।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२०**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

1. M.Sc.-II Year-Botany
2. M.Sc.-II Year-Herbal Medicine
3. M.Sc.-II Year-Analytical Chemistry
4. M.Sc.-II Year-Biochemistry
5. M.Sc.-II Year-Organic Chemistry
6. M.Sc.-II Year-Physical Chemistry
7. M.Sc.-II Year-Computer Management
8. M.Sc.-II Year-Computer Science
9. M.Sc.-II Year-Information Technology
10. M.C.A. (Master of Computer Applications)-II Year
11. M.Sc.-II Year-Software Engineering
12. M.Sc.-II Year-System Administration & Networking
13. M.Sc.-II Year-Dairy Science
14. M.Sc.-II Year-Environmental Science
15. M.Sc.-II Year-Applied Mathematics
16. M.Sc.-II Year-Mathematics
17. M.Sc.-II Year-Microbiology
18. M.Sc.-II Year-Physics
19. M.Sc.-II Year-Zoology
20. M.Sc.-II Year-Biotechnology
21. M.Sc.-II Year-Bioinformatics

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदव्युत्तर–सीबीसीएस अभ्यासक्रम/२०२०–२१/**३३५**

दिनांक : १६.०७.२०२०.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CURRICULUM OF M. Sc. II YEAR ENVIRONMENTAL SCIENCE

JUNE 2020

SWAMI RAMANANAD MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
Faculty of Science

Distribution of credits and Syllabus Structure
M.Sc. II Year (Environmental Science)

M. Sc. II Year (Semester III)				
Paper No.	**Name of the Paper**	**External (ESE)**	**Internal (CA)**	**Credits**
Env.501	Environmental Microbiology	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 502	Remote Sensing and GIS	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 503	Biostatistics and Computational Techniques	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 504 A	Soil Pollution and Solid waste Management	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
OR				
Env. 504 B	Agriculture and Environment	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 505	Seminar	Credit-1 25 Marks		Credit- 1
			Total Credits for Semester III	**Credit - 17**
M. Sc. II Year (Semester IV)				
Env.506	EIA and Disaster Management	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 marks	Credit- 4 100 Marks
Env. 507	Occupational Health Safety and Management	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 508	Environmental Policies, Law and Ethics	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 509 A	Environmental Sustainable Development	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
OR				
Env.509 B	Environmental Modeling and Research Methodology	Credit-3 75 Marks	Credit: 1 (25 marks) Test 15 Marks + Assignments 10 Marks	Credit- 4 100 Marks
Env. 510	Seminar	Credit-1 25 Marks		Credit- 1
			Total Credits for Semester IV	**Credit - 17**
Laboratory Course (Annual)				
Env. 511	Laboratory Course – V	Credit-3 75 Marks	Credit: 1 (25 marks)	Credit- 4 100 Marks
Env. 512	Laboratory Course – VI	Credit-3 75 Marks	Credit: 1 (25 marks)	Credit- 4 100 Marks
Env. 513	Laboratory Course – VII	Credit-3 75 Marks	Credit: 1 (25 marks)	Credit- 4 100 Marks
Env. 514	Laboratory Course – VIII	Credit-3 75 Marks	Credit: 1 (25 marks)	Credit- 4 100 Marks
			Total Credits for Laboratory Course (Annual)	**Credit – 16**
			Total Credits for M. Sc. II Year : Semester III + Semester IV + Laboratory Course	**Credit – 50**

Curriculum
M. Sc. II Year (Semester III)
Subject : Environmental Science

ENV. 501 ENVIRONMENTAL MICROBIOLOGY	CREDITS : 04 PERIODS : 45

Unit I : Introduction:

History & Scope of Microbiology, Modern Environmental Microbiology, Microbiology – Tools & Techniques: Microscopy, Bright field microscopy, Dark field Microscopy, Ultraviolet Microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Electron Microscopy ……(**10)**

Unit II: Bacterial Structure & Growth:

Size, Shape, reproduction, Growth curve, Continuous culture, Synchronous Culture, Quantative Measurement of bacterial growth, Physical Conditions required for growth. ……(**10)**

Unit III: Soil microbiology:

Microorganisms in soil: Bacteria, Fungi, Protozoa, Algae, Viruses; Functions of microorganisms in soil; Humus; Functions of Humus; Role of microorganisms in Environment: Biodegradation, Biodeterioration, Bioremediation; Role of microbes in carbon cycle; Role of microbes in Nitrogen cycle: Ammonification, Nitrification, Nitrate reduction, Denitrification, Nitrogen fixation, Symbiotic nitrogen Fixation, Non symbiotic nitrogen fixation,; Role of microbes in Sulphur cycle ……..(**10)**

Unit IV: Milk and Food Microbiology:

Sources of microorganisms in Milk, Microbiological examination of Milk, Pasteurization of Milk, Dehydration of Milk, Manufactured Dairy products; Food microbiology: Initial contamination of fresh food, Microbial spoilage of foods, Preservation of foods, Microbiological examination of foods, Fermented foods, Food poisoning. ……(**08)**

Unit V: Industrial Microbiology:

General types of industrial process, Types of fermentation processes, Food and food additives, Alcoholic fermentation, Production of Vinegar, Manufacture of various chemicals, Production of microbial enzymes, Textile microbiology. ……..(**07)**

Suggested Readings :

