

**Ramakrishna Mission Vivekananda Educational and
Research Institute
(RKMVERI)**

(Deemed-to-be-university)

(Declared by Government of India under section 3 of UGC Act, 1956)

School of Environment and Disaster Management

SYLLABUS

Two Years M.Sc. in Environment and Disaster Management



Faculty Centre for Integrated Rural Development and Management (IRDM)

Ramakrishna Mission Ashrama, Narendrapur

2022

SUMMARY OF THE COURSE

SEMESTER-I

Code	Title of the Course	Credits
EDM 101	Environmental Characteristics and Sustainability	2+1
EDM 102	Water Quality Monitoring and Wastewater Treatment	2+1
EDM 103	Disaster Management – Legal, Institutional and Policy Framework	2+2
EDM 104	Environmental Toxicology – I	2+2
EDM 105	Environmental Regulation and Standards	2+1
EDM 106	Research Methodology and Statistical Technique	2+2
SCH 101	Spiritual and Cultural Heritage of India – I	1+0
Total		13(T)+9(P)

SEMESTER –II

Code	Title of the Course	Credits
EDM 201	Geo- informatics Basics	2+2
EDM 202	Environment, Health and Safety Management System	2+2
EDM 203	Pollution and Waste Management	2+2
EDM 204	Environmental Biotechnology and Bioremediations	1+1
EDM 205	Environmental Toxicology – II	1+2
EDM 206	Disaster Risk Reduction	2+2
EDM 207	Research Methodology- Case Study & Software	2+2
SCH 201	Spiritual and Cultural Heritage of India – II	1+0
Total		13(T)+13(P)

SEMESTER-III

Code	Title of the Course	Credits
EDM 301	Climate Change: Issues and Challenges	1+1
EDM 302	Risk Assessment Methodology	1+2
EDM 303	Disaster Response, Recovery and Reconstruction	1+1
EDM 304	Energy Analysis and Environmental Degradation	1+1
EDM 305	Environment Impact Assessment	1+2

EDM 306	Applying Geo-informatics in Environmental Management	1+2
EDM 307	Research Ethics and Advanced Orientation	1+1
Total		7(T)+10(P)

SEMESTER IV

Code	Title of the Course	Credits
EDM 401	Seminar-I	0+2
EDM 402	Seminar-II	0+2
EDM 403	Research Project	0+24
Total		0+28 (P)

SEMESTER I

EDM 101: Environmental Characteristics and Sustainability

2+1 credit (36+18 hours)

1. Earth's atmosphere: composition, vertical structure, observation Temperature: scales, methods of heat transfer, different temperature measures, human comfort; Humidity: types and measures; Atmospheric pressure in relation to temperature and humidity. Basic parameters in psychometric chart 6
2. Atmospheric stability and instability, adiabatic process and its mechanism. 2
3. Wind: Direction, speed, surface and vertical air circulation, surface pressure systems and wind, Pressure gradient force, Coriolis effect 4
4. Atmospheric circulation: scales, eddies; Global wind circulation: Tri cellular model and earth pressure system, Jet stream: characteristics, formation 4
5. Wind circulation and oscillation: Ekman spiral, Walker circulation, El Nino, Indian Ocean Dipole Effect, Madden Julian Oscillation – formation and characteristics 2
6. Air masses: concept, types and characteristics; Fronts, cyclones and anticyclones; Koppen's system of climate classification. 4
7. Ozone layer and its depletion 2
8. Radiation balance: Electromagnetic radiation, solar constant, energy spectrum of sun and earth, Stefan – Boltzmann law, insolation and its losses, radiation balance, albedo. 4
9. Water conservation and Management Practices, Rainwater Harvesting – Techniques of Watershed Management – Objectives, Strategies, Training of Watershed Management etc-Desert Development Programme (DDP) in India. Watershed Development in different domain, Drought Prone Area Programme (DPAP). 6
10. Sustainable Development: Concept, The Key Aspects, Strategy, Campaign, etc, Sustainable Agriculture, Forestry, etc. 2

