

Module III Colonial Impact on the Tribal Population

Forest acts and representation of the tribes in India - decay of tribal ethnicity - tribal resistance – leaders - association with peasant and national movement - result- sanskritisation - social change and the tribe

Module IV Alienation and Loss of Culture

Contemporary Tribal Issues- Poverty, indebtedness, land alienation-Unemployment and migration-Industrialization and urbanization- Social Structure and organization of the tribes-displacement and rehabilitation

Module V Tribal Right as Human Right

Tribal rights social implications – upliftment - women rights - forest rights - need for a global approach

III. HUMAN VALUE

➢ CERTIFICATE COURSE IN NUTRITION AND DIETETICS

Organizer	PG Department of Zoology
Beneficiary	18 students of PG Department
Year	2021-22
Scope	To promote lifestyles with improvement to diet
Coordinator	Sunu N.V, Guest lecturer, Mar Thoma College for Women, Perumbavoor
Duration	30 Sessions (Theory)
Objective	To understand the causes and consequences of undernutrition.
Outcome	Students developed the skills and attitudes required for working in the broad field of applied nutrition.

Module 1 (10hrs)

Introduction to food source, optimum nutrition, balanced diet, structure, physical and chemical properties of food constituents (cereals & grains, pulses & legumes, vegetables & fruits, nuts & oilseeds, Milk & Milk products, meat & poultry, sugar & fat)

Module 2 (10hrs)

Concept & scopes of public health and community nutrition, ecology of health, major public health problems in India, Nutritional deficiency and lifestyle diseases (Cardiovascular, gastrointestinal, diabetics, cancer, hypertension, cancer, COD), Renal problems

Module 3 (10hrs)

Nutrition, Immunity & Infection, food quality control technique, food regulation- loss, standard & Agencies-National & International. Different food processing & preservation methods, (Roasting, boiling, frying, baking, grilling, freezing, canning, fermentation)

IV. ENVIRONMENT AND SUSTAINABILITY

➢ SOLAR ENERGY TECHNOLOGY

Programme	**Certificate course in Solar Energy Technology**
Organizer	**Department of Physics**
No. of students enrolled	31
Year	2020-21
Duration	30 hours
Scope	The certificate course in solar energy technology is offered to students to understand solar energy storages and applied different fields.
Course in charge	Dr. Melvi Chandy
Objective	This course allows the students to have a deep insight into the various available renewable energy sources. A detailed study on solar energy collectors and storage are included in the syllabus.
Outcome	Students who completed the course will have thorough knowledge about various renewable energy sources. They are strongly familiarized with how to collect solar energy and how it can be stored effectively.

Module 1 (5 Hrs)
Introduction to energy sources
Renewable energy sources-different types-solar energy, advantages of renewable energy, prospects of renewable energy
Module 2 (5 Hrs)
Solar energy collectors
Introduction, physical principles of conversion of solar radiation into heat, flat type collectors, concentrating collectors-advantages and disadvantages
Module 3 (10 Hrs)
Solar energy storage
Introduction, solar energy storage systems-thermal storage, electrical storage, chemical storage, mechanical energy storage, electromagnetic energy storage, solar pond-principles of operation and applications
Module 4 (10 Hrs)

Applications of solar energy

Solar water heater, solar desalination, solar dryer, solar cooker, solar air conditioning, solar heating of buildings, solar green houses, solar furnace, solar thermos mechanical power, solar powered thermal water pump, solar photovoltaic, economic analysis

➢ GREEN ACCOUNTING IN DIGITAL ERA

Organizer	Department of Commerce -Finance and Taxation
Beneficiary	39 Students of the Department of Commerce -Finance and Taxation
Year	2021-22
Scope	Marketing
Coordinator	Avani T, Assistant Professor, Mar Thoma College for Women, Perumbavoor
Duration	30 sessions
Venue	103
Objective	Enhance proficiency in Green Marketing
Outcome	• Comprehensive understanding of Green Marketing and its relevance • Increased environmental consciousness

Module 1- Fundamentals of Green Marketing

Green Marketing – Meaning – Importance – Evolution of Green Marketing – Difference between Traditional Marketing and Green Marketing – Benefits – Challenges – Green Marketing Mix – Green Products

Module 2 – Green Marketing Strategies

Green Spinning- Green Selling – Green Washing- Consequences of Green Washing- Enviropreneur Marketing – Compliance Marketing – Ecotourism- Triple Bottom Line