01. General microbiology Volume I & II : C. B. *Powar & H. F. Daginawala (Himalaya publishing House, Mumbai), 2002*
02. Fundamental principles of Bacteriology (TMH Edition): *A. J. Salle, (Tata McGraw-Hill Publishing Company Limited, New Delhi),1974*
03. Microbiology : *P. D. Sharma (Rastogi publication Meerut)*
04. Microbiology : *Pelizer, Reid & Chan (Tata McGraw-Hill Publishing Company Limited, New Delhi),*
05. Hand book of Microbiology : *Yu. S. Krivashein (Mir Publishers Mascow)*
06. Microbiology for Environmental Engineering : *M. C. Kinnery (Tata McGraw-Hill Publishing Company Limited, New Delhi),*
07. Applied Microbiology : *Vimta Kale & Kishore Bhusari (Himalaya Publishing House, Mumbai)*
08. Soil Microbiology : Martin Alexander, Wiley Eastern Limited, 1981
09. Soil microbiology & Plant Growth : N. S. Subba Rao, Oxford & IBH Publishing Co., New Delhi, 1989
10. Food Microbiology : W. C. Frazier, D. C. Westhoff, Tata McGraw-Hill Publishing Co., New Delhi, 1981
11. Text Book of Microbiology : Anantnarayan & Paniker, Orient Longman Pvt. Ltd., 2005
12. Microbes & Man : John Postgate, Cambridge University Press, New York, 1991

LEARNING OUTCOMES

01. Students will master in Basics of Microbiology
02. Master in understanding the Importance of microbes in Environmental interactions.
03. Master in advances in microbiology and their application in environmental problem solving.
04. Understand the Industrial microbiological processes.

ENV. 502 REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM (GIS)	CREDITS : 04 PERIODS : 45

UNIT- I Principles of Remote Sensing:

Concepts of Remote Sensing, Electromagnetic spectrum; effects of atmosphere, Physics of remote sensing, Principle of scanner and CCD array, Spectral reflectance of earth's surface features in different wavelength region of electromagnetic spectrum: spectral characteristics of surface features (rocks, soils, vegetations, water**). (07)**

UNIT- II Space Imaging:

Land sat, SPOT, IRS, NOAA, Sea sat, ERS, RADARSAT, INSAT satellites and their sensors, geometry and radiometry, Orbital characteristics, Data products. **(a) Thermal and remote sensing:** Basic principles, Radiation laws, Sensing radiant energy, Thermal sensors, characteristics of image and their uses. **(b) Microwave remote sensing:** Definitions and principles, advantages, Types of microwave systems - RADAR, SLAR, SAR; General characteristics, spectral resolution and interpretation. Digital Image Processing: Principles, Image Rectification and restoration, Image enhancement and Mosaicing. Image classification - Supervised, Unsupervised, Ground truth data and training set manipulation, Classification accuracy assessment. …… **(10)**

UNIT- III Aerial Photographs and Satellite Imageries:

Fundamentals of photogrammetry, aerial cameras, planning of aerial photography, principle of stereo photography, parallax and measurement of height & slope; characteristics of aerial photographs; Elements of image interpretation - visual interpretation of aerial photographs and satellite imageries, instruments used in interpretation; Path and Row Index Maps; selecting and ordering images; Interpretation of photographs and images for environmental analysis. ……..**(10)**

UNIT- IV Geographical Information System (GIS):

Basic principles and terminologies, Raster and vector data, Map projection, Topology creation, Overlay analysis, Data structure and Digital cartography; Software used in GIS Surveying: Leveling, Triangulation, Geodetic survey; Global Positioning System (GPS) - Basic principles, Applications to environmental studies. …… **(07)**

UNIT-V Application of Remote Sensing and GIS in Environmental Management:

Applications of Remote Sensing and GIS in environmental monitoring and action plan development of environmental fragile area; Natural resource management - forest resources, water resources, land resources and mineral resources; Hazard and disaster mapping and management. **Applications of Remote Sensing:** Applications to atmospheric studies, Applications to Geographic survey, Applications to biospheric survey, Applications to Hydrospheric survey, Applications to cryospheric survey, Applications to Geo botanical exploration, Applications to Oceanography, Agricultural applications, Forest Applications, Land use mapping **(11)**

Suggested Readings:

01. Remote Sensing of the Environment – An earth resource perspective: J. R. Jensen; Pearson Education
02. Geographic Information Systems: Martin, Routledge
03. An Introduction to GIS: Heywood, Pearson
04. Remote sensing in Land Evaluation: Yadav; Rajesh Pub
05. Essentials of GPS (2004): N. K. Agarwal; Spatial Networks Pvt. Ltd., Hyderabad
06. Remote Sensing, Principles and interpretation: Floyd F. Sabins Jr., W.H. Freeman & Company, New York, 2nd Ed., 1987.
07. Remote Sensing and Image interpretation: T.M. Lillesand & R.W. Kiefer, John Wiley & Sons,
08. Fundamentals of Remote Sensing : George Joseph, Universities Press Hyderabad, 2005
09. Remote Sensing and GIS : M. Anji Reddy, BS Publications, Hyderabad, 2008
10. GIS Basics : Shahab Fazal, New Age International Publishers, New Delhi, 2008
11. Geographical Information Systems : Anil K. Jamwal, Jnanda Prakashan, New Delhi, 2008
12. Environmental Science : S. C. Santra, New Central Book Agency, Kolkata, 2005

LEARNING OUTCOMES

01. Understand key concepts of Remote Sensing and GIS.
02. Conscious about Arial photography and satellite imageries
03. Figure out with use of GIS software.
04. Get the idea of applying RS and GIS in Environmental Management

ENV. 503 BIOSTATISTICS AND COMPUTATIONAL TECHNIQUES	CREDITS : 04 PERIODS : 45

Unit I : Introduction to Biostatistics:

Definition, Development of Biostatistics, Application of Biostatistics, Role of Biostatistics, Some definitions concerning statistics inference, Characteristic of statistics, Limitations of statistics, Data: Classification of Data; Collection of Data: Collection of primary data, Collection of Secondary data; Diagrammatic presentation of Data: Simple bar diagram, Multiple bar diagram, Pie diagram; Graphical presentation of data: Histogram, Frequency polygon, Frequency curve, Ogive curve. ……**(10)**

Unit II : Measures of Central tendency:

Characteristics of a good average, Calculation of Arithmetic mean, Merits of mean, Demerits of mean, Calculation of Median, Merits of median, Demerits of median, Calculation of Mode, Merits of mode, Demerits of mode, ……..**(10)**

Unit III : Measures of Dispersion and Correlation Analysis:

Definition, Objects of measuring dispersion, Properties of good measure of dispersion, Calculation of standard deviation, Merits and Demerits of standard deviation; Correlation Analysis: Definition, Uses, Types of correlation, Methods of studying correlation, Merits and Demerits of Correlation; Probability: Basic concepts, Measures of probability, Thermos of probability; Chi-square test: Characteristics of X^2 test, application of X^2 test. ……..**(12)**

Unit IV : Introduction to Computers:

Uses of computers, Components of computer, Types of computers; DOS: Working of DOS, DOS prompt, DOS Commands; Windows; Ms-Word; MS Excel ……..…**(10)**

Unit V : Internet and E - mail:

Internet connection, Website, Internet Browsing, Applications of Internet, E-mail ……..**(03)**

Suggested Readings:

01. Biostatistics: *P. N. Arora, P. K. Malhan, Himalaya publishing House, Delhi, 2008*
02. Basic concepts of Biostatistics: N. Arumugam, Saras Publications, Kanyakumari, 2003 03.
03. Biostatistics in theory and Practice: T. K. Saha, Emkay Publications, Delhi, 1992
04. Biostatistics: P. Ramakrishnan, Saras Publications, Kanyakumari, 1995
05. Environmental Science: S. C. Santra, New Central Book Agency, Kolkata, 2005 06.
06. Statistical Methods: S. C. Gupta, S. Chand & Sons Publishers, New Delhi, 1997
07. Evolution Biostatistics & Computer Applications: A. Gopi, A. Meena, N. Arumugam, Saras Publications, Kanyakumari, 2003
08. Fundamentals of Computer: V. Rajaraman, Prentice Hall of India, New Delhi, 2008
09. Computer Fundamentals: Pradeep K. sinha, Preeti Sinha, BPB Publications, New Delhi, 2007
10. Computer: Malhar V. Lathkar, Sadhusudha Prakashan, Nanded, 1995
11. Environmental Science Principles and Practices: R. C. Das, D. K. Behra, Printice Hall, New Delhi, 2008

LEARNING OUTCOMES

01. Have the basic knowledge of Biostatistics and Computers.
02. Grasp knowledge about Central tendency, dispersion and correlation analysis.
03. Identify the use of computers in environmental analysis.
04. Have the complete knowledge about use of internet in environmental management.

ENV. 504 (A): SOIL POLLUTION & SOLID WASTE MANAGEMENT	CREDITS : 04 PERIODS : 45

Unit I: Introduction:

Soil, types of soils in India, Salt affected soils, Reclamation, Acid, alkaline and saline soil indicator plants, , Solid waste pollution and waste land scenario in India. ……**(07)**

Unit II: Sources and detrimental effects of soil pollution:

Sources of soil pollution: Industrial wastes, Urban wastes, Radioactive wastes, Agricultural practices, Chemical and metallic pollutants, Absorption of toxic metals by soil; Chemicals absorbed in the soil, Cadmium accumulation in soil, Animal manures l, Waste water added to soil, Solid waste applied to soil, Salt stress in soil; Effects of Industrial pollutants, Effects of urban waste products, Effects of radioactive pollutants, Effects of modern agro technology, Effects of pesticides on soil. ……**(10)**

Unit III: monitoring, Analysis of soil pollutants and soil pollution control:

Monitoring and Analysis of Pesticides, Herbicides, Fungicides, Carcinogens, Industrial pollutants; Remedial measures for soil pollution, Methods to minimize soil pollution, Bacterial fertilizer, Fungi to increase soil fertility. ……**(10)**

Unit IV: Solid waste:

Sources and characteristics; Solid waste properties : Chemical composition, Density characteristics, Combustion properties, Reuse characteristics; Types of solid wastes: Residential wastes, Commercial wastes, Industrial wastes, Demolition wastes, Bulky wastes, Hazardous wastes, Biomedical Wastes; Collection and transportation of solid wastes: Storage, Containers, Bags, Drop boxes, Compactors, Source segregation and reclamation, Collection system parameters, Types of services, Collection equipments. ……**(10)**

Unit V: Solid waste management:

Solid waste processing, Long distance transport; Disposal of solid wastes: Hog feeding, open dumping, Sanitary landfills, Pyrolysis, Incineration, Controlled tipping, Pulverization, Hammer mills, rotating drum Machines. Utilization, Recovery, Reuse, Recycling of waste and residues, Packaging. ……**(08)**

Suggested Readings:

01. Soil and Noise Pollution: B. K. Sharma, H. Kaur, Goel Publishing House, Meerut, 1994
02. Solid waste pollution: Dr. Aradhana Salpekar, Jnanada Prakashan, New Delhi,
2008. **03. Principals of soil science:** M. M. Rai
04. **Soil pollution & Soil organisms:** P. C. Mishra
05**. Environmental Chemistry:** B. K. Sharma
06. Environmental Science: S. C. santra, New Central Book Agency, Kolkata, 2005
07. Environmental Pollution Control Engineering: C. S. Rao, New age International, Mumbai, 2003
08.**Fundamentals of Soil Science:** Henry D. Foth, John Wiley & Sons, New York, 1984
09.Environmental Engineering: Davis & Cornwell, McGraw – Hill Publications, New York, 1998
10.Environmental Science Principles and Practices: R. C. Das, D. K. Behra, Printice Hall, New Delhi, 2008
11. Solid Waste Management : Amul Late & Mahadeo Mule (Lambert Academic Publishing, Mauritius, 2020

LEARNING OUTCOMES

01. Get the idea of different types of soils in India and world.
02. Identify the sources and detrimental effects of soil pollution
03. Master in monitoring and analysis and pollution control of soil.
04. Apprehend the knowledge about solid waste and its management.

