SRM UNIVERSITY AP
Andhra Pradesh

SCHOOL OF ENGINEERING AND SCIENCES

M.Sc. in Environmental Science

2023-25 Batch

M.Sc. in Environmental Science

Semester-1							
Category	**Sub-Category**	**Course Title**	**L**	**T/D**	**P/Pr**	**Credits**	**Learning Hours**
AEC1	University AEC	Community Engagement and Social Responsibility	0	0	0	1*	
VAC1	University VAC	Effective Communication for Impactful Interviews	2	0	0	2	60
SEC1	School SEC	Introduction to R and Python	1	1	1	3	90
CORE	Department	Environmental issues, Climate Change, and sustainable development	2	0	2	4	120
CORE	Department	Earth and Planetary processes	2	1	0	3	90
CORE	Department	Environmental Pollution	2	1	0	3	90
CORE	Department	Environmental Laboratory – I	0	0	6	3	90
FIC	School	Data Science for Beginners	3	0	0	3	90
					Semester Total	**21**	**630**
Semester-2							
Category	**Sub-Category**	**Course Title**	**L**	**T/D**	**P/Pr**	**Credits**	**Learning Hours**
AEC2	University AEC	Community Engagement and Social Responsibility	0	0	0	1*	
VAC2	University VAC	Entrepreneurial Mindset	2	0	0	2	60
SEC2	School SEC	Research Design and Methods	2	1	0	3	90
Core Elective	Department	Water Resource/Introduction to Limnology and Oceanography/Solid Waste Management/Wastewater Treatment	3	0	0	3	90
Core	Department	Environmental Chemistry & Microbiology	3	0	1	4	120
Core	Department	Ecology & Biodiversity	3	0	1	4	120
Core	Department	Environmental Laboratory – II	0	0	3	3	90
FIC	University	Design Thinking	3	0	0	3	90
					Semester Total	**22**	**660**

Category	**Sub-Category**	**Course Title**	**L**	**T/D**	**P/Pr**	**Credits**	**Learning Hours**
RDIP	Department	Summer Internship	0	0	2	**2**	0

Semester-3							
Category	**Sub-Category**	**Course Title**	**L**	**T/D**	**P/Pr**	**Credits**	**Learning Hours**
AEC3	School AEC	Research Seminar	0	0	0	1*	
Core	Department	Environmental Legislation and Impact Assessment	2	0	1	3	90
Core	Department	Geospatial Technologies for Environmental Applications	2	0	1	3	90
Core Elective	Department	Hydroinformatics/Aquatic Ecology & Biogeochemistry /Applied Hydrogeology	2	0	1	3	90
Core Elective	Department	Green Economy/Energy and Environment/Process Design and Systems Analysis	2	1	0	3	90
Core Elective	Department	Hazards, Disasters and Risk Reduction / Environmental Entrepreneurship and Planning/Biomass Energy	2	1	0	3	90
Core Elective	Department	Bioeconomy/Urban mining & Sustainability	2	1	0	3	90
FIC	School		3	0	0	3	90
					Semester Total	**21**	**630**

Semester-4							
Category	**Sub-Category**	**Course Title**	**L**	**T/D**	**P/Pr**	**Credits**	**Learning Hours**
RDIP	Internship / Research / Thesis	Project	0	0	14	14	420
					Semester Total	**14**	**420**

Appendix-I

Syllabus of I & II Semesters

Semester–I

Effective Communication for Impactful Interviews

The KASB Model (Knowledge, Attitude, Skill, Behaviour); Verbal Communication: Develop effective interview responses, clear and concise articulation of thoughts, Voice modulation: tonality, volume and pitch, active listening and congruent response, storytelling for interviews: Non-Verbal Communication: Body language- gesture, posture, facial expressions, managing nervousness, conveying confidence ; Rapport Building with the Interviewer, adapting communication style to different interview formats (e.g., panel, one-on-one, telephonic and virtual), Asking relevant questions, handling FAQs and stressful questions, interview etiquette and attire; Customising resumes, Drafting cover letter and SOPs.