Practical

1. Hands on measurement of dry bulb temperature, wet bulb temperature, pressure, wind speed. Calculation and conversion of these basic meteorological parameters 4
2. Psychometric Chart 6
3. Calculation of PGF, Gradient force, Heat Index and wind chill Index 2
4. Watershed management practical 4
5. Presentation on a contemporary issue. 2

EDM102: Water Quality Monitoring and Wastewater Treatment

2+1 credit (36+18 hours)

1. Types and sources of water pollution 2
2. Major Water Quality (physicochemical and bacteriological) parameters and their applications 4
3. Water use - classifications and water quality standard, Basics of water sampling Water quality objectives; major chemical, physical and biological processes required to design and manage modern drinking water and wastewater treatment plants. 6
4. Principles of coagulation, flocculation, porous media, filtration, disinfection, ion exchange, absorption 8
5. Membrane processes 4
6. Major contaminant groups and natural pathways for their removal from water 4

Practical

Estimation of pH, Hardness, Free Carbon dioxide, Acidity, Alkalinity, Chloride, BOD, COD, DO, TDS, TOC

EDM 103: Disaster Management – Legal, Institutional and Policy Framework

2+2 credit (36+36 hours)

1. **Understanding risks of disasters** - Hazards – classification of hazards - Vulnerabilities – types of vulnerabilities - Exposures - Risks - Patterns and trends of disasters at global, regional, national and local levels 2
2. **Understanding disasters** - geological disasters (earthquake, landslide, volcanoes, avalanche, tsunami) - hydro-meteorological disasters (cyclone, flood, drought, heat wave, cold wave, lightning) - biological disasters (epidemics, pandemics) - manmade disasters (industrial disasters, CBRN - complex and systemic disasters 6
3. **Framework of Disaster Management** - IDNDR, Yokohama, Hyogo and Sendai Framework for DRR - Objectives, expected outcome and strategic goals, Priorities for action - Implementation and Monitoring 2
4. **Legal and institutional framework of disaster management in India** – Disaster Management Act 2005 - NDMA, SDMA, DDMA - NEC, SEC – NIDM – NDRF- Role of other institutions – NCMC - Nodal Ministries and Departments - Armed Forces - Civil Defence - SDRF, State Police, Fire Services 4
5. **Disaster Management Policy, Guidelines, Plans and Procedures** - National Policy on Disaster Management - National Guidelines on Disaster Management - National Plan on Disaster Management - State Disaster Management Plan - District Disaster Management Plan - Relief Manuals and SOPs 4
6. **Disaster Communication System** - Early Warning of Disasters – cyclone, flood, drought, tsunami, landslide etc - Disaster communication network - NEOC, SEOC - India Disaster Resource Network 4
7. **Capacity Development Framework** - Education and Research - Training - Sensitisation programme - Awareness Generation 2
8. **Financing Disaster Management in India** - National Disaster Response Fund - National Disaster Mitigation Fund - State Disaster Response Fund - State Disaster Mitigation Fund - Finance Commission Awards - Audits of NDRF/ SDRF 2
9. **Other Stakeholders in disaster management** - Urban and Local bodies - Scientific and technical organisations - Academic and research institutions - Civil Society and NGOs - Private and Corporate sector - International and regional organisations - Religious and faith based organisations - Community based organisations – Volunteers 4
10. **Community Based Disaster Management** - Traditional role of communities in disaster management - Strength and weakness of communities - Empowering communities for effective management of disasters 2
11. **Participatory Disaster Risk Assessment** - Concept and theoretical framework - Methods and techniques - Tool kit 4

Practical

1. Application of participatory methods in disaster risk assessment- field visit, project submission 10
2. Short project on national and international disaster 8

EDM104: Environmental Toxicology –I

2+2 credit (36+36 hours)

- 1. General Principles of Toxicology: a) Basic definition and terminology.**
 - b) Importance of dose and dose response relationship.
 - c) Dose response curve and factor affecting dose response curve.
 - d) Testing adverse effects of chemicals and generating dose response data.
 - e) Risk and risk assessment
 - f) Different types of toxicity study

- 2. Major class of contaminants:**
 - a) Inorganic: Metal and metalloids, organometallic compounds, inorganic gases.
 - b) Organic contaminants: CFC, organochlorine compounds, polycyclic aromatic hydrocarbons, pesticides, herbicides etc.
 - c) Radiation: Source, nature and different type of radiation, protection and control from radiation.