ENV. 504 (B): AGRICULTURE AND ENVIRONMENT	CREDITS : 04 PERIODS : 45

Unit I:

Ecology and its relevance to man Natural resources, their sustainable management and conservation. Physical and social environment as factors of crop distribution and production. Agro ecology; cropping pattern as indicators of environments. ……..…..**(09)**

Unit II:

Cropping patterns in different agro-climatic zones of the country. Impact of high-yielding and short-duration varieties on shifts in cropping patterns. Concepts of various cropping and farming systems. Organic and Precision farming. ……..…**(09)**

Unit III:

Dry land agriculture and its problems. Technology for stabilizing agriculture production in rain fed areas. Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Rainwater harvesting. Drip and sprinkler irrigation. Drainage of waterlogged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution. …… .**(10)**

Unit IV:

Soil - physical, chemical and biological properties. Processes and factors of soil formation. Soils of India. Mineral and organic constituents of soils and their role in maintaining soil productivity. Principles of soil fertility, soil testing and fertilizer recommendations, integrated nutrient management. Biofertilizers. Losses of nitrogen in soil. Soil factors affecting greenhouse gas emission. Soil conservation, integrated watershed management. Soil erosion and its management.

……...**(10)**

Unit IV:

Pesticides : Classification, nature, routes of exposure, modes of action, biological and health effects; pesticide residues in the environment: adsorption, retention, transport and degradation; concept of pesticide resistance ……**(07)**

Suggested Readings:

01. Fundamentals of Environmental Science : G. S. Dahliwal, G. S. Sangha, P. K. ralhan, Kalyani Publishers, New Delhi
02. Principles of Ecotoxicology, 4th Edition, C.H. Walker, R.M. Sibly, S.P. Hopkin, D.B. Peakall, CRC Press,
03. Ecotoxicology Essentials, 1st Edition, Environmental Contaminants and Their Biological Effects on Animals and Plants, Donald Sparling, Elsevier Publications.
04. Biochemical Ecotoxicology,1st Edition, Principles and Methods, Francois Gagne, Academic Press.
05. Environmental Science : Enger Smith, Smith, W. M. C. Brown (Company Publishing)
06. Environmental Chemistry : *B*. K. Sharma & H. Kaur(Goel Publishing House, Meerut)
07. The Nature and Properties of Soil: N.C.Brady and Ray weil.Pearson Publications.
08. Land and water Management Engineering: VVN Murthy,Kalyani Publishers Kolkata.
09. The future of Indian Agriculture: Y.K.Algah, Delhi.

LEARNING OUTCOMES

01. Know about agriculture and pollution.
02. Get the idea of agriculture zones and different farming systems.
03. Grasp the knowledge about water use efficiency in different agro climatic zones.
04. Understand about soil fertility and pesticide pollution.

ENV. 505: SEMINAR	CREDITS : 01

LEARNING OUTCOMES

01. Able to do critical thinking on particular problem of environment.
02. Understand to apply the scientific method to solve the scientific problem.
03. Have the knowledge to acquire and synthesize scientific information from a variety of sources.
04. Able to demonstrate an understanding of core knowledge in environmental science

Curriculum
M. Sc. II Year (Semester IV)
Subject : Environmental Science

ENV. 506: ENVIRONMENTAL IMPACT ASSESSMENT AND DISASTER MANAGEMENT	CREDITS : 04 PERIODS : 45

Unit I: Introduction:

Definition, Methods of Environmental Impact Assessment: Adhoc method, Overlay method, checklist and Matrices method, 1) Initial Screening 2) Rapid Environmental Impact assessment 3) Comprehensive Environmental Impact Assessment, Developmental activities requiring EIA, Cost Benefit Analysis, Relationship between cost of damage and cost of control, EIA in India, Nexus between Development and Environment , Role of EIA in Society, Status of EIA in India, Statutory requirements for EIA ……**(08)**

Unit II: Process of EIA:

EIA and quality of life, EIA procedures, Environmental Impact Statement (EIS), Peoples participation in EIA process,, Structure of EIA report; Checklists methods for EIA Study ….**(08)**

Unit III: Legislations and Case studies:

Important matter for consideration in carrying out EIA for energy, Policy and Programmee. Impact Identification network, Strategies for environmental management plan and green belt development, Environmental appraisal of projects with respect to industry, mining and water resources, Critical issues and formulation of strategies for EMP, Strategic environmental Impact Assessment methods and benefits. Legislation of EIA in India. Case studies.: Thermal power plants, mining projects, tourism and coastal zone development and river valley projects. ……**(10)**

Unit IV: Environmental audit:

A support tool for environmental management systems, Definition, Concept of EA, Type of EA, Benefits of EA, Audit Methodology, Pre audit , on site audit and post audit activities, water audit, raw materials audit and energy audit, Health and Safety audit, Environmental Audit Scenario in India, EA as a management tool, Environmental management systems (EMS),Concept of ISO 9000 and ISO 14000 in ESM, Environmental labeling, Eco –Labeling, Indian Scenario. ……...**(07)**

