

Date: 10/04/2017

Department of Environmental Science

Submitted to Hon'ble Vice-Chancellor

It is submitted that the Outcome Based Education curriculum (OBE) for M.Sc. (Environmental Science) which was prepared by Head of the Department in consultation with the expert from various Universities and Industries was discussed and approved by the Department Committee in its meeting held on 06/04/2018.

Hon'ble vice-Chancellor is requested to accord his approval for the same so that it can be implemented from academic year 2017-18.

If approved, the Outcome Based Curriculum (OBE) for M.Sc (Environmental Science) will be implemented from academic year 2017-18.

Balchandra
10/04/2017

Vice- Chancellor

* Prof. Shirsad
(NAAC)



Dr. N.N. Bandela
Professor & Head

Professor & Head
Department of Environmental Science,
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Date: - 06/04/2017

IQAC Meeting Minutes:

The IQAC meeting of The Environmental Science department was held in the cabin of HOD at 04.00 pm. On 06/04/2017. The following resolutions were made in the meeting.

Resolution - 1: Meeting minutes of previous DC meeting held on 15/02/2017 are reviewed and confirmed.

Resolution – 2: OBE (Outcome Base Education):-

It is resolved that the Outcome Base Education is to be implemented from the year 2017-18 and accordingly curriculum is to be designed and will be forwarded to university authority for the grant further approval.

Resolution – 3: NAAC preparation:-

It is resolved that as per the revised guideline of NAAC, the information with respect to 7 point criteria will be prepared and will be submitted to IQAC office for further process.

Resolution – 4: Departmental Infrastructure :-

It is resolved that to renew the infrastructure of the department as per the requirement and the proposal will be forwarded to Estate section for renovation.

Resolution – 5: Preparation of Academic Calendar :-


It is resolved that the academic calendar for the year 2017-18 and exam schedule will be prepared and communicated to concern officials.


Resolution – 6: About Academic Audit :-


It is resolved that to carry out the Academic Audit to the department for last 3 years.

Meeting ended with vote of thanks by the Head of the department.

The Meeting attended by following members.

1. 
Dr.N.N.Bandela
Professor

2. 
Dr.M.B.Mule
Professor

3. 
Mrs. Y. L. Padme
Asst. Professor


Professor & Head

PART-C

Copy of the curriculum/syllabus for all programmes offered by the department-

M.Sc. I year (Semester- I)					
Course	Course Code	Paper Titles	Hrs/ week	Credits	Marks
COM	COM-100	Constitution of India	02	02	50
RM	ENV-001	Research Methodology Part-I	02	02	50
FC	ENV-401	Foundation Course on Environment	04	04	100
CC	ENV-402	Environmental Chemistry	04	04	100
CC	ENV-403	Environmental Instrumentation & Analysis	04	04	100
EC	ENV-421A	Wildlife Conservation & Management	04	04	100
EC	ENV-421B	Environmental Metrology & Geosciences	04	04	100
LC	ENV-441	Lab Course-I	04	02	50
LC	ENV-442	Lab Course-II	04	02	50
LC	ENV-443	Lab Course-III	04	02	50
LEC	ENV-444A	Lab Course-IV	04	02	50
LEC	ENV-444B	Lab Course-IV	04	02	50
Total Credits for Semester – I : 28 (Theory:20 ;Lab:08) (With One Elective Course)					
M.Sc. I Year (Semester-II)					
Course	Course Code	Paper Titles	Hrs/ week	Credits	Marks
RM	ENV-002	Research Methodology Part-II	02	02	50
CC	ENV-404	Environmental Biotechnology	04	04	100
CC	ENV-405	Green Technology	04	04	100
CC	ENV-406	Environmental Engineering & Technology	04	04	100
EC	ENV-422A	Environmental Management Systems	04	04	100
EC	ENV-422B	Environmental Statistics & Modeling	04	04	100
LC	ENV-445	Lab Course-V	04	02	50
LC	ENV-446	Lab Course-VI	04	02	50
LC	ENV-447	Lab Course-VII	04	02	50
LEC	ENV-448A	Lab Course -VIII	04	02	50
LEC	ENV-448B	Lab Course-VIII	04	02	50
Total Credits for Semester – II : 26 (Theory:18 ;Lab:08) (With One Elective Course)					

