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INSTITUTE OF EARTH SCIENCES

ORDINANCE, SCHEME OF EXAMINATION

AND SYLLABUS

FOR

*Approved only for
current session 2012-13.
Dr. S. C. Singh
02/11/12*

B.Sc. (Hons.) Geology
2012-2013

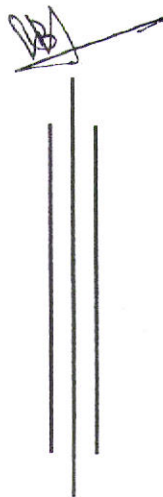
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21/11/12*

*Dr. S. C. Singh
2/11/2012*

Dr. S. C. Singh

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BUNDELKHAND UNIVERSITY

JHANSI, UP-284128

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Bundelkhand University, Jhansi

Institute of Earth Sciences Ordinance For B.Sc. (Hons.) Geology

1.(A) Eligibility for Admission :

The minimum qualification for seeking admission in B.Sc. (Hons) Geology is 10+2 or Intermediate in Science (Bio or Math Group) from any recognized Educational Board with 40% marks in aggregate.

Note - Relaxation of 5% marks will be provided to SC/ST candidates.

1 B. Intake - 40 seats.

Note - Reservation : Applicable as per norms of the State Government/University rules.

2. Duration - Minimum 3 years (maximum 6 years for completion of course).

3. Criteria of Admission -

Admission to eligible candidates will be given strictly on the basis of merit list.

Note - (a) 15% of the marks obtained in entrance test will be awarded as additional marks to all candidates who pass, the qualifying exam from any institution falling within the jurisdiction of Bundelkhand region.

(b) For courses where there is no entrance exam and admission is granted on the basis of merit of qualifying exam, 15% marks obtained in qualifying exam will be awarded as additional marks to all candidate who pass the qualifying exam from any institution / college falling with in the jurisdiction of Bundelkhand region.

4. Medium of Instruction and Examination - English.

5. Fee Structure -

(i) Tuition and other fee:

As prescribed by the University for each academic year.

(ii) Refund of fees -

(a) Request for refund of fee should be made to the Vice-Chancellor, Bundelkhand University within three weeks of deposition of the fee. On approval such candidate shall be entitled for refund of 50% of total amount deposited as fee.

(b) Request for refund of fee shall not be considered under any circumstances, if made after three weeks from the date of deposition of Admission fees.

6. Examination -

(i) Attendance: Minimum attendance required to become eligible to appear in the examination for each paper shall be 75% of all class lectures (theory and practical both).

In case a student is short of attendance due to illness, participation in sports, extra curricular activities etc the following rules shall apply.

(a). Shortage of up to 10% shall be condoned by the HOD on the specific recommendation of the class teacher.

(b). A shortage of up to 25% can be condoned by the Vice Chancellor on the specific recommendation of the Head of the Department.

(ii) Process of Evaluation

(a) Theory Papers

The semester/Annual examination for each course shall be conducted by the University as per date/schedule/program mentioned in the academic calendar of the department/university. The question papers will be set by examiners appointed by the Vice-Chancellor from the recommended list of the board of studies. The pattern of the question paper will be decided by the University. The weightage of this examination will be 100%.

(b) Practical Examination

Practical examination will be conducted by the examiners appointed by Vice-Chancellor from the recommended list of the Course Committee/Board of Studies. Each student has to maintain practical records for all practical conducted during the session/semester.

(c) Field Tour/Training

Department will organize field training program in IIIrd year and will be conducted at different geological aspects. It will carry 100 marks. Field program is compulsory and will be evaluated by internal examiners.

(iii) Qualifying marks and promotion:

The minimum passing marks shall be 40% in the aggregate. The minimum pass marks will have to be obtained by a candidate in theory, sessional and practical individually. On the basis of percentage of total marks secured in the aggregate for all years by a candidate. The division shall be awarded as follows:

- (a) Third Division: 40% or more than it but less than 50%.
- (b) Second Division: 50% or more than it but less than 60%.
- (c) First Division: 60% or more than it but less than 75%.
- (d) First Division with Distinction: 75% or more.

A candidate will be promoted to next semester/or final year if he/she has passed/cleared at least 50% of theory papers and all practical papers. The remaining theory papers (50% or less) will be cleared by a candidate/s as back papers in the next semester or next academic session.

(iv) Declaration of results and award of degree:

After completion of the evaluation process, the result will be declared by the university. The candidates declared successful may get the provisional degree from the concerned section of the university after one week of declaration of result. The original degree will be conferred to the candidate at the time of convocation.