Module 3 – Green Marketing Practices and Initiatives

Green Marketing Policy- Green Firms- General Principles- Business Implications – Case Studies of firms adopting Green Marketing Practices- Role of business, innovation and advertising in Green Marketing

Module 4 – Environmental Consciousness

Environment- Types- Benefits of Green Environment to society- Solid Waste Management- Urban, domestic and industrial waste- Causes, effects and control measures – E-waste- Collection, Storage, Transportation and Disposal – Role of individual in prevention and generation of waste

Module 5– Technological and Legal Aspects

Green Technology- Energy consumption and GHG emissions- Energy Efficient Devices- Green Architecture- Carbon Capture- Sustainable value creation – Ladder of Sustainability- Trademarks- International Organisation for Standardisation (ISO) Standards, Environment Protection Act - Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act

CURRICULUM ENRICHMENT: PROJECT

Sl. No	Programme Name	Nature of Work-Project work/Field visit/Internship	Year	Name of the Student	Title of the Project	Cross-cutting issue addressed in the Project
1	M. Sc. Zoology	Project	2021-2022	Amritha Singh K	Study on molluscan diversity of Cherai beach	Environmental and Sustability
2	M. Sc. Zoology	Project	2021-2022	Aswathy Vijayan	Study on bird diversity in the Kalady range of Malayattor forest division	Environmental and Sustability
3	M. Sc. Zoology	Project	2021-2022	Deepika Y	Diversity and endemism of Butterflies of Mannavan shola of Anamudi shola National park in Western Ghats	Environmental and Sustability
4	M. Sc. Zoology	Project	2021-2022	Devika Shybu	An investigative study on Spider diversity at Iringolkavu	Environmental and Sustability
5	M. Sc. Zoology	Project	2021-2022	Divya K S	Conservation of butterfly through butterfly garden	Environmental and Sustability
6	M. Sc. Zoology	Project	2021-2022	Farsana M J	Biodiversity of butterflies and host plant interaction in Iringolkavu	Environmental and Sustability
7	M. Sc. Zoology	Project	2021-2022	Jaseera Fairoosa	Study of diversity of some common edible fishes in Ponnani fishing harbour	Environmental and Sustability
8	M. Sc. Zoology	Project	2021-2022	Jitto Joy	A comparative study on ant diversity of Thommankuth forest area, pineapple plantation and rubber plantation	Environmental and Sustability
9	M. Sc. Zoology	Project	2021-2022	Karthika Ravi	A study on the Ant diversity of ward 12 of Vengola Panchayath, Ernakulam	Environmental and Sustability
10	M. Sc. Zoology	Project	2021-2022	Pooja Krishnan K	A comparative study of the Odonate diversity of wetlands in Puzhakattiri panchayat , Malappuram	Environmental and Sustability
11	M. Sc. Zoology	Project	2021-2022	Reshma R Kurup	A study on the avian diversity of Randampuncha wetland near Manthuka, Pathanamthitta district	Environmental and Sustability
12	M. Sc. Zoology	Project	2021-2022	Revathy P G	A study of the avian diversity of the paddy field in Mararikulam panchayath, Alappuzha	Environmental and Sustability