M.Sc. II year (Semester- III)					
Course	Course Code	Paper Titles	Hrs/ week	Credits	Marks
CC	ENV-501	Municipal & Hazardous waste Management	04	04	100
CC	ENV-502	Remote Sensing and GIS application for Environmental Management	04	04	100
CC	ENV-503	Environmental Toxicology & Biodiversity Assessment	04	04	100
EC	ENV-521A	Environmental Plan, Policies, and legislation	04	04	100
EC	ENV-521B	Ecological footprints and carbon sequestration	04	04	100
SC	ENV-522	Climate Change and Global Environmental Issues	04	04	100
LC	ENV-541	Lab Course- IX	04	02	50
LC	ENV-542	Lab Course- X	04	02	50
LC	ENV-543	Lab Course- XI (Project /Dissertation Part- I)	08	08	100
Total Credits for Semester – III : 32 (Theory:20 ;Lab:04;Research Project :08) (With One Elective Course)					
M.Sc. II Year (Semester-IV)					
Course	Course Code	Paper Titles	Hrs/ week	Credits	Marks
CC	ENV-504	Risk Assessment and Disaster Management	04	04	100
CC	ENV-505	EIA & Environmental Auditing	04	04	100
EC	ENV-523A	Advanced Technologies & CDM	04	04	100
EC	ENV-523B	Ground Water Engineering and Watershed Management	04	04	100
LC	ENV-545	Lab Course-XII	04	02	50
LC	ENV-546	Lab Course – XIII (Field work and In-plant training)	04	02	50
LC	ENV-547	Lab Course- XIV (Seminar / Dissertation Part- II)	08	08	200
Total Credits for Semester – IV : 24 (Theory:12 ;Lab:04;Research Project :08) (With One Elective Course)					
Total Credits : 110 (Sem I : 28 +Sem II : 26 + Sem III : 32 + Sem IV:24)					

Semester - I

RM (ENV- 001:- Research Methodology – Part-I)

(Theory Course with 02 Credits)

Course Objectives

1. Student will know the different research approaches, scientific methods, criteria for good research and innovation.
2. Student will get knowledge of problems encountered while working on research plan, trouble shooting mechanism and field and laboratory problems.
3. Students will get the knowledge of data collection, presentation of data, data analysis and presentation of samples.

Teaching Scheme

Lectures	:-	2 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	02

Evaluation Scheme

Test	:-	10 Marks
Teacher Assessment	:-	15 Marks
Sem-End Examination	:-	25 Marks
Total Marks	:-	50 Marks

Unit –I:

10+2

Definition of research, Objectives of research, Research approaches, Significance of research, Research and scientific methods, Innovation and research, Research process, Criteria of good research, Defining the research problem, Technique involved in defining a problem, Research design, Important components and concepts related to research design, Developing a perspective research plan.

Unit-II:

10+2

Problems encountered during working of research plan, Trouble shooting mechanisms for encountering, Field and laboratory problems , Data collection-by survey method and by experimentation, Types of data, Data presentation methods, Data analysis, process of data analysis, Sampling -Collection of samples, Preservation of samples (soil, water, or live specimen or live samples), Selection of representative samples, Populations and samples.

Current developments in the subject.

Course Outcome

Students should able to:

1. Explain the different research approaches, scientific methods, criteria for good researches.
2. Describe the problems encountered while working on research plan, trouble shooting mechanism, field and laboratory problems.
3. Acquire knowledge of data collection, presentation of data, data analysis and presentation of samples.

References

1. Research Methodology-Methods and Techniques , By Kothari C.R.(2011); New Age International Publisher, new Delhi.
2. "Research methodology-Text and cases with SPSS applications" by Gupta S.L. and Hitesh Gupta (2011); International book house Pvt.Ltd, new Delhi.
3. "Stastical Methods" by S.P.Gupta, Publisher S.Chand and Sons.
4. "Fundametrnals of Research methodology and stastics" by Yogesh Kumar Singh , New Age International Publication, New Delhi.
5. "How SAGE has shaped Research methods A 40 years history" by John W Creswell, University of Nebraska. Lincoln.
6. "The Essence of Research Methodology, A Concise Guide for Master & Ph.D. students in management science, by Jan Jonker & Bartjan Pennink, Springer.

