DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,AURANGABAD.

CIRCULAR NO.SU./Env.Sci./Elective/26/2023

It is hereby informed to all concerned that, the syllabus prepared by the Ad-hoc Board, Environmental Science and on the recommendation of the Dean, Faulty of Science & Technology, the Hon'ble Vice-Chancellor **has accepted the "Electives for Choice Based Credit and Grading System M.Sc. Environmental Science i.e. ENV-521B : Environmental Toxicology and Biodiversity Assessment for IIIrd semester and ENV-523B Ground Water Engineering and Watershed Management for IVth semester to the affiliated Colleges and University Department of Environmental Science** under the Faculty of Science & Technology in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This shall be effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. SU/SCI./2023/ 11001-11
Date:- 22.08.2023.

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Deputy Registrar,
Syllabus Section.

Copy forwarded with compliments to :-

1] Head of the Department, Department of Environmental Science, Dr.Babasaheb Ambedkar Marathwada University, Aurangabad.
2] The Principals, affiliated concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University.
3] The Director, University Network & Information Centre, UNIC, with **a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation,
2] The Section Officer, [M.Sc.Unit] Examination Branch,
3] The Section officer, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The In-charge, [E-Suvidha Kendra],
7] The Public Relation Officer,
8] The Record Keeper,

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DR. BABASABEB AMBEDKAR MARATHWADA UNIVERSITY
AURANGABAD- 431004 (M.S)

Department of Environmental Science

Structure and Curriculum

For

M.Sc. Ist year Environmental Science
of
College and University Department
(Choice Based Credit System)
With
OBE Pattern

(Effective from the Academic year2021-22)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Course Structure

M.Sc. (Environmental Science) in Choice Based Credit System

From Academic Year 2021-2022

106 credits against 2650 marks.

	M.Sc. I year (Semester- I)				
Course	**Course Code**	**Paper Titles**	**Hrs/ week**	**Credits**	**Marks**
COM	IC-001	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	Physical and chemical Aspects of Environment	04	04	100
CC	ENV-403	Techniques in Environment and Analysis	04	04	100
EC	ENV-421A	Wildlife Conservation & Management	04	04	100
EC	ENV-421B	Environmental Metrology & Climate Change	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
ELC	ENV-444A	Lab Course-IV	04	02	50
ELC	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	Application of 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
ELC	ENV-448A	Lab Course -VIII	04	02	50
ELC	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	Solid Waste Management	04	04	100
CC	ENV-502	Ecological Footprint & Carbon Sequestration	04	04	100
CC	ENV-503	Advance Technology & CDM	04	04	100
EC	ENV-521A	Mooc's Course from SWAYAM Platform	04	04	100
EC	ENV-521B	Environmental Toxicology and Biodiversity Assessment	04	04	100
SC	ENV-522	Global Environmental Crises &Climate Change	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	04	02	50
LC	ENV-544	Lab Course- XII	04	02	50
		Total Credits for Semester – III = 28 (Theory:20 ;Lab:08) (With One Elective Course)			

	M.Sc. II Year (Semester-IV)				
Course	**Course Code**	**Paper Titles**	**Hrs/ week**	**Credits**	**Marks**
CC	ENV-504	RS & GIS Application in Environment	04	04	100
CC	ENV-505	EIA & Environmental Auditing	04	04	100
CC	ENV-506	Sustainable Urban & Rural Developmental Planning	04	04	100
EC	ENV-523A	Mooc's Course from SWAYAM Platform	04	04	100
EC	ENV-523B	Ground Water Engineering and Watershed Management	04	04	100
LC	ENV-545	Lab Course -XIII	04	02	50
LC	ENV-546	Lab Course-VIV	04	02	50
LC	ENV-547	Project + Internship + Field visit / Tour + Review Writing + Research Proposal writing,	08	04	100
		Total Credits for Semester – IV : 24 (Theory:16 ;Lab:08) (With One Elective Course)			

COM: Common
CC: Core Course
LC: Lab Course
SC: Service Course
RM: Research Methodology
EC: Elective Course
ELC: Elective Lab Course
FC: Foundation Course

Semester – III

EC (Env-521 B :- Environmental Toxicology and Biodiversity Assessment)

(Theory Core Course with 04 credits)

(Offline Mode)

Course Objectives

Students will be able to know

1. Scope of Toxicology, Source's of Toxicants in Atmospheres, Hydrosphere & Soil.
2. Recent Trend's in pesticides, factors affecting metabolism of Xenobiotics.
3. Bio-assay Test, Protocol of Toxicity Evaluation.
4. Important of Biodiversity, Causes of Loss of Biodiversity.
5. Need of Biodiversity Assessment, Biodiversity Measurements & Extinct Species.