13	M. Sc. Zoology	Project	2021-2022	Shalu Reju	A Comparative study on the litter fauna diversity in multicrop agro ecosystem in Mazhuvanoor Panchayath, Ernakulam	Environmental and Sustability
14	M. Sc. Zoology	Project	2021-2022	Sreelakshmi S	A comparative study on the effect of Copper sulphate and Ammonium sulphate on the growth, survival and reproduction of Guppy (Poecilia reticulata)	Environmental and Sustability
15	M. Sc. Zoology	Project	2021-2022	Swathy Sajikumar	A comparative study on the seasonal diversity of Coleoptera in Iringole Kavu evergreen forest, Ernakulam	Environmental and Sustability
16	M. Sc. Zoology	Project	2021-2022	Swathy Sasi	A study on diversity of dragonflies in varappetty panchayath	Environmental and Sustability
17	M. Sc. Zoology	Project	2021-2022	Thasni P M	A comparative study on the butterfly diversity of Pallarimangalam panchayath and Varappetty panchayathof Ernakulam district Kerala	Environmental and Sustability
18	M. Sc. Zoology	Project	2021-2022	Treesa Mary Bose	Study on diversity of fishes in Thannermukom bund.	Environmental and Sustability
19	M. Sc. Zoology	Project	2021-2022	Varsha V	A comparative study on the moth (Lepidoptera: Heterocera) diversity in selected areas of Malappuram and Ernakulam districts	Environmental and Sustability
20	B. Sc. Zoology	Project	2021-2022	Shabna Kareem	A case study on mitochondrial neurogastro intestinal encephalopathy	Environmental and Sustability
21	B. Sc. Zoology	Project	2021-2022	Aleena Mariyam George	A study on the poultry farm in Koovappady panchayath	Environmental and Sustability
22	B. Sc. Zoology	Project	2021-2022	Hindbeevi AM	A Study on butterflies and their interactions with plants in ward 11 of Kottapady panchayath	Environmental and Sustability
23	B. Sc. Zoology	Project	2021-2022	Fathima Shaji	A comparative study on the distribution and diversity of ants in different habitats of Perumbavoor municipality	Environmental and Sustability
24	B. Sc. Zoology	Project	2021-2022	Nabeela A A	A Study on the bird diversity In Ward 7 Keezhmad Panchayath	Environmental and Sustability
25	B. Sc. Zoology	Project	2021-2022	Sandra PS	A study on the dragonfly diversity in ward 6 of Koovapady panchayath	Environmental and Sustability
26	B. Sc. Zoology	Project	2021-2022	Fathima Kareem	Study of spider diversity in ward 10 of Assamannoor grama panchayath	Environmental and Sustability
27	B. Sc. Zoology	Project	2021-2022	Anjana Sajeev	The study on pig farm management and economic importance in chooramudi, meembara	Professional Ehics
28	B. Sc. Zoology	Project	2021-2022	Nidhy Anna Sunny	Study on diary farm management and economic importance in a cattle farm in Rayamangalam panchayath	Professional Ehics
29	B. Sc. Zoology	Project	2021-2022	Siya Paul	A study on the diversity of millipede in peechanickad, ward XXX of Angamaly municipality	Environmental and Sustability
30	B. Sc. Zoology	Project	2021-2022	Leeshma Shaji	A study on the survey of joint diseases with special relevance to rheumatoid arthritis	Human Values
31	B. Sc. Zoology	Project	2021-2022	Fathima Farzana	A study on the effect of different colours of light on red coral platy fish	Environmental and Sustability