(v) Back-paper and improvement:

In case, a candidate is able to clear at least 50% of the theory papers in annual examination, he/she will be promoted to next year with the conditions that he/she has to clear remaining 50% or less number of the theory papers as back paper/s, which shall be conducted along with the scheduled exam of back paper of the university. Such candidate will be given maximum two attempts to clear the back paper/s.

A candidate may be allowed one chance to improve his percentage in two papers only.

The improvement of percentage will be allowed in B.Sc. Ist, IInd and IIIrd year examinations.

Note -If a candidate has availed a chance of appearing in the back paper; he/she will not be allowed for improvement of his/her percentage.

(vii) Ex-Student

In case a student fails in the examination, he/she may be allowed to re-appear in the subsequent examination as an ex-student, without attending classes. He/she shall be required to appear & clear all theory papers, practical exam etc. as per course module of that course. **Marks obtained in field training program will carry forward.**

(viii) Scrutiny:

A candidate may be allowed for scrutiny only in two papers after deposition of prescribed fee.

Amendment:

Any ordinance, fee structure and eligibility are subject to amendment from time to time as decided by appropriate body of the University.

B.Sc. (Hons) Geology

I- Year Geology

Paper & Code	Name of the Paper	Total Marks
Paper – I	Physical and Structural Geology	100
Paper – II	Mineralogy, Crystallography and Optical mineralogy	100
Paper – III	Chemistry-I	100
Paper – IV	Mathematics and Computer Science-I (unified)	100
Practical I	(Paper I + Paper II) Geology	100
Practical II	(Paper III) Chemistry-I	50
Practical III	(Paper IV) Mathematics and Computer Science-I	50
Total Marks = 600 Marks, Passing Marks = 240		

II- Year Geology

Paper & Code	Name of the Paper	Total Marks
Paper – V	Petrology (Igneous, Sedimentary, Metamorphic)	100
Paper – VI	Palaeontology and Stratigraphy	100
Paper – VII	Chemistry-II	100
Paper – VIII	Mathematics and Computer Science-II	100
Practical IV	(Paper V + Paper VI) Geology	100
Practical V	Paper VII Chemistry-II	50
Practical VI	Paper VIII Mathematics and Computer Science-II	50
Total Marks = 600 Marks, Passing Marks = 240		

III- Year Geology

Paper & Code	Name of the Paper	Total Marks
Paper – IX	Engineering Geology and Hydrogeology	100
Paper – X	Remote Sensing and GIS Applications	100
Paper – XI	Economic Geology, Mining Geology and Geochemistry	100
Paper – XII	Environmental Science	100
Practical VII	(Paper IX + Paper X + Paper XI + Paper XII)	100
Field Training		100
Total Marks = 600 Marks, Passing Marks = 240		

Grand Total of I Year (600)+II Year(600)+III Year(600) = 1800 Marks
 Passing Marks = 720 Marks

Syllabus

B. Sc. (Hons.) First Year

Paper – I Physical and Structural Geology

MM:16

Physical Geology

The scope and branches of geology and its relationship with other branches of geology, solar system, origin, shape and dynamics of solid earth, age of earth, geological time scale. (1/2 Unit)

Weathering, Erosion, Denudation, Geological agents (wind, river, glacier, ocean and underground water). (1 Unit)

Earthquakes, Earth's interior, Isostasy, Volcanoes, Continental Drift, Sea Floor Spreading, Plate Tectonics, Orogeny and Mountain building process. (1 Unit)

Structural Geology

Dip and Strike, Outcrop pattern, Unconformity, Types of Unconformity and criteria for their recognition in the field, Outlier, Inlier, Overlapping, Offlapping, Rheological properties of rocks. (1/2 Unit)

Folds, Terminology and Classification of fold, Mechanism of folds, Recognition of folds, Joint and type of joints, Elementary idea about planar and linear structures. (1 Unit)

Faults, nomenclature and classification of faults, Mechanism for faulting. Thrust and related structures, Window, Klippe, Nappe. (1 Unit)

Paper – II Mineralogy, Crystallography and Optical mineralogy

MM:100

Mineralogy

Definition of Mineral, mode of occurrences, classification and physical properties of minerals. (1/2 Unit)

Physical properties, uses and chemical composition of following minerals: Garnet, Chlorite, Olivine, Epidote, Calcite, Apatite, Fluorite, Gypsum, Baryte, Beryl, Kyanite, Tourmaline, Corundum and Kaolinite. (1/2 Unit)