Semester – I
FC (Env-401 :- Foundation Course on Environment)
 (Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Dynamics of ecosystems, energy flow in ecological system, nature of abiotic and biotic components and stability concept of ecosystem.
2. Various types of degraded ecosystems, ecological succession, concept of climax and role of pioneer's species in restoration of ecosystems.
3. Population dynamics, prey predator relationship, concept of community, community competition and ecological sustainability.
4. Nature and status of renewable and non-renewable resources, mineral resources, fishery resources, energy resources and recycle, reuse and recovery of these resources.

Teaching Scheme

Lectures :- 4 hr/week
 Tutorials :- 1 hr/ week
 Test :- 1 hr/week
 Total Credit :- 04

Evaluation Scheme

Test :- 20 Marks
 Teacher Assessment :- 30 Marks
 Sem-End Examination :- 50 Marks
Total Marks :- 100 Marks

Unit-I: - Ecosystem Dynamics :

10+2

Concept of ecosystem, A biotic and biotic components, Energy in ecological system, Concept of productivity, Energy flow in ecosystem, Food chain, Food web, Ecological pyramids, Cybernetic nature and stability of ecosystem, Concept of habitat, Ecological niche, Guild, concept of ecotone, Edge effect, Ecological succession, Mechanism of succession, Concept of climax , Concept of Gaia hypothesis.

Unit-II :- Restoration of Degraded Ecosystems:

10+2

Degraded ecosystems such as, Forest, grassland, Desert ecosystem, Lentic and Lotic ecosystems, Coastal ecosystems, etc., Role of pioneer species in restoration, Major biomes of world.

Unit-III :- Population and Community Ecology:

10+2

Concept of population ecology, Population dynamics, Characteristics of population: Natality, Mortality, Fecundity, Density, Age distribution, Prey predator Relationship, Population explosion: Concept of community, Interspecific and intraspecific competition, Concept of carrying capacity, Ecological sustainability.

Unit-IV :- Natural Resources :

10+2

Renewable and non-renewable resources, Wild life resources, Water resources, Water use, Water conservation, Rain water harvesting, fishery resources, Mineral resources, Impact of over exploitation of mineral resources, Exploitation of metallic ores, Energy resources, Conventional and non-conventional energy resources, Natural resource conservation practices, Recycle, reuse and recovery of resources through 3 R principles.

Unit-V : Environmental Pollution:

10+2

Air pollution :- Sources, Air pollution episodes and disasters, Industrial pollution, Major effects of air pollution, Control measures.

Water pollution :- Sources, Types, Water pollution episodes and disasters, Major effects, Monitoring and preventive measures.

Noise pollution :- Sources, Vibration and impact isolation, Monitoring of noise, Noise pollution control equipments, Noise standard and control measures.

Soil pollution :- Sources, Effects, Methods of soil reclamation, Soil conservation measures.

Radiation :- Major sources, Nuclear fusion and fission effects, Use of nuclear weapons and their consequences, Impact, Radioactive risk assessment and waste disposal practices.

Current development in the subject.

Course Outcome

Students should be able to:

1. define ecological systems and its functionality along with stability concept of ecosystem
2. Describe various types of pioneer species and their role in restoration of ecosystems.
3. Recognize ecological succession, concept of climax and degraded ecosystem.
4. Examine nature and status of renewable and non renewable energy resources, mineral resources and energy resources.

References

1. Fundamentals of Ecology – E.P. Odum, Revised Edition 1995-96
2. Principles of Ecology – P.S. Verma, V.K. Agarwal, S. Chand and Co. Delhi.
3. Principles of Environmental Science – W.K.E.F. (1973) Mc Graw Hill Book Company.
4. Basic Ecology – E.P. Odum
5. Concept of Ecology – E.J. Koromondy, 1996, concept of modern biology series, prentice Hall.
6. Modern Concepts of Ecology – H.D. Kumar
7. Principles of Environmental Biology – P.K.G. Nair, Himalaya pub. House, Delhi
8. Environmental Biology – P.D. Sharma, Rastogi Publication, Meerut.
9. Ecology and Environment - P.D. Sharma, Rastogi Publication, Meerut.
10. Basic concepts of soil science – A.K. Kolay, Willey estern ltd., New Delhi.
11. Environmental Science – Enger, Smith, Smith, W.M.C. Brown company publishing
12. Practical Method in Ecology – R.K. Trivedi, P.K. Goel and Trisal., Enviro Publication, Karad.
13. Chemical methods for Environmental Analysis Water and sediments – R.Ramesh, M. Anbu. Macmillan India Ltd. New Delhi.
14. Fundamental of Ecology – Dash M.C. Tata McGraw Hill Pub. Co. Ltd. NewDelhi.
15. Concepts of Ecology (Fourth Edition)- Edward J. Koromondy, Prentice Hall of India Pvt. Ltd. New Delhi.
16. Environment forest, ecology and man – Dixit R.K. Rastogi Publication, NewDelhi.
17. Environment, energy, health planning for conservation – V. Vidyanath, Gyan Publishing House, New Delhi
18. Air pollution-M.N. Rao
19. Air pollution- A.C. Stern, Academic press Vol. I-X.
20. Air pollution-V.P. Kudesia.
21. Air pollution control-NEERI
22. Air pollution-Magill Holder and Ackely
23. Water pollution-A.K. Tripathi and S.N. Pande
24. Waste water engineering, treatment, disposal and reuse-Metcalf and Eddy.
25. water supply and sanitary engineering-R.C. Rangwala