Sl. No	Programme Name	Nature of Work-Project work/Field visit/Internship	Year	Name of the Student	Title of the Project	Cross-cutting issue addressed in the Project
32	B. Sc. Zoology	Project	2021-2022	Mayoori MB	A study on the importance of diagnosis in joint disorder	Human Values
33	B. Sc. Zoology	Project	2021-2022	Maneesha Beegum PM	Obesity in daily life	Human Values
34	B. Sc. Zoology	Project	2021-2022	Amalendhu Rajan	A study on the poultry farm in Kurupumppady panchayat in Perumbavoor	Professional Ehics
35	B. Sc. Zoology	Project	2021-2022	Ashlin Sabu	A study on the effect of different colours of light on red coral platy fish	Environmental and Sustability
36	B. Sc. Zoology	Project	2021-2022	Alfiya Shaji	A comparative study on the distribution and diversity of ants in different habitats of Perumbavoor municipality	Environmental and Sustability
37	B. Com Computer Applications	Project	2021-2022	Aswathy P .R	A study on awareness and attitude of working women towards stock market	Gender
38	B. Com Computer Applications	Project	2021-2022	Aswahy Rajeevan	A study on awareness and attitude of working women towards stock market	Gender
39	B. Com Computer Applications	Project	2021-2022	Aysha Beevi C .H	A study on awareness and attitude of working women towards stock market	Gender
40	B. Com Computer Applications	Project	2021-2022	Farhana Muhammed	A study on awareness and attitude of working women towards stock market	Gender
41	B. Com Computer Applications	Project	2021-2022	Farrhana Muhammed	A study on problems and prospects of small scale business during the Covid pandemic situation	Professional Ehics
42	B. Com Computer Applications	Project	2021-2022	Fathima Meharine M .M	A study on problems and prospects of small scale business during the Covid pandemic situation	Professional Ehics
43	B. Com Computer Applications	Project	2021-2022	Fathima A .K	A study on problems and prospects of small scale business during the Covid pandemic situation	Professional Ehics
44	B. Com Computer Applications	Project	2021-2022	Fida Nasreen	A study on problems and prospects of small scale business during the Covid pandemic situation	Professional Ehics
45	B. Com Computer Applications	Project	2021-2022	Karthika T. M	A study on Impact of social media on youth with special reference to Mar Thoma College for Women Perumbavoor	Human Values
46	B. Com Computer Applications	Project	2021-2022	Mariya Jose Peter	A study on Impact of social media on youth with special reference to Mar Thoma College for Women Perumbavoor	Human Values
47	B. Com Computer Applications	Project	2021-2022	Reshma Rajesh	A study on Impact of social media on youth with special reference to Mar Thoma College for Women Perumbavoor	Human Values
48	B. Com Computer Applications	Project	2021-2022	Safnamol C. J	A study on Impact of social media on youth with special reference to Mar Thoma College for Women Perumbavoor	Human Values
49	B. Com Computer Applications	Project	2021-2022	Sona Suresh	Work life at office before and after COVID-19	Professional Ehics
50	B. Com Computer Applications	Project	2021-2022	Thara Paulose	Work life at office before and after COVID-19	Professional Ehics
51	B. Com Computer Applications	Project	2021-2022	Amina Latheef	Work life at office before and after COVID-19	Professional Ehics
52	B. Com Computer Applications	Project	2021-2022	Aparna Eldose	Work life at office before and after COVID-19	Professional Ehics
53	B. Com Computer Applications	Project	2021-2022	Basila P.S	A study on the influence of COVID 19 on online consumer purchasing behaviour and business operations	Professional Ehics
54	B. Com Computer Applications	Project	2021-2022	Meenakshi O .S	A study on the influence of COVID 19 on online consumer purchasing behaviour and business operations	Professional Ehics
55	B. Com Computer Applications	Project	2021-2022	Navya Jose	A study on the influence of COVID 19 on online consumer purchasing behaviour and business operations	Professional Ehics
56	B. Com Computer Applications	Project	2021-2022	Nivya Jose	A study on the influence of COVID 19 on online consumer purchasing behaviour and business operations	Professional Ehics
57	B. A History	Project	2021-2022	Sneha Jose	Nilambur forest and the British techno ecological imperialism in Kerala	Environmental and Sustability
58	B. A History	Project	2021-2022	Aiswarya Mohanan	Sustainable development Kerala model in feminist view	Gender
59	B. A History	Project	2021-2022	Sreekutty M.S.	Representation of Dalits in Higher Education ,A Case Study of Ernakulam District	Gender
60	B. A English	Project	2021-2022	Alfiya P A	Urban Expansion and Marginalisation in *Kammatipaadam*	Human Values
61	B. A English	Project	2021-2022	Anusha M S	Exploring the New Indian Woman in select novels of Sudha Murthy	Gender
62	B. A English	Project	2021-2022	Fathima Sahadhiya N B	Reading Masculinity in *Bulbbul*	Gender