Teaching Scheme			**Evaluation Scheme**		
Lectures	:-	4 hr/week	Test	:-	20 Marks
Tutorials	:-	1 hr/ week	Teacher Assessment	:-	30 Marks
Test	:-	1 hr/week	Sem-End Examination	:-	50 Marks
Total Credit	:-	04	**Total Marks**	**:-**	**100 Marks**

UNIT- I : Introduction to Toxicology:

Scope of toxicology and eco-toxicology, Branches of toxicology - clinical, environmental, economic, forensic, industrial, genetic, systemic and behavioral; Environmental toxicology- environmental toxicants - toxicant in atmosphere, toxicants in hydrosphere, toxicant in soil; Source of toxicants / poisons in atmosphere, hydrosphere and soil; Acute toxicity, Chronic toxicity and Safe concentration; Neurotoxicity, carcinogenicity and mutagenicity.

UNIT-II: Classification of toxicants:

Natural and synthetic, Pesticides- classification of pesticides, mode of action of pesticides; Recent trends in the use of pesticides; Plant toxins- Aflatoxins, ergots, pyrethroids; Heavy metal toxicants and their toxicity - lead, arsenic, mercury, cadmium and chromium, copper; Zink; Xenobiotic components- Factors affecting metabolism of xenobiotics; Exposure of toxicants- Routes and sites of exposure, types of exposure - acute and chronic, Dose- response relationship, Dose response curve; Translocation of toxicants - absorption, distribution and extraction; Mechanism of action of toxicants; Selective toxicity; bioaccumulation of toxicants.

UNIT-III: Bio-assay:

Bio-assay tests, Concept of lethal concentration and lethal dose, Protocol of toxicity evaluation of toxicants, Determination of LC_{10}, LC_{50} & LC_{90} for exposure period, Tests for assessing carcinogenicity and mutatoxicity of toxic compounds, TLC techniques for determination of toxicants in water and vegetables samples

Unit-IV: Introduction to biodiversity:

Importance of biodiversity; value of biodiversity; Types of biodiversity- alpha and beta biodiversity; genetic diversity, species diversity and ecosystem diversity; causes of loss of biodiversity; measurements of biodiversity; listing of threatened biodiversity;

Unit-V: Biodiversity Assessment :

Need of biodiversity assessment, Qualitative and quantitative assessment, Biodiversity measurement methods, Diversity indices – Species richness indices, Species evenness indices, Wildlife status- Abundant, Threatened, Endangered, Greatly endangered, Extinction prone and Extinct species.

Current development in the subject.

Course Outcome

Students should able to:

1. Describe the basic principle of environmental toxicity.
2. Apply the different toxicity tests and protocols of toxicity.
3. Categorize toxicants and biodiversity.
4. Assess the biodiversity.

References

1. Principles of Environmental toxicology:-Ian C.Shaw and John Chadwick, Taylor and Francies.
2. Environmental Toxicology and Chemistry:-Donald G. Crosfy 1998
3. Text book of modern Toxicology:- David A. Wright and Pamela Welbourn Cambridge University Press 2002.Ernest Hodgsen and patricia E.levi Appleton and Lange Stamford etc U.S.A.1995.
4. Basic Toxicology:- Frank C. Lu, Homisphere publishing Corporation, New York, Washington 1993.
5. Essentials of Toxicology: - Loomis TA, Leae Fabiger.
6. Toxicology:-Hayes.
7. Principles of toxicology:-Cassarett and Doulls.
8. Biodiversity and environment – S.K. Agrawal
9. The Biological Diversity Act. 2002 and Biological diversity rules 2004-National Biodiversity Authority India. 475, 9th South cross stree, Kalpalocwar Nagar, Neelangarai, Chennai-600041
10. Biodiversity measurement and estimation D.L. Hawks
11. Biodiversity conservation-Global agreements and national concerns. RAMSAR sites CBD, Quarantine, Regulation, National Forestry policy, Biodiversity Act, Wild life protection Act.