Introduction to R and Python

Introduction to Python, Python syntax, keywords, variables, indentation, comments, data types, lists, tuples, sets, dictionaries, operators, control statements, loops. Built-in functions, user input-output, file handling, Recursive functions, Matrix computations and linear equations, graphing curves and surfaces using Matplotlib, simple optimization problems. Introduction to R, objects, vectors, matrices, arrays, lists, data frames, missing data, reading and writing to CSV or text files, data manipulation: sub setting, filtering, and merging, plotting using ggplot2, descriptive statistics, linear regression, hypothesis testing, creating reports, forecasting with time series data. Department specific computational project.

Environmental issues, Climate Change, and sustainable development

The course "Environmental Issues, Climate Change, and Sustainable Development" offers a comprehensive and in-depth understanding of the interrelated challenges that our planet faces. It examines the intricate network of environmental issues, encompassing deforestation, pollution, habitat loss, and species extinction. The course thoroughly investigates the pressing issue of climate change, analysing its causes, impacts, and potential solutions. It emphasizes the significance of sustainable development as a framework for harmonizing economic growth, environmental preservation, and social well-being. By instilling a profound appreciation for the vulnerability and interconnectedness of our planet, this course equips students with the knowledge and tools needed to tackle these critical challenges and actively contribute to a more sustainable and resilient future.

Earth and Planetary processes

This course Earth and Planetary processes emphasizes on the broader aspect of the earth formation process to its building block and human aspects of understanding. This course will explain from the holistic and scientific understanding of solar system to the origin of earth and its various process in a different time scale. Earth and Planetary processes are crossroad between larger tectonic process to the different mineralogical composition of rocks and sediments to impact of climate change in different time frame. Ultimately this course will link the anthropogenic intervention on climate change processes carbon cycle, carbon economy, global energy consumption, fossil fuels – global warming – consequences.

Environmental Pollution

This course deals with a basic understanding of various types of environmental pollution. It covers responsible natural and anthropogenic factors for the occurrence and release of pollutants in the environment, dispersions, hazards associated with different types of pollutants, and problems of accumulation of toxic substances. The course includes lectures, tutorials, field trips, and an exercise in handling research data and writing a report.

Environmental Laboratory – I

The Environmental Laboratory – I is designed to develop the field-based knowledge and skills for a wider exposure of students, which is prerequisite for understanding the structural and functional aspects of ecosystems. Through this Lab course students would gain field knowledge, sampling skills, field sample collection & techniques, labelling, carrying procedures from field to laboratory, lab analysis, data interpretation and report preparation. The major topics covered by the Environmental Laboratory – I include phytosociological methods of agriculture, grassland and forest ecosystems, plant species composition, structure and functional traits of the above-mentioned ecosystems, biomass & carbon stock estimation, estimation of primary, secondary, and net primary productivity (NPP), growth of trees through increment model, Techniques and methods for the collection of soil samples, physico-chemical and biological parameters of soils and field trip to protected (National parks, Biosphere reserves, sanctuary etc.) and un-protected areas and waterbodies for data collection and report preparation.

Data Representations-Introduction to data, data structures, variables, and basic data collection techniques, Summarizing data, graphics, histograms, popular database softwares, A glimpse inside the mind of a data scientist (IBM Analytics); Basics of Linear Algebra-Vectors, matrices, linear system, consistency, transpose, determinants, inverses, trace, Vector space, subspaces, independence of vectors, basis and dimension, dot product, inner product, Eigenvalues and Eigenvectors.: Probability Distributions and Inferential Statistics-Basic principles of probability, distributions of random variables, The normal model and other popular distributions. Foundations for inference, point estimates, variability, confidence intervals, General ideas for statistical inference in the context of estimating the population proportion, Inference for categorical data, Inference for proportions and tables using the normal and chi- square distributions. Inference for one or two samples means using the t-distribution, statistical power for comparing two groups: Regression, and Classification- Introduction to linear regression. Regression for a numerical outcome with one predictor, Variable, Multiple and logistic regression. Regression for numerical and categorical data using many Predictors, Logistic regression for classification.