Unit V: Natural Disasters:

Natural Disasters- Floods, landslides, earthquake, volcanism, avalanche, cyclones, drought and fire, Tsunami, Wind storms, Prediction, perception and adjustment to hazards. Disaster Management- Natural Hazard Management, Environmental risks due to project activities, Preparation of onsite and offsite disaster management plans. Pre disaster, actual disaster, post disaster, relief camp organization, Role of voluntary organization and armed forces. ……**(12)**

Suggested readings:

01. Environmental Impact Assessment: Principles and Procedures, John Wiley and Sons, New York.
02. Environmental Impact Assessment: A.K.Shrivastav, APH Publishing Corporation,New Delhi.
03. Environmental Impact Assessment: S.A.Abbasi, D.S.Arya,Discovery Publishing House,New Delhi.
04. Environmental Pollution Control: Neelima Rajvidya and Dilipkumar Markandey, APH Publishing Corporation,New Delhi. (2005)
05. Environment Problems and Solutions: D.K.Asthana and Meera Asthana, S.Chand & Co. Ltd. New Delhi..
06. An Introduction to Environmental Management: Dr.Anand S.Bal, Himalaya Publishing House, New Delhi.
07. Environmental Impact Analysis Handbook: John G.R. and David C.Wooten, McGraw Hill Publications. (1987
08. Natural Disaster Reduction: Girish K.M. and G.C.Mathur, Reliance Publishing House, New Delhi. (1993
09. Disaster Management: Shailendra K.Singh , Subhash. C, Kundu and Shobhue Singh , Mittal Publications, New Delhi. (1998)
10. Disaster Preparedness in India: Narendra Kumar Jain, Adhyatma Sadhana Kendra, New Delhi. (1996)
11. Disaster Management: Dr. S. R. Singh, A. P. H. Publishing Carporation, New Delhi, (2008)
12. Environmental Science : S. C. Santra, New Central Book Agency, Kolkata, 2005

LEARNING OUTCOMES

01. Get the idea of different methods and process of EIA.
02. Have the knowledge of Environmental legislation along with case studies.
03. Achieve the thorough knowledge about environmental auditing.
04. Conceive the awareness about natural disasters

ENV. 507: OCCUPATIONAL HEALTH, SAFETY & MANAGEMENT	CREDITS : 04 PERIODS : 45

Unit I: Introduction:

Environmental Guidelines for industry, Water for industry, Hard and soft water, Fuels, Devices for power generation, Refrigeration and air conditioning, Carbonization of coal, Liquid fuels from coal, Fuel gases; Industrial gases: Hydrogen, Oxygen and Nitrogen, Carbon di oxide, Acetylene, Ethylene …...**(05)**

Unit II: Occupational health:

Introduction – Occupational health risks – health hazards at work place – occupational diseases – care of skin – Back ache – effect of dust on lungs – airborne dust in working environment – physiology of respiratory system – pulmonary function tests – diabetes over view – prevention and treatment of infectious diseases – prevention and cure of TB – care of liver – insomnia – healthy living – role of occupational health services ……(**08)**

Unit III: Risk Assessment:

Identifying risk factors Risk Assessment – Identifying hazards ,Risk factors ,physical properties, security risk ,product or service ,competitive risk ,purchasing ,people elements , ,protection, processes ,performance , planning, policy. ……...(**07)**

Unit IV: Industrial relations and accidents:

Industrial accidents – Human carelessness – accident proneness-physical factors – vision – reaction time – relationship between perception and muscular responses and injuries – relationship between intelligence and injury experience – hearing – emotional instability – marital status – fatigue – illumination. ……..**(09)**

Unit V: Industrial Safety management:

Safety Management, Objectives of Safety management, National safety Council, Safety acts and Provisions for workers welfare, Principles of Safety management, Safety Organization, Management's safety policy, Responsibilities of Management for safety in plant,; Safety and housekeeping; Industrial fire management: Fundamentals of fire, Elements of fire, Classification of fires, Common causes of industrial fires, Fire–Extinguishing Techniques, Fire–Extinguishing agents and applications, Fire protection & Fire fighting. ……..**(16)**

Suggested Readings:

01. Industrial Chemistry : B. N. Chakrabarty, Oxford and IBH Publishing Co., New Delhi, 1998
02. Environmental Science : S. C. Santra, New Central Book Agency, Kolkata, 2005
03. Industrial Chemistry : B. K. Sharma, Goel Publishing House, Meerut, 1994
04. Industrial Chemistry : Harish Kumar, Sarup & Sons Publishers, New Delhi, 2000
05. Pollution management in Industries : R. K. Trivedy, Environmental Publications, Karad, 1995
06. Industrial water pollution control : W. Wesley Eckenfelder Jr., McGraw-Hill Book Company, New Delhi, 1989
07. Environmental Science : S. C. Santra, New Central Book Agency, Kolkata, 2005
08. Industrial Hygiene : Dr. G. R. Kakri, Everest Publishing House, Pune, 1987
09. Reutilization of Industrial Effluents & Wastes : R. K. Baslara, A. K. Shrivastava, Pragati Prakashan, Meerut, 2008
10. Waste Water Treatment : Rao & Datta A. K.
11. Waste Water Treatment : S. P. Mahajan
12. Environmental Management : G. N. Pandey, Vikas Publishing House, Noida, 2007.
13. Water pollution : V. P. Kudesia, Pragati Prakashan Meerut, 2007
14. Industrial Safety, Health & Environment Management Systems : R. K. Jain, Sunil S. rao, Khanna Publishers, Delhi, 2007
15. Reutilization of Industrial Effluents and Wastes : R. K. Baslass, A. K. Srivastava, Pragati Prakashan, Meerut, 2008