Semester – I
CC (Env-402 :- Environmental Chemistry)
(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Understand the basics of Environmental Chemistry
2. Acquire the knowledge of composition of Air, Water & Soil
3. Identify the chemical contamination in Environment.
4. Analyze process for Air, Water & Soil
- 5.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Test	:-	20 Marks
Teacher Assessment	:-	30 Marks
Sem-End Examination	:-	50 Marks
Total Marks	:-	100 Marks

Unit-I :- Basic Concepts of Environmental Chemistry :

10+2

Energy-definition, types (kinetic and potential), Forms of energy : Laws of thermodynamics (First & Second), Stoichiometry , Gibbs energy, Chemical potential, Chemical equilibrium, Acid-base reactions. Solubility product, Solubility of gases in water, The Carbonate system, Unsaturated and Saturated hydrocarbons, Radionuclide.

Unit-II :- Chemical Agents in Environment:

10+2

Introduction, definition, Scope, Importance , Role of chemical agents in environment, Basic water chemistry, Chemical bonding, Solubilization, and ionization , Impurities, Basic principles and sources, Gases solubility in water, Heat influencing chemical reactions, Solubility of impurities, Characteristics of sanitary spent water, Concentration, Normality, Molarity, concept of dilution , Serial dilution, Single step and multiple step dilution, Sample collection guidelines, Sample preservation , Sample order, Data collection and record keeping.

Unit –III :- Chemistry of Air :

10+2

Classification of elements, Composition of air, Chemical speciation, particles, Ions and radicals in the atmosphere, Chemical processes for formation of inorganic and organic particulate matter, Toxic chemicals in environment, Pesticides, Insecticides, Arsenic, Cadmium, Lead, Mercury, Carbon monoxide and Ozone, MIC and other carcinogens in air and water.

Unit –IV :- Chemistry of Water and Soil:

10+2

Chemistry of water, Structure of water molecule, Solubility of compounds in water, Dissociating constant, Water quality parameters and standards, Chemistry of soil, Composition of soil, Biogeochemical cycles (nitrogen, oxygen, carbon, sulphur, phosphorus etc), Micronutrients of soil, Factors effecting the soil quality, Adsorption of contaminant in soil, Toxic chemicals present in soil.

Unit – V :-Global warming and green house gases :

10+2

Global warming, Effects, Control of global warming, Carbon sequestration, International agreements, Green house gases , Impact on global climate, Consequences of green house effects, Impact of global warming, Formation of ozone, Mechanism of ozone depletion , CFC and ozone layer depletion, Chemistry of photochemical smog, HCFC, NO₂, HC and PAN, Chemistry of cleaning agents, Soap, Detergents and bleaching agents, Chemistry of colloids, Gasoline and additives antiknock compounds, Lubricants and greases, Biogases.

Current development in the subject

Course Outcome

Students should able to:

- Define basics of environmental chemistry.
- Explain chemical contamination in environment
- Analyze air, water and soil.
- Apply the knowledge to assess the contamination of environment.