Semester – IV

EC (Env-523-B: - Ground Water Engineering and Watershed Management)

(Theory Core Course with 04 credits)

(Offline Mode)

Course Objectives

Students will be able to know

1. History and Characteristics of ground water, ground water level fluctuation & Environmental influence.
2. Advanced methods in Well hydraulics, waste water recharge for reuse.
3. Status of Groundwater in India
4. Concept of watershed & management short term and long term strategies planning.

Teaching Scheme					**Evaluation Scheme**
Lectures	:-	4 hr/week	Test	:-	20 Marks
Tutorials	:-	1 hr/ week	Teacher Assessment	:-	30 Marks
Test	:-	1 hr/week	Sem-End Examination	:-	50 Marks
Total Credit	:-	04	**Total Marks**	**:-**	**100 Marks**

Unit – I : Introduction

Ground water utilization & historical background, Characteristic of ground water, Global distribution of water, Role of groundwater in water resources system and their management, groundwater column, aquifers, classification of aquifers, Hydro geological cycle, water level fluctuations, Groundwater balance, ground water level fluctuations & environmental influence.

Unit – II : OCCURRENCE AND MOVEMENT OF GROUND WATER

Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, Darcy's Law, Hydraulic conductivity, Aquifer transmissivity and storativity, Dupuit assumptions Storage coefficient - Specific yield Heterogeneity and Anisotropy, Direct and indirect methods for estimation of aquifer parameters, Governing equation for flow through porous medium - Steady and unsteady state flow - Initial and boundary conditions, solution of flow equations.

Unit-III : ADVANCED METHODS IN WELL HYDRAULICS

Steady and unsteady flow to a well in a confined and unconfined aquifer - Partially penetrating wells - Wells in a leaky confined aquifer - Multiple well systems - Wells near aquifer boundaries - Hydraulics of recharge wells, partially penetrating/horizontal wells & multiple well systems, well completion/ development/ protection/ rehabilitation/ testing for yield, Concept & methods of artificial ground water recharge mounds & induced recharge, wastewater recharge for reuse, water spreading.

Unit-IV : Introduction and Basic Concepts:

Concept of watershed, Introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making, Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; Watershed Management Practices in Arid and Semiarid Regions, Case studies, short term and long term strategic planning.

Unit-V: Integrated Watershed Management:

Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system, Standard modeling approaches and classifications, System concept for watershed modeling, Overall description of different hydrologic processes, modeling of rainfall-runoff process, Subsurface flows and groundwater flow, Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies, Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management, Drought assessment and classification, drought analysis techniques, drought mitigation planning.

Current development in the subject.

Course Outcome

Students should be able to:

1. Describe current status of ground water with respective environmental influence
2. Apply knowledge in wells hydraulic mechanisms
3. Analyze ground water quality
4. Create models of integrated water sheds & Apply GIS and Remote Sensing in watershed management

References

1. Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979.
2. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
3. Driscoll, F., Groundwater and Wells, St. Paul, Minnesota, II Ed., 1986.
4. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000.
5. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987.
6. Bear J., Dynamics of fluids in porous media, American Elsevier publishing co. 1972.
7. C. Walton, Groundwater Resources Evaluation, McGraw Hill, 1970.
8. O.D.L. Strack, Groundwater Mechanics, Prentice Hall, 1989.
9. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1990.
10. D. K. Todd and L. F. Mays, "Groundwater Hydrology", John Wiley and sons.
11. K. R. Karanth, "Hydrogeology", TataMcGraw Hill Publishing Company.
12. S. Ramakrishnan, "Ground water", S. Ramakrishnan.
13. Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management, Colorado State University, 1994.
14. American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975.
15. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
16. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
17. Murty, J.V.S. "Watershed Management", New Age Intl., New Delhi 1998.
18. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .
19. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad.
20. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.
21. Das M.M. Watershed Management, Prentice Hall India Learning Pvt. Lit, 2012
22. R.S. Kurothe, A. k. Vishwakarma, Gopal Kumar. Watershed Management An Encyclopedia, Biotech Books Publisher.
23. Reddy Yvr, Watershed Management, Agrotech Publishing Academy.
24. Kenneth N. Brooks, Peter F. Flolliott, Joseph A. Magner, Hydrology and the management of watershed