- 3. Adsorption, distribution, metabolism and elimination (EDME) of toxic agents**
 - a) Passive diffusion, Filtration,
 - b) Carrier-mediated transport,
 - c) Engulfing by cell,
 - d) Gastrointestinal tract, Respiratory tract, skin, Barriers, Binding and storage organs, Urinary and biliary excretion, Lungs and other routes of excretions

- 4. Biotransformation of toxicants:**
 - a) Phase I (Degradation) reactions: Oxidation, Reduction and hydrolysis;
 - b) Phase II (Conjugation) reaction: Glucuronide formation, Sulfate conjugation, methylation, acetylation, amino acid conjugation, glutathione conjugation.

- 5. Bioactivation and bioaccumulation:**
 - a) Epoxide formation, N-Hydroxylation, free radicals and superoxide formation, Activation in gastrointestinal tract.
 - b) Factor affecting bioaccumulations

- 6. Ecological risk assessment: an overview.**

EDM105: Environmental Regulation and Standards

2+1 credit (36+18 hours)

1. **Environmental regulation and Act:** Environment (Protection) Act, Water (prevention and control of pollution) Act, Indian forest Act, Forest conservation Act, Ganga action plan and Yamuna action plan, The nation environmental tribunal Act, The national green tribunal Act, Factories Act (1948) 12
2. **Environmental standard:** Types, ambient and different industries emission standard. 6
3. **Environmental movement:** National and international case studies 4
4. ENVIS [environmental information system]: Objective of the scheme, ENVIS framework, role of the centres, monitoring mechanism. 2
5. **International guidelines and limit values of exposure:** ISO, USEPA, OSHA, ACGIH, ASHRAE, EN ISO 6
6. **Population ecology and environmental impacts:** population density, population dynamics, Logistic growth curve or sigmoidal growth curve, or dynamics curve, Exponential population growth curve, Environmental exodus and population migration 6

EDM106: Research Methodology and Statistical Technique

2+2 credit (36+36 hours)

Group A:

1. **Fundamentals of Research** 4
 - 1.1. Concepts related to Science and Research – Definitions, Aims, Characteristics, Types; Scientific research vs. Commonplace explanation
 - 1.2. Methods, Methodology, Techniques
2. **Research Problem and Design** 6
 - 2.1. Research Process: Concept, Major Steps of Research
 - 2.2. Selection and Identification of Research Problem; Research Issue, Problem, Questions, Objectives
 - 2.3. Research Design – Definitions and Concepts; Types of research design – experimental, quasi-experimental, ex-post facto
3. **Data Collection procedure** 8
 - 3.1. Tools of Data Collection: Secondary information, Observation – Participant and Non-participant, Interview, Administering written questionnaire, Focus Group Discussion
 - 3.2. Interview - Group interview, Panel interview, Focused interview, Repetitive interview;
 - 3.3. Administering Questionnaire – Typology; Procedure of questionnaire development; Pre-testing
 - 3.4. Scaling techniques - Ranking and rating scale, Thurstone's Equal Appearing Interval Scale, Likert's Summated rating Scale;
 - 3.5. Reliability and Validity of measurement – Concepts, Types, Examples
 - 3.6. Measurements – Levels of measurement, Problems of measurement
 - 3.7. Writing technical/scientific reports: Aims, Types, Format, Language

Group B:

1. Data presentation and interpretation

1.1. **Basic Probability:** definitions, event and sample space, random variable, joint and conditional probabilities, expectations.

1.2. **Sampling:** population and sample, advantages of sampling, techniques of sampling, sampling error, Optimum sample size.

1.3. **Measures of Central Tendency,** dispersion, skewness and kurtosis: mean, median, mode, range, mean deviation, quartile deviation, standard deviation - definition, properties, advantage and disadvantages, uses; interpretation and conclusion.

1.4. **Correlation and Regression:** definition, simple correlation coefficients - properties, rank correlation coefficients, partial correlation coefficients, multiple correlation coefficients, simple and multiple regression analysis, regression line - utility, interpretation.