References

1. Environmental Chemistry- G.S. Sodhi.
2. Environmental Chemistry- S. E.Mannhan
3. Environmental Chemistry – A.K. De
4. Environmental Chemistry-A global perspective; G.W. Vantoon and S.J. Duffy, Oxford Uni. Press, London.
5. Environmental chemistry – B.K. Sharma
6. Environmental chemistry – B.K. Sharma and H. Kaur
7. Environmental pollution analysis – S.M. Khopkar
8. Environmental chemical analysis – Lanin L. Marr, Malcom S.
9. Environmental Chemistry – Kanan Krishnan.
10. Environmental Chemistry – S.K. Banerjee.
11. Environmental Chemistry – J.W. Moore and E.A. Moore.
12. Destruction of hazards chemicals in the laboratory: G. Lunn and E.B. Sansone.
13. A text book of Environmental Chemistry and pollution control – S.S. Dara.
14. Environmental Chemistry – M. Satake, Do. S. Sethi, S.A. Eqbal.
15. Environmental and Man: The chemical environmental: J. Lenihan and W.W. Fletcher.

Semester – I
CC (Env-403 :- Environmental Instrumentation and Analysis)
(Theory Core Course with 04 credits)

Course Objectives

Students will be able to

1. Study different sampling techniques, sampling equipments, sample preservation and processing of air, water and soil samples.
2. Use instruments for Studies.
3. Know analytical Instrumentation.
4. Apply Knowledge of instruments in Environmental Fields.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Test	:-	20 Marks
Teacher Assessment	:-	30 Marks
Sem-End Examination	:-	50 Marks
Total Marks	:-	100 Marks

Unit-I: - Introduction and sampling techniques:

10+2

Samples preparation, preservation and processing of air, water and soil samples, sampling equipments, separation and sampling techniques, precipitation, fractional crystallization, fractional distillation, solvent extraction, accuracy and precision, types of errors, trouble shooting of instruments.

Unit – II: - Chromatography:

10+2

Theory, Principles , working, methods and application of Thin Layer Chromatography (TLC) , Gas Chromatography (GC) , High Performance Liquid Chromatography (HPCL), Gas Liquid Chromatography (GLC), Ion Exchange Chromatography

Unit-III: - Spectrophotometry :

10+2

Theory , principles, working methods, and application of colorimeter and spectrophotometer, ultra violet (UV) spectrophotometer, Infra Red (IR) spectrophotometer, Nuclear Magnetic Resonance (NMR), Atomic Absorption Spectrophotometers (AAS), flame photometer , fluoride meter, Conductivity meter, Nephelometer turbidity meter , pH meter .

Unit-IV: - Air Sampling Equipments:

10+2

Theory and applications of High Volume Air Sampler (HVAS), Respirable Suspended Particulate Matter (RSPM) measurement and its scope, Suspended Particulate Matter (SPM) analytical significance, its measurement and practical importance , Anderson Sampler, Tilak air sampler, non-dispersive infrared analyzer (NDIR) Pulsed fluorescent analyzers and chemiluminescent analyzer .

Unit-V :- Microbiological instruments and Equipments:

10+2

Theory, principles, working and application of Colony Counter, Autoclave, Oven, Incubator, Laminar air flow and BOD incubator

Current developments in the subject

Course Outcome

Students should be able to:

1. Define sampling techniques, instrumental trouble shooting
2. Apply applications in pollution studies.
3. Categorize analytical instruments and instruments used for environmental problems.
4. Create consultancies.

Reference:

1. Analytical chemistry -Gary D..Christian.
2. Hand book of analytical instruments- Khandpur R.S.
3. Instrumentation methods for chemical analysis-B.K.Sharma
4. Instrumentation methods for chemical analysis- Chatwal and Anand
5. Instrumental methods of analysis : Willered merit and Dean (CBS publication , New Delhi)
6. Instrumental methods of Environmental analysis : Karan saveen (sarup and sons publishers, New Delhi) (2001)
7. Instrumental methods of chemical analysis: H.Kaur, Pragati prakashan, merrut. (2009)
8. Instrumental analysis for science and technology : W. Ferren (Agrobios Indian, Jodhpur).
9. Instrumental methods : V.B.Borade, Nirali prakashan, Mumbai.
10. Instrumental Methods of Analysis : G.W.Ewing.
11. Instrumental Analysis: gurdeep Chatwal (Himalaya Publishing House, New Delhi, (2000)

Semester – I
EC (Env-421 A :- Wildlife Conservation and Management)

(Theory Elective Course with 04 credits)