LEARNING OUTCOMES

01. Aware of basics of Occupational health and safety.
02. Identify hazards and risks.
03. Master in handling accidents in industry.
04. Able to work for industrial safety management

ENV. 508: ENVIRONENTAL POLICIES, LAWS AND ETHICS	CREDITS : 04 PERIODS : 45

Unit I : Environmental Planning:

Importance of planning, local, regional, state and national planning. Zoning-Physical planning. National policy, sectorial – integration, state level policy and implementation. Organizational structure at state and central governmental levels. ……**(06)**

Unit II : Environmental Policies:

Global Environmental Policies and National Strategies for Protection of Environmental Quality 1) Introduction, International Policies. 2) The Agenda 21 of Earth Summit. 3) Major International Organizations and Agencies Involved in Environmental Management. 4) Environmental Protection Efforts at National Level. 5) National Environmental Policy, Constitutional Mandate. ……..**(12)**

Unit III : Environmental Legislation:

Basic Concepts; Criminal versus Civil Liability; Doctrine of strict liability; History of Environmental Legislation in India; Lacunae in Environmental Acts and Policy, Scope for improvement; National Environmental Appellate Authority; Environmental Tribunal; Green benches; Role of Central and State Pollution Control Board. ……**(07)**

Unit IV: Laws and Acts guarding environmental concerns:

Provision of Constitution of India regarding Environment; Environmental Policy Resolution; Enviro-Legal system in India: PIL and Public Hearing, National Green Tribunal; Public Policy Strategies in Pollution Control; Indian Forests Act, 1927; Wildlife (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act, 1980; Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; Motor Vehicle Act, 1988; Hazardous Wastes (Management and Handling) Rules, 1989; Public Liability Insurance Act, 1991; Biological diversity Act, 2002; Disaster Management Act, 2005; Environmental Impact Assessment Notification, 2006; Coastal Regulation Zone Notification, 2011; …… **(14)**

Unit V: Environmental Ethics:

Aldo Leopold's Land Ethic, Philosophical Roots of Anthropocentricism, Non-anthropocentric Conceptions, The Human Place in Nature, The Concept of Sustainability, Restoration of Nature ,.**(06)**

Suggested Readings:

01. Environmental Laws of India - An Introduction : CPR Environmental Education Centre, Chennai (2001).
02. Conservation and Environmentalism - An Encyclopedia : Paehlka R. Garland Publishing Inc. New York. (1995)
03. Environmental Awareness and Education : V.P.Kudesia, Educational Publishers, Meerut U.P.
04. Biodiversity : V.P.Kudesia, Educational Publishers,Meerut,UP.
05. Our Environment and Green Revolution : M.P.Mishra, S.Chand & Co.Ltd.New Delhi.(2000)
06. Environmental Concerns and Strategies : T.N.Khoshoo.
07. Environmental Management in India : R.K.Sapru.
08. Environmental Ecology : Gurudeep Raj, P.R.Trivedi, Akashdeep Publishing House, New Delhi.
09. Forests in India : V. P. Agrawal, Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi, (1968).
10. Introduction to Social Forestry : Sitram Rao, Oxford and IBH Pub. Co. Pvt. Ltd.
11. An Introduction to Environmental Management : Dr. Anand S. Bal, Himalaya Publishing House (2005).
12. Environmental Law and Policy in India: Cases, Material & Statutes:Diwan Shyam
13. Environmental Law in India, 2018: Prof. P.Leelakrishnan, Lexis Nexis Butterworth India; 2018 edition (2018)
14. Environmental Law , 2017: Dr Nishtha Jaswal Dr. P S Jaswal Allahabad Law Agency (2017)

LEARNING OUTCOMES

01. Understand the knowledge about environmental planning and policies.
02. Have the idea of role of central and state pollution control boards.
03. Learn about different environmental laws.
04. Get the knowledge of Environmental ethics

ENV. 509 (A): ENVIRONMENTAL SUSTAINABLE DEVELOPMENT	CREDITS : 04 PERIODS : 45

Unit I Values:

Environment / Nature , ecosystem services, separation of humans from nature in history Tragedy of the Commons, Goals of Sustainable development, Basic sustainability theory – triple bottom line, Brundt land report Human growth and development (consumption vs. population) – global markets Behavioral changes v. technological solutions. ……**(07)**

Unit II Status of environment:

Environmental, Social and Economical issues – Need for sustainability – Nine ways to achieve sustainability – population, resources, development and environment ……**(06)**

Unit III Concept of Sustainability:

Sustainability indices; Strategies and debates on sustainable development; Concept of Sustainable Agriculture; India's environment action program : issues, approaches and initiatives towards Sustainability; Sustainable development in practice; Urbanization; Urban sprawling and urban growth; Concept and characteristics of smart city; Urban resources and environmental problems; Carrying capacity analysis; Concept of ecological footprints. ……..**(13)**

Unit IV: Sustainable Development and Global Environmental issues:

Concept of sustainability, Factors governing sustainable development, Linkages among sustainable development, Environment and poverty – Determinants of sustainable development – Case studies on sustainable development – Population, income and urbanization – Health care – Food, fisheries and agriculture – Materials and energy flows ……**(10)**

Unit V: Sustainable Development Indicators:

Need for indicators – Statistical procedures – Aggregating indicators – Use of principal component analysis – Three environmental quality indices. ……..**(09)**

Suggested Readings:

01.Sayer, J. and Campbell, B., "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.
02.Kirkby, J., O"Keefe P. and Timberlake, "Sustainable Development", Earth scan Publication, London, 1993.
03. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, "An introduction to sustainable development", Glen Educational Foundation, 2008.
04. Jennifer A. Elliott, "An introduction to sustainable development". London: Routledge: Taylor and Francis group, 2001.
05. Low, N. Global ethics and environment. London: Routledge. 1999.
06. Douglas Muschett, Principles of Sustainable Development, St. Lucie Press, 1997.