1.5. **Presentation of data:** meaning and importance, characteristics. Data - definition, types (qualitative vs. quantitative, primary vs secondary, experimental vs. survey), variables – types (discrete vs. continuous, categorical, ordinal, time series), analysis and interpretation, presenting quantitative data - graphical presentation (bar diagram, histogram, frequency polygon, ogive, pie chart etc.); tabular presentation (univariate, bivariate, multivariate).

Practical

1. Collection of data through - Personal Interview, Group interview, Questionnaire; Attitude measurement and Scales;

2. Ranking and rating scale, scientific report writing, determination of reliability and validity

3. Familiarity with uses of computer

4. Graphical presentation (Bar diagram, histogram, frequency polygon, ogive, pie chart etc.); tabular presentation (univariate, bivariate, multivariate).

5. Measures of Central Tendency, Dispersion, Skewness and Kurtosis.

6. Correlation and Regression.

SCH 101: Spiritual and Cultural Heritage of India - I

Credit = 1 (Theory) + 0 (Practical) / Total (18 + 0) hours

- Shanti Mantras and some selected *Vedic* hymns. **(2 hours)**
 - Life of Swami Vivekananda (Journey from Narendranath Datta to Swami Vivekananda) and his speech at Parliament of Religion. **(4 hours)**
- Swami Vivekananda on India: India's eminence, Life centre, Mission and Future. **(2 hours)**
- India's decadence:
 - (a) Its Causes - We are to blame, Ignoring the past, Narrowing our outlook, Perversion of religion, Tyranny over masses Neglect of women. **(2 hours)**
 - (b) It's symptoms and Cure – Cultural heresy and fanaticism, Physical weakness, Lack of faith in ourselves etc. **(2 hours)**.
 - Essentials for Regeneration: Training Sincere Workers, Deluging the Land with Spiritual Ideals, Social Reform, Its Method. **(3 hours)**
 - Education the Panacea of all social evils: The present system, True Education, Ideal Method – Concentration and Detachment, Brahmacharya, Shraddha, Character, Communion with Nature, Gurukula system, Psychological approach, Present Need and Swami's Plan. **(3 hours)**

SEMESTER II

EDM 201: Geo- informatics Basics

2+2 credit

1. DBMS – concept, formation and management procedure;	2
2. Remote sensing: Introduction and process, Agencies and satellite system	2
3. EMR concept, EMS – associated wavelength and frequency, other atmospheric phenomena	2
4. Types of Remote Sensing, Image characteristics, orbits, swath, nadir, orbital calendar	2
5. Sensor resolutions and its types, Digital image and classification, visual image interpretation	2
6. Concepts on co-ordinate system: Map, scale, coordinate systems, sphere/spheroid, Datums, projection, projection parameters;	2
7. Overview of GIS: Introduction, components, functions and advantages, Application Areas	2
8. Raster and vector data concept, Data sources and format, data capture (raster/vector/attribute)	2
9. Image processing	6
10. Practical orientation and demonstration	14

Practical

1. DBMS – MS Access	3
2. Introduction to ERDAS Imagine; Georeferencing (3), AOI tool; Mosaicking and Subsetting, Digital image processing (3)	6
3. Visual interpretation of digital images; Map composition; import/export	3
4. Introduction with ArcGIS; Raster and vector data recognition (3), Georeferencing (6), Reprojection; digitization (3), creating Geodatabase, feature class and shapefile (3)	12
5. Thematic Map, graphs and Layout; Import and export	6
6. Preparation and submission of assignment	6

EDM 202: Environment, Health and Safety Management System
2+2 credit

1. ISO 14001 –

- a. Emergence, core-principles (continual improvement), policy, planning and implementation, Hazardous materials: Definition and classification; Material safety data sheets; Handling of hazardous materials. Regulations: Rules and regulations pertaining to the management and handling of hazardous chemicals, hazardous and solid wastes, biomedical wastes, hazardous microorganisms, E-wastes.
- b. Documentation requirements – policy formulation, targets and objectives, standard operating procedure (SOP), record keeping etc. Training requirements.