Sl. No	Programme Name	Nature of Work-Project work/Field visit/Internship	Year	Name of the Student	Title of the Project	Cross-cutting issue addressed in the Project
63	B. A English	Project	2021-2022	Gopika Nandanakumar	Exploring 'Barrenness' as Disability' in *One Part Woman* and *Trial by Silence*	Gender
64	B. A English	Project	2021-2022	Sharon Sara Thomas	Obscure Representation of Dalits: Dismantling *Kala*	Gender
65	B. A English	Project	2021-2022	Afrin Shahul	Reading Masculinity in *Ayyappanum Koshiyum* and *Ishq*	Gender
66	B. A English	Project	2021-2022	Amal Saleem	Reading Transhumanisam in *Lucy*	Human Values
67	B. A English	Project	2021-2022	Fathima Noushad V N	Racism in the movie *The Lastman in San Franscisco*	Human Values
68	B. A English	Project	2021-2022	Rumaisa C B	Reading Body shaming in Malayalam Movie *Thamaasha*	Human Values
69	B. A English	Project	2021-2022	Reshma Reghu	When Nature Weds Man : An Ecocritical Re-reading of the Novel Vanara the Legend of Baali,Sugreeva and Tara by Anand Neelakantan	Environmental and Sustability
70	B. A English	Project	2021-2022	Vinaya Priya Venugopal	Represenatation of Transgender Identity in *Njan Marykutty*	Gender
71	B. A English	Project	2021-2022	Asna Sherin M H	Reading Feminism in *Chak de India* and *Bigil*	Gender
72	B. Com. Finance and Taxation	Project	2021-2022	Anitha Benny	A study on " Glass Ceiling effect on women" While deploying managerial roles in IT Sector of Ernkulam Region	Gender
73	B. Com. Finance and Taxation	Project	2021-2022	Asna A.A	A study on " Glass Ceiling effect on women" While deploying managerial roles in IT Sector of Ernkulam Region	Gender
74	B. Com. Finance and Taxation	Project	2021-2022	Chandini Malavika	A study on " Glass Ceiling effect on women" While deploying managerial roles in IT Sector of Ernkulam Region	Gender
75	B. Com. Finance and Taxation	Project	2021-2022	Elizabeth Chacko	A study on " Glass Ceiling effect on women" While deploying managerial roles in IT Sector of Ernkulam Region	Gender
76	B. Com. Finance and Taxation	Project	2021-2022	Arathi Saji	A study on the Attitude of People towards Green products	Environmental and Sustability
77	B. Com. Finance and Taxation	Project	2021-2022	Aswathy sreekumar	A study on the Attitude of People towards Green products	Environmental and Sustability
78	B. Com. Finance and Taxation	Project	2021-2022	Fathima Nazrin C I	A study on the Attitude of People towards Green products	Environmental and Sustability
79	B. Com. Finance and Taxation	Project	2021-2022	Gopika Regikumar	A study on the Attitude of People towards Green products	Environmental and Sustability
80	B. Com. Finance and Taxation	Project	2021-2022	Jixa Mathew	A study on the Effectiveness of Social Media Entrepreneurship in the contemporary world	Professional Ehics
81	B. Com. Finance and Taxation	Project	2021-2022	Krishnapriya Manoj	A study on the Effectiveness of Social Media Entrepreneurship in the contemporary world	Professional Ehics
82	B. Com. Finance and Taxation	Project	2021-2022	Lija Johnson	A study on the Effectiveness of Social Media Entrepreneurship in the contemporary world	Professional Ehics
83	B. Com. Finance and Taxation	Project	2021-2022	Lakshmi Sajan	A study on the Effectiveness of Social Media Entrepreneurship in the contemporary world	Professional Ehics
84	B. Com. Finance and Taxation	Project	2021-2022	Malavika S Kartha	An analysis of Bank Employees Occupational Stress with reference to Ernakulam District	Human Values
85	B. Com. Finance and Taxation	Project	2021-2022	Merlin P S	An analysis of Bank Employees Occupational Stress with reference to Ernakulam District	Human Values
86	B. Com. Finance and Taxation	Project	2021-2022	Muhzina Yooseph	An analysis of Bank Employees Occupational Stress with reference to Ernakulam District	Human Values
87	B. Com. Finance and Taxation	Project	2021-2022	Nathasha C S	An analysis of Bank Employees Occupational Stress with reference to Ernakulam District	Human Values
88	B. Sc. Physics	Project	2021-2022	Khadeeja M H	Home Energy Audit	Environmental and Sustability
89	B. Sc. Physics	Project	2021-2022	Fathima T S	Home Energy Audit	Environmental and Sustability
90	B. Sc. Physics	Project	2021-2022	Fathima Hamsa	Home Energy Audit	Environmental and Sustability
91	B. Sc. Physics	Project	2021-2022	Surya M C	Home Energy Audit	Environmental and Sustability
92	B. Sc. Physics	Project	2021-2022	Akhina K Sudheesh	Home Energy Audit	Environmental and Sustability
93	B. Sc. Physics	Project	2021-2022	Adhila K S	Home Energy Audit	Environmental and Sustability
94	B. Sc. Physics	Project	2021-2022	Ann Paul	Home Energy Audit	Environmental and Sustability
95	B. Sc. Physics	Project	2021-2022	Farsana Ashraf	Home Energy Audit	Environmental and Sustability
96	B. Sc. Physics	Project	2021-2022	Afrin M K	Home Energy Audit	Environmental and Sustability
97	B. Sc. Physics	Project	2021-2022	Akhilendu T Anil	Home Energy Audit	Environmental and Sustability
98	B. Sc. Physics	Project	2021-2022	Fathimath Saniya	Home Energy Audit	Environmental and Sustability
99	B. Sc. Physics	Project	2021-2022	Fathima Shiril	Home Energy Audit	Environmental and Sustability
100	B. Sc. Physics	Project	2021-2022	Durga Gopan	Home Energy Audit	Environmental and Sustability
101	B. Sc. Physics	Project	2021-2022	Anna Davis	Home Energy Audit	Environmental and Sustability