LEARNING OUTCOMES

01. Understand the basics of the sustainable development.
02. Have the knowledge of sustainable practices.
03. Get the idea of challenges of sustainable development
04. Achieve the knowledge about indicators of sustainable development.

ENV. 509 (B): ENVIRONENTAL MODELING AND RESEARCH METHODOLOGY	CREDITS : 04 PERIODS : 45

Unit I :Mathematical modeling and simulation:

Definition ,Modeling systems and its components, Types of models and their applications. Models for Fate and Transport of Contaminants. ……**(05)**

Unit II Introduction to Research Methodology:

Meaning, Objective and Motivation in research, Types of research, Research approaches, Significance of research research Methods versus Methodology, Research and Scientific Method , Importance of Knowing how research is done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. …..……**(09)**

Unit III :Problem Identification & Formulation:

Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches. ……..…**(**11**)**

Unit IV: Sampling:

Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size …… **(12)**

Unit V : Data Analysis:

Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. Interpretation of Data and Paper Writing – Layout of a Research Paper, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism …….. **(08)**

Suggested Readings:

01. Integrated Environmental Modeling - Pollutant Transport, Fate and Risk in the Environment, Ramaswami A., Milford J.B., Small M. J., John Wiley & Sons 2005.

02. Principles of Geographical Information Systems, Burrough P.A. and McDonnell, R.A., Oxford University Press.1998.

03. Dynamics of Environmental Bioprocesses Modeling and Simulation Snape J.B., Dunn I.J., Ingham J and Prenosil J.E., VCH, Weinheim.1995.

04. Activated Sludge Models ASM1, ASM2, ASM2d and ASM3, Henze M., IWA Publ.2005.

05. Surface Water Quality Modeling, Chapra S.C., McGraw-Hill Inc.

06. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition

07. Research Methodology (Methods and Techniques), Kothari, C.R. New Age Publisher.

08. Power Analysis for Experimental research A Practical Guide for the Biological, Medical and social Sciences R. Barker Bausell, Yi-Fang Li Cambridge University Press.

09. Design of Experience: Statistical Principles of Research Design and Analysis, Robert O. Kuehl Brooks/cole.

LEARNING OUTCOMES

01. Understanding of the qualitative and quantitative research methods.
02. Develops depth of critical analysis and writing of research papers.
03. Have the knowledge of sample collection from the field.
04. Have the skill of Data analysis and its interpretation.

ENV. 510: SEMINAR	CREDITS : 01

LEARNING OUTCOMES

01. Able to do critical thinking on particular problem of environment.
02. Understand to apply the scientific method to solve the scientific problem.
03. Have the knowledge to acquire and synthesize scientific information from a variety of sources.
04. Able to demonstrate an understanding of core knowledge in environmental science.

ENV. 511: LABORATORY COURSE	CREDITS : 04

1. Study of Bacteria (Types).
2. Isolation of bacteria from Air.
3. Isolation of Fungi from Air.
4. Observation of motility of organisms by hanging drop technique.
5. Monochrome staining.
6. Differential (Gram's) staining.
7. Negative staining.
8. Endospores staining
9. Isolation of bacteria by Streak plate, Pour plate, Spread plate method.
10. Total Viable Count of Water.
11. Determination of Total Coliforms from water.
12. Determination of Fecal Coliforms from water.
13. Differentiation between Fecal and non fecal Coliforms by IMViC test.
14. Determination of Quality of Milk by Methylene Blue Reductase test.
15. Qualitative test for protein by biuret test.
16. Qualitative test for carbohydrate by Benedict's test.
17. To Study the Effect of Temperature on bacterial Growth.
18. To Study the Effect of P^H on bacterial Growth.
19. Determination of Growth curve of Bacteria.
20. Study of effectiveness of Hand washing.

Suggested Readings:

01. Practical Methods in Ecology and Environmental Science : R. K. Trivedy, P. K. Goel, Trisal (Environmental Publication, Karad)
02. Manual of Environmental Pollution Analysis : N. N. Bandela, Masarat Sultana, Uday P. Patil, Prathivi Publication, Aurangabad
03. A Manual of Fresh water ecology : R. Santhanam, P. Velayutham, G. Jegatheesan (Daya Publishing House, Delhi)
04. Physico-Chemical Examination of Water, Sewage & Industrial effluents : N. Manivasakam (Pragati Prakashan, Meerut)
05. Manual on Water and Waste Water Analysis : National Environmental Engineering Research Institute, Nagpur
06. Methodology for Water Analysis : Dr. Mohan S. Kodarkar, (Indian Association of aquatic Biologist's, Hyderabad)
07. Chemical and Biological methods for Water Pollution Studies : R. K. Trivedy, P. K. Goel (Environmental Publication, Karad)
08. Methods in Environmental Analysis : Water, Soil, Air : P. K. gupta, (Agrobios India, Jodhpur)
09. Chemical methods for Environmental analysis: Water & Sediments : R. Ramesh & M. Anbu (Macmillan India Limited)
10. Microbial Analysis : Aneja,
11. Practical Microbiology : R. C. Dubey, D. K. maheshwari, S. Chand & Co., New Delhi, 2008.