2. ISO 45001 (OSHAS 18001) –

- a. Need for integration of Safety, Health and Environment (SHE), Hazard Identification - Assessment of risk; Risk management
- b. Principles of Accident Prevention: Accident recording, analysis, investigation and reporting; Onsite and off-site emergency preparedness and response plans; rules and regulations dealing with chemical accidents.
- c. Protection from Hazardous Materials: Personal protective equipment and clothing; Fire safety; Noise and vibrations; and Principles of noise control.
- d. Hazardous Material – Storage, Disposal and Safety: Notification of sites; Safety reports; and safety audits.
- e. Documentation requirements – policy formulation, targets and objectives, standard operating procedure (SOP), record keeping etc. Training requirements.

3. International model on OHS environment

- a. Documentation requirements – policy formulation, targets and objectives, standard operating procedure (SOP), record keeping etc. Training requirements.

4. EIA (Environment Impact Assessment)

- a. Documentation requirements – policy formulation, targets and objectives, standard operating procedure (SOP), record keeping etc. Training requirements.
- b. Questionnaire design on on-site and off-site emergency plans
- c. Quantitative environmental risk analysis, safety audit and preparation of report and notification of sites

EDM 203: Pollution and Waste Management

2+2 credit

1. Air Pollution

Chemical composition of atmosphere (Classification of elements, chemical speciation, Particles, ions and radicals in the atmosphere), sources of air pollution (Natural and anthropogenic sources of air pollution), types of air pollutants (Primary and Secondary pollutants), organic and inorganic pollutants, their behavior and fate on local, regional and global scale, monitoring of criteria and non-criteria pollutants (Stack sampling (with special emphasis on isokinetic sampling), Air Quality standards. Effects of air pollutants on human health, plants, animals and materials.

2. Air pollution meteorology: Inversion conditions, Stability of the atmosphere, Long range transport, plume behavior, Air pollution dispersion.
3. Land-atmosphere-ocean interactions of air pollutants. Photochemistry of troposphere (photochemical reactions in the atmosphere), Inorganic reaction in the atmosphere. Reactions involving organic pollutants, Ozone depletion, Formation of photochemical smog, CFC, their nomenclature, sources and effect, Air pollution control technologies.

4. Solid Waste Management

Solid wastes: Definition, types, sources, characteristics, and impact on environmental health. Waste generation rates. Concepts of waste reduction, recycling and reuse. Collection, segregation and transport of solid wastes Handling and segregation of wastes at source. Collection and storage of municipal solid wastes. Solid waste processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery. Composting, Incineration of solid wastes. Disposal in landfills.

Demonstration

Practical

- | | |
|---|----------|
| 1. One day Field visit to solid waste management system | 8 Hours |
| 2. Preparation of report on field visit | 20 Hours |
| 3. Presentation of Report | 08 Hours |

EDM 204: Environmental Biotechnology and Bioremediations

1+1 credit

1. Waste water treatment with aquatic macrophytes: Concepts of aquatic macrophyte - based waste water treatment, Thin film techniques for waste water treatment using aquatic plants.
2. Anaerobic digestion: anaerobic digestion of high-solid wastes.
3. Solid waste management with vermicomposting: organic waste processing, vermiculture and vermicomposting,
4. Biofertilizer: Bacterization, green manuring, the blue green algae, algalization, *Azolla*,
5. Biological nitrogen fixation: nitrogen fixing organisms, biochemistry of nitrogenase, genetics of nitrogen fixation, symbiotic nitrogen fixation,
6. Biomass production technology: sources of biomass, crop residues (cereals, leguminous crops, sugar cane etc.), composition of plant biomass, wastes as a source of energy, (cellulose, hemicellulose and lignins), biomass conversion,
7. Tissue culture technology: Concept of tissue culture technology, Micropropagation, clonal propagation, Resistance to drought and flooding
8. Bioremediation: Types of bioremediation, use of fungi, algae and bacteria in biosorption, biodegradation of oilspills, dye stuff wastes,
9. Polymers and plastic degradation: polymer degradation, photochemical degradation, disposable synthetic polymers, polymer recycling, role of microorganisms in degradation