Semester-II

Entrepreneurial Mindset

Innovation of the product using design thinking, affordable innovation, product innovation, use of technology for entrepreneurship and innovation, use of data analytics. Development of business plan, concept note, understanding the market strategy, finding the delivery value, determining the product differentiation, feasibility analysis and study, market considerations for startups. Business model innovation, prototyping the product innovation, working out the business processes, identify competitive advantages, factors influencing the success of a business, incubation process. Funding options- Bootstrapping, angel investors, PE investors, lenders- financial projections, pitching, create value for all stakeholders.

Research Design and Methods

The Research Design and Methods course is designed to equip students with the necessary skills and knowledge to conduct research effectively. It covers research methodology, including the principles and techniques of designing and conducting research studies. Students will learn how to formulate research questions, develop hypotheses, collect and analyse data, and draw meaningful conclusions. Additionally, students will be introduced to helpful tools such as Mendeley, an academic reference manager, Turnitin, a plagiarism detection software, and Grammarly, an online writing assistant, which aid in organizing research materials, ensuring academic integrity, and enhancing writing skills. Overall, this course provides students with a solid foundation for undertaking research projects in their respective fields.

Environmental Chemistry & Microbiology

Knowledge of chemical behavior of pollutants is very important for suggesting remediation measures. That's why the present course is designed to demonstrate in-depth knowledge of chemical and biochemical properties of various environmental pollutants like soil, water, and air. The course gives the ideas of basics of environmental chemistry – chemical processes involved in various environmental problems; chemistry of air, water, and soil – composition, chemical speciation, structure and properties, mobility of heavy metals and emerging contaminants. The environmental microbiology section of this course covers the diversity and physiology of the microorganisms in the environment which includes the microbial distribution and growth in air, water, and soil. It also deals with the concept of microbial methods for metal remediation – bioremediation; transmitted pathogens – bacteria, viruses; microbial metabolism and biogeochemical processes.

Ecology & Biodiversity

This course will foster the basic understanding of Ecology & Biodiversity and its role in relation to current environmental problems, conservation and management. This course will provide a solid foundation on fundamental ecology & biodiversity topics, which students require for future studies in various fields. This course will explore the fundamentals of

ecology and its multidisciplinary nature, major terrestrial biomes, basic concepts of community ecology, meaning and values of biodiversity, major threats to biodiversity and efforts to conserve, manage, and sustain biological diversity.

Environmental Laboratory – II

This course provides students with hands-on experience in analysing the quality of water resources through various practical experiments. Through a combination of laboratory sessions and fieldwork, students will learn how to measure and analyse important parameters that determine the water quality. The course will focus on techniques for assessing dissolved oxygen, pH, conductivity, transparency, total alkalinity, nitrate, nitrite, ammonia, phosphate, biochemical oxygen demand (BOD), chemical oxygen demand (COD), light intensity, temperature, flow rate, chlorophyll, and suspended particulate matter (SPM) in water. Throughout the course, students will gain a solid understanding of the principles underlying each measurement technique and develop proficiency in performing accurate and reliable analyses. They will also learn to interpret the obtained results in the context of water quality assessment, enabling them to evaluate the environmental implications of their findings.

Design Thinking

To critically draw inferences from qualitative and quantitative data to creatively and effectively solve a problem, define the pain points and the latent needs, and analyse complex situations using effective innovation methodology. Develop design principles to create user-focused ideas, experiment with ideation tools, and explore different ideation approaches. Develop a potentially disruptive solution to create value leading to sustainable growth. Refine innovation ideas using design heuristics and apply techniques and models to make innovations easier to adopt. Understand the bias both from user and developers' perspectives. Evaluate the idea solution designed from the desirability, feasibility, and viability by critically analysing.