LEARNING OUTCOMES

01. Have the knowledge of different types of bacterial staining techniques.
02. Understand different isolation techniques for microbes and fungi.
03. Grasp the knowledge about effect of different parameters on the growth of microbes

ENV. 512: LABORATORY COURSE	CREDITS : 04

Statistical Problems

01. Mean.
02. Median.
03. Mode.
04. Standard Deviation.
05. Correlation Analysis.
06. Probability.
07. Chi-Squre Test.
08. Computer Problems.

Soil Pollution

09. Determination of Bulk density of soil.
10. Determination of Water holding capacity of soil.
11. Determination of Specific gravity of soil.
12. Determination of Soil P^H
13. Determination of Soil Conductivity.
14. Determination of Sulphate from Soil by Turbidimetric Method.
15. Determination of Nitrate from Soil by Spectrophotometric Method.
16. Determination of Phosphates from Soil by Spectrophotometric Method.
17. Determination of Sodium from Soil.
18. Determination of Potassium from Soil.
19. Isolation of Azatobacter from Soil.
20. Isolation of Sulphur bacteria from Soil.

Suggested Readings:

01. Biostatistics : *P. N. Arora, P. K. Malhan, Himalaya publishing House, Delhi, 2008*
02. Basic concepts of Biostatistics : N. Arumugam, Saras Publications, Kanyakumari, 2003
03. Biostatistics in theory and Practice : T. K. Saha, Emkay Publications, Delhi, 1992
04. Biostatistics : P. Ramakrishnan, Saras Publications, Kanyakumari, 1995
05. Environmental Science : S. C. Santra, New Central Book Agency, Kolkata, 2005
06. Statistical Methods : S. C. Gupta, S. Chand & Sons Publishers, New Delhi, 1997
07. Environmental Analysis Water, Soil & Air : M. M. saxena, Agro Botanical Publisher, Bikaner, 1987
08. Practical Methods in Ecology and Environmental Science : R. K. Trivedy, P. K. Goel, Trisal (Environmental Publication, Karad)
09. Manual of Environmental Pollution Analysis : N. N. Bandela, Masarat Sultana, Uday P. Patil (Prathivi Publication, Aurangabad)
10. Methods in Environmental Analysis : Water, Soil, Air : *P. K. gupta, (Agrobios India, Jodhpur)*

LEARNING OUTCOMES

01. Master in applying statistical tools in environmental analysis.
02. Have the knowledge of analysis of different soil parameters.
03. Able to do isolation of Azatobactor and sulphur bacteria from soil.

ENV. 513: LABORATORY COURSE | CREDITS : 04

01. Preparation of Air quality Impact Assessment check list.
02. Preparation of Environmental Health Impact Assessment Checklist.
03. Preparation of Noise Impact Assessment Checklist.
04. Preparation of Water Quality Impact Assessment Checklist.
05. EIA Case study : Thermal power plants.
06. EIA Case study : River valley projects.
07. EIA Case study : Any one Industry.
08. Preparation of Environmental Audit Report.
09. Determination of Nitrogen from soil by Kjeldhal Method.
10. Determination of Calcium from soil.
11. Determination of Magnesium from soil.
12. Analysis of Effluents from Textile Industry By TLC Method.
13. Analysis of Effluents from Pharmaceutical Industry By TLC Method.
14. Analysis of Effluents from Metal Industry By TLC Method.
15. Estimation of BOD from Industrial effluents.
16. Estimation of COD from Industrial effluents.
17. Study of Relative Stability of Organic Effluents.
18. Determination of Sulphite from Effluents of Pulp & paper Industry.
19. Types of fire extinguishers used in Industrial safety
20. Use of personal protective equipments in industrial safety
    (Rubber and Leather Gloves, Helmet, Safety shoes, welding apron, breathing apparatus etc.)

Suggested Readings:

01. **Practical Methods in Ecology and Environmental Science :** R. K. Trivedy, P. K. Goel, Trisal (Environmental Publication, Karad)
02. **Manual of Environmental Pollution Analysis :** N. N. Bandela, Masarat Sultana, Uday P. Patil (Prathivi Publication, Aurangabad)
03. A Manual of Fresh water ecology: R. Santhanam, P. Velayutham, G. Jegatheesan (Daya Publishing House, Delhi)
04. Physico-Chemical Examination of Water, Sewage & Industrial effluents : N. Manivasakam (Pragati Prakashan, Meerut)
05. Manual on Water and Waste Water Analysis : National Environmental Engineering Research Institute, Nagpur
06. Methodology for Water Analysis : Dr. Mohan S. Kodarkar, (Indian Association of aquatic Biologist's, Hyderabad)
07. Chemical and Biological methods for Water Pollution Studies : R. K. Trivedy, P. K. Goel (Environmental Publication, Karad)
08. Methods in Environmental Analysis : Water, Soil, Air : P. K. gupta, (Agrobios India, Jodhpur)
09. Chemical methods for Environmental analysis: Water & Sediments : *R*. Ramesh & M. Anbu (Macmillan India Limited)

LEARNING OUTCOMES

01. Able to prepare Environmental Impact assessment Checklist
02. Able to work on case studies.
03. Master in effluent analysis.

ENV. 514: PROJECT | CREDITS : 04

Project should be completed in the fourth semester and the report of project should be submitted to the concerned department of the College one month before the practical examination of fourth semester. The presentation of Project work is compulsory to every student. The presentation of project should be done at the time of practical examination.

LEARNING OUTCOMES

01. Understand to use scientific reasoning to gather, evaluate and interpret the evidence.
02. Able to design and conduct scientific studies for specific purposes.