Practical

1. Aseptic techniques
2. Microbial culture techniques
3. Culture media preparation
4. Isolation of environmentally beneficial bacteria and morphological characterization
5. Mass production and Biofertilizer preparation
6. Basic principle of tissue culture techniques
7. Fresh culture, callus culture, embryo culture
8. Primary and secondary harnessing techniques

EDM 205: Environmental Toxicology - II

1+2 credit

1. Mechanistic aspects of human toxicology – empirical studies and recent understanding;
2. Volatile organic pollutants, PAH, other gaseous substances, Persistent organic pollutants – sources and origins, and effects on human health; methods of measurement; permissible exposure limits;
3. Pesticide residues, different categories, persistent pollutants, toxic effects of pesticides, Minimum permissible/allowable limits; xenobiotics, endocrine disruption, allowable pesticides/ban pesticides; national consumption data;
4. Risk assessment - carcinogenic and non-carcinogenic risks, principles and evaluation (use of software for area-specific prediction analysis);
5. Instrumentation for quantification of toxicological exposure.

EDM 206: Disaster Risk Reduction

2+2 credit

1. **Disaster Prevention and Mitigation** - Disaster Risk Reduction: Conceptual Issues - Risk Prevention: Concept, Strategies and Limits of Prevention - Risk Mitigation: Concept and Strategies - Structural and non-structural mitigation - Economics of Disaster Prevention and Mitigation 2
2. **Early Warning of Disasters** - Early Warning of Cyclones – Floods – Droughts – Earthquakes – Dissemination of Early Warning of Disasters 2
3. **Capacity Building for Disaster Risk Reduction** - Capacity: Concept and Issues - Capacity Development Strategies - Training and Sensitisation - Education and Research - Awareness Generation 2
4. **Earthquake Risk Mitigation** - Understanding Risks of Earthquake - Earthquake Resilient Housing and Infrastructure - Retrofitting of Lifeline Structures - Training of engineers, architects, planners and masons - Enforcement of Building Regulations 4
5. **Cyclone Risk Mitigation** - Understanding Risks of Cyclone - National Cyclone Risk Mitigation Project - Structural Measures for Cyclone Risk Mitigation - Non-Structural Measures for Cyclone Risk Mitigation - Cyclone Resilient Agriculture and Livelihood 4
6. **Flood Risk Mitigation** - Understanding Risks of Flood - Structural Measures for Flood Risk Mitigation - Non-Structural Measures for Flood Risk Mitigation - Management of Urban Flood - Trans-border Management of Flood 6
7. **Drought Risk Mitigation** - Understanding Risks of Drought - Evolution of Drought Risk Management in India - Institutional Framework for Drought Risk Management - Programmes and Schemes for Mitigating Risks of Drought - National Drought Manual 4
8. **Eco-system based Disaster Risk Reduction** - Eco-system, Human Well-being and Disasters - How can Eco-system contribute to DRR - Strategies and Tools of Eco-DRR- Eco-DRR for Flood, Cyclone and Drought 2
9. **Mainstreaming DRR in Development** - Concepts, Principles and Strategic Approach- Mainstreaming DRR in Development Sectors - Mainstreaming DRR in Project Cycle Management - Tools for Mainstreaming DRR in Development 8
10. **Future of Disaster Risk Reduction** - Patterns and Trends of DRR since 1990- Global Goals and Targets of DRR: Prospects and Challenges - Future of DRR. 2

Practical

1. One day field visit to India Meteorological Department for orientation and demonstration of early warning of disasters 8 Hours
2. Preparation and presentation of report 10 Hours
3. Visit to a flood mitigation project in West Bengal 8 Hours
4. Preparation and presentation of report 10 Hours

EDM 207: Research Methodology- Case Study & Software

2+2 credit

1. Sampling: Meaning and Significance, Types, Sampling methods, Sampling errors and biases, sample selection;
2. Elementary concept of Normal Distribution; bias and standard errors of estimates;
3. Hypothesis- Definitions, Types, Sources, Utility, and Characteristics of good hypothesis, Test of hypothesis: 'T Test', 'Chi square Test', F-test, One way ANOVA
4. Design of field experiment
5. Calculation of cost –Benefit ratio
6. Non-parametric statistics : Elementary concept
7. Time Series: components – secular trends, seasonal variation, cyclical fluctuation, irregular variation, moving average, periodic average, residual method, periodogram analysis, serial correlation, auto regression, correlogram, lag correlation.
8. Theoretical Probability Distributions: binomial, poisson, uniform, exponential, normal and gamma distributions.
9. Non-parametric tests: sign, Wilcoxon, median, run.