Course Objectives

Students will be able to

1. To understand the value of wildlife, its ecological importance and its scientific, commercial and ethical value.
2. Explain the threats and causes of loss of wild life and extinctions of wild species from India.
3. Illustrate different wild life conservation methods, and importance of protected areas conservations such as national parks, biosphere reserves, zoos, botanical gardens and gene banks.
4. Know the importance of wildlife management, management of forest fires, water resources, shelters and corridors management for wild life protection.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Test	:-	20 Marks
Teacher Assessment	:-	30 Marks
Sem-End Examination	:-	50 Marks
Total Marks	:-	100 Marks

Unit-I :- Introduction to wildlife :

10+2

Definition and concept of wildlife, Value of wildlife- ecological importance, Commercial value, Scientific value, Game value, Recreational value, and Ethical value, Status of wildlife-abundant, Threatened, Endangered, Greatly endangered, Extinction-prone, Extinct, and vermin, Wildlife distribution in India-Himalayan mountain system (north east and north west), Peninsular India, Tropical rainforest region of Indian, Indian desert.

Unit- II :- Threats and causes of loss of wildlife :

10+2

Pollution, Hunting, Superstitions, Over exploitation, Developmental activities, Mining, Destruction of forest, Habitat degradation, Trade in wildlife-history of trade in wildlife, Trade in live animals, Trade in wildlife products, Wildlife trade in India, CITES.

Unit- III :- Endangered Fauna of India :

10+2

Causes of extinction of wild species, Endemic wild species from India, Endangered wild animals from India-Mammals, Birds, Reptiles, Amphibians.

Unit – IV :- Wildlife Conservation :

10+2

Need of wildlife conservation, Types conservation-In-situ conservation, Ex-situ conservation, Wildlife conservation methods, Species specific conservation methods, Crocodile breeding project, Musk deer breeding project, Project Hangul , Project elephant, project tiger etc., Community conservation methods, Protected areas such as sanctuaries, National parks, Biosphere reserves, Zoo's, Botanical gardens & gene banks.

Unit- V:- Wildlife Management:

10+2

Need of wild life management, Wildlife management principles, Wildlife management techniques, Control hunting technique, Ecosystem management for wildlife, Sanctuary and national park management , Management of forest fires, Management of water resources, Shelters, Habitats, roads, Corridors management for wildlife.

Current developments in the subject.

Course Outcome

Students should be able to:

1. Identify the value of wildlife, its ecological importance and its scientific, commercial and ethical values.
2. Examine the threats and causes of loss of wildlife, extension of wildlife species from India.
3. Assess different wildlife conservation methods and importance of protected area such as national parks, biosphere reservoirs, zoo, botanical gardens and gene bank.
4. Evaluate importance of wildlife management, management of forest fires, water resources, shelters and corridors management for wildlife protection.

References

1. Zoos in India: legislation, policy, Guidelines and strategy, Central zoo authority, New Delhi 2007.
2. Wildlife ecology, conservation and Management , Anthony R.E.Sinclair, John M.Fryxell and Graeme Caughly , Blackwell publishing,U.S.A. 2006.
3. Colorful Atlas on Indian wildlife Diseases and Disorders, Arora dn Bipulchakraborty B.M. , IBDC,Lucknow,2008.
4. Indian wildlife yearbook ,Arora B.M., Editor., AIZ and WV .Bareilly and central zoon authority, New Delhi 2002.
5. Rehabilitation in free living wild animals, Arora.B.M. AIZ and W.V.,Bareilly., 2007.
6. Reproduction in Wild Mammalia & Conservation, Arora B.M. AIZ and WV., 2002.
7. Wild Animals in Central India, Brander,A.A. Natraj Publisher, Dehradun.
8. The Temple Tiger. Corbett,Jim., Oxford University Press, New Delhi., 2007.
9. Handbook of Environment, Forest and Wildlife Protection Laws in India., justice Kuldip Singh, Natraj Publishers, Dehradun., 1998.
10. Biodiversity conservation in managed and protected areas, katwal/ Banerjee, Agrobios, India., 2002.
11. The Ecology of wildlife Diseases. Peter J.Hudson, Annapaola Rizzoli, Bryan T.Grenfell, Hans Heestribeek and Andy P.Dobson, Oxford University Press. Oxford ., 2002.
12. Text book of wildlife management, Singh, S.K, IBDC, Lucknow., 2005.