Practical

1. Analysis of Time Series.
2. Parameter Estimation.
3. Test of Statistical Hypotheses.
4. Non-parametric tests (sign, Wilcoxon, median, run)
5. Use of Computer in Research (Concepts only)

SCH 201: Spiritual and Cultural Heritage of India – II

Credit = 1 (Theory) + 0 (Practical) / Total (18 + 0) hours

- Selected Shlokas from Srimad Bhagavad Gita on shaping own destiny, secret of work and success, concentration of mind: Bhagavad Gita-6.5, Bhagavad Gita-6.6, Bhagavad Gita-2.3, Bhagavad Gita-2.47, Bhagavad Gita-2.48, Bhagavad Gita-6.38, Bhagavad Gita-6.35. **(3 hours)**
- Swami Vivekananda's Message on the Uplift of the Masses: Dedicate yourself; develop faith in equality and oneness of man; educate the masses, solution to the caste problem. **(3 hours)**
- Swami Vivekananda's view on caste problem and its solution: Caste is a social institution not a religious institution, Ideal of Brahmin-ness, Characteristics of noble minded man, Untouchability is form of mental disease, Uplifting all to the state of ideal Brahminhood. **(3 hours)**
- Swami Vivekananda's Message on Women's Empowerment: The ideal of woman as mother; womanhood personified in Sita; as warrior; eligibility for the highest knowledge; common humanity grounds; respecting the women; all round education of women; develop their own solutions. **(3 hours)**
- Swami Vivekananda's Message on Restoring our National Glory: India's ideal is spirituality, India's mission is spiritual regeneration of the world, India's solution to life's challenges, India must share the spiritual knowledge with the West and gain material knowledge from them, India is readying for its time under the sun. **(3 hours)**
- Swami Vivekananda's thought on Karma Yoga: Karma in its effect on character is the most tremendous power that man has to deal with, what is duty, power of purity and chastity, How to make the duty sweeter in daily life. **(3 hours)**

SEMESTER III

EDM301: Climate Change: Issues and Challenges

1+1 credit (18+18 hours)

1. Climate Change – Concepts, Issues and Science of Climate Change	2
2. Parameters and Projections of Climate Change	2
3. Extreme Climatic Events	2
4. Impacts of Climate Change	2
5. Climate Change Mitigation	2
6. Climate Change Adaptation	2
7. Climate Change Convention, Protocol and Agreements	2
8. Climate Change in India	2
9. National Missions, State Action Plans and Nationally Determined Contributions to Climate Change	2

Practical

Climate Change Related Project Work – 18 hrs

EDM 302: Risk Assessment Methodology

1+2 credit (18+36 hours)

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|--|---|
| 1. USEPA risk assessment methodology (human health risk assessment) | 2 |
| 2. Ecological risk assessment | 2 |
| 3. Dose-response assessment, No-Observed-Adverse-Effect Level (NOAEL), lowest-observed- adverse-effect level (LOAEL), reference dose (RfD), reference concentration (RfC), Slope Factor, inhalation unit risk (IUR) | 4 |
| 4. Chronic daily intake (CDI), Evaluation of Cancer risks, Noncancer risks, hazard quotient (HQ) for a single substance, hazard index (HI) for multiple substances, sensitivity analyses, Monte Carlo simulation, Mathematical problems on the determination of risk accompanying carcinogenic and noncarcinogenic contaminants, Computation of acceptable concentration | 8 |
| 5. Bio-concentration, use of bio-concentration factors | 2 |

Practical

- | | |
|---|------|
| 1. Estimation/ determination of carcinogenic and non-carcinogenic risk due to environmental hazards; primary and secondary data | 8 |
| 2. Use of SADA software | 8 |
| 3. Case studies | 18+2 |

EDM 303: Disaster Response, Recovery and Reconstruction

1+1 credit (18+18 hours)

- 1. Disaster Preparedness for Response** - Scenario building and contingency planning-
Mock drills and table top exercises - Emergency Support Functions and Coordination -
Logistics and supply chain management - Emergency Operation Centres 3
- 2. Disaster Response** - Incident Response System - Evacuation - Search and Rescue -
Emergency Health Management - Emergency Humanitarian Assistance 3
- 3. Post Disaster Need Assessment** - Rapid Damage and Loss Assessment - Post Disaster
Need Assessment 3
- 4. Disaster Relief and Rehabilitation** - Humanitarian Charter, Standard and Principles -
SPHERE Core Standards of Relief - Minimum Standards of Relief - SDRF Norms for
Disaster Relief & Rehabilitation 3
- 5. Disaster Recovery** - Early recovery and long term recovery - Inclusive recovery -
Livelihood recovery - Psycho-social recovery 3
- 6. Building Back Better** - Concept and principles of Build Back Better - Build back houses
and habitat - Build back infrastructure - Build back communities 3

Practical

1. Visit to NDRF Battalion Headquarter in Barrackpore and Emergency Operation Centre
in Nabanna for briefing 4
2. Case study on Post Disaster Response, Relief, Recovery and Reconstruction after
Cyclone Amphan in West Bengal 14

EDM304: Energy Analysis and Environmental Degradation

1+1 credit (18+18 hours)

1. Energy codes; energy audit; energy efficient product development; energy rating; EU Energy Performance of Buildings Directive (EPBD)-concept, Effect of Energy Codes on Building Design and Construction, Bureau of Energy Efficiency (BEE), BEE energy performance star rating of commercial buildings, Building Envelope, performance cost index, co-efficient of performance, energy efficiency ratio 6
2. Lighting System- selecting lighting sources (FL, CFL, LED etc.), lighting control, emergency lighting, standards (LDS, LES etc.), LENI 6
3. ANSI/ASHRAE/IES Standard energy standard 90.1-2016; EN 15193- Energy requirements for Lighting; ISO EN 13790:2008 - Energy performance of buildings (industry and residential); ISO EN 13790:2008 calculation procedures; 4
4. ISO 50001:2011, Energy management systems; Energy code Compliance evaluation (objective methods) 2

Practical

1. LENI calculation
2. Energy transfer in building envelop

EDM 305: Environment Impact Assessment

1+2 credit (18+36 hours)

1. Application of EIA in different sectors
2. Detailed documentation requirements and maintenance of data records, matrices of training, roles and responsibilities of occupier of the site, regulatory requirements, quantification and targets
3. Project development and documentation on EIA (Project work)

EDM 306: Applying Geo-informatics in environmental management

1+2 credit (18+36 hours)

1. Image classification – information class, spectral class, supervised and unsupervised classification, decision rules of supervised and unsupervised classification 6
2. Microwave remote sensing: Introduction, passive and active remote sensing, Radar imaging: frequency, polarization, viewing geometry, speckle and other features 2
3. Sensor properties, Different scanning technique, Thermal remote sensing and thermal image interpretation 2
4. Vector editing and cleaning; Geospatial analysis: raster and vector overlay, network analysis, surface analysis 6
5. Landuse - landcover change detection, mineral identification using satellite 2

Practical:

1. Unsupervised and Supervised image classification 8
2. Vector editing 2
3. Geospatial analysis 8
4. Preparation and submission of project using different techniques 3 weeks

EDM 307: Research Ethics and Advanced Orientation

1+1 credit (18+18 hours)

- | | |
|--|---|
| 1. ICMR guideline for human experiment | 8 |
| 2. Scientific conduct and publication ethics | 8 |
| 3. Philosophy of ethics | 2 |

Practical:

1. Ethical consent form
2. Style manual – (American Psychological Association etc.)
3. writing review – structuring the review, quoting/ paraphrasing, the citation referencing system

SEMESTER IV

EDM 401: Seminar I

0+2 credit

EDM 402: Seminar-II

0+2 credit

EDM 403: Research Project

0+24 credit