Description of common minerals of following groups- Silica, Feldspar, Feldspathoid, Mica, Amphibole and Pyroxene. (1 Unit)

Optical Mineralogy

Light, polarised light, critical angle, nicol-prism, defraction, introduction to polarising petrological microscope and it's working, Study of important optical properties (excluding under convergent polarised light) of minerals: Quartz, Orthoclase, Microcline, Plagioclase, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite and Tourmaline. (1 Unit)

Crystallography

Crystals and their characters: form, faces, edge, solid angle, interfacial angle and their measurement, Axial ratios and crystal parameter, Unit forms, Weiss and Miller systems of notation, Elements of symmetry, Seven crystal systems. (1/2 Unit)

Crystal studies (system type, crystallographic axes, elements of symmetry and forms present) of the following: Galena, Fluorspar, Leucite, Magnetite, Garnet, Pyrite, Zircon, Cassiterite, Vesuvianite, Baryte, Gypsum, Orthoclase, Hornblende, Axinite, Twinning: laws and type. (1/2 Unit)

Crystal systems, forms, symmetry and axes of Normal Class- Cubic system (Galena and Pyrite types), Tetragonal system (Zircon type), Hexagonal system (Beryl type), Trigonal (Calcite Type), Orthorhombic (Baryte type), Monoclinic (Gypsum type), Triclinic (Axinite type). (1 Unit)

Practical (Paper I and II) Geology

MM:100

Study of structural modal and problems, Study of Geological maps, Study of Minerals in hand specimens, Study of minerals and texture in thin section, Study of Crystal Modals.

Paper III Chemistry-I

MM:100

Atomic Structure, Properties of elements, Ionisation Potential, Electro Negativity, Electron Affinity, Magnetic Properties of elements, Bond (Ionic, covalent, co-ordinate, vanderwalls), Hydrogen bonding, properties of covalent, co-ordinal compound, VBT, MOT, Hybridisation, VSEPR, Structure of H_2O , NH_4 , SiF_4 . (1 Unit)

Solid State Chemistry: Unit cell, Bragg's equation, Crystal structure, Lattice energy, Crystal defect. Symmetry of elements. (1 Unit)

Electro Chemistry: EMF, Standard emf. Galvanic cell, Electrodes and their type, Electro chemical Series and their application. (1 Unit)

Periodic Table: Modern periodic table, their properties, period, group and their detail study, s p d & f elements, Lanthanide, Actinides. (1 Unit)

Co-ordination Chemistry: Classification, Nomenclature of co-ordination compounds. Werner's theory, effective atomic number. (1 Unit)

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Practical

Titration, Determination of Surface tension, Viscosity, Radicals, Functional group with measurement of boiling points, Elemental detection. MM 50

Paper IV Mathematics and Computer Science-I

MM:100

Fundamentals of Computer

UNIT – I History and Concepts

Brief history of development and generation of computers, Computer system concepts, hardware and software, Computer system characteristics, Capabilities and limitations, Types of computers-Analog, Digital, Hybrid, General, Special Purpose, Micro, Mini, Mainframe, Super Computers. Personal Computer (PCs), Types of PCs- Desktop, Laptop, Notebook, Palmtop, Workstations Tablets etc. & their characteristics.

Number System: Binary, Octal, Hexadecimal number systems, their conversions and basic arithmetic. (1 Unit)

UNIT – II Basic components of a computer system

CPU: Processor, Mother Board Control unit (CU), Arithmetical & Logical Unit (ALU)

Input / Output units: Keyboard, Mouse, Trackball, Joystick, Digitizing tablet, Scanners, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen, Monitors, Printers - Daisy wheel, Dot Matrix, Inkjet, Laser, Line Printer, Plotter, Sound Card and Speakers,

Memory: Primary-RAM, ROM and other types of Primary memory. Secondary-Floppy Disc, Hard Disc, CD, DVD, Pen Drive, Zip Drive, storage units (Bits, Nibble, Bytes, KB, MB, GB, TB) (1 Unit)

UNIT – III Software

Types of Software: System software, Application software

System Software: Operating System, Utility Program, Programming languages.

Application Software: Word-processing, Spreadsheet, Presentation, An introduction to MS-Word, MS-Excel and MS-Power Point. (1 Unit)

UNIT – IV Operating System

Fundamentals of Operating Systems: Functions, Types, CUI and GUI.

Concepts of Windows Operating System: Windows Explorer, Desktop, Task Bar, Icon, Recycle bin, My Computer, Windows Accessories, Short Cut Commands etc. (1 Unit)

UNIT-V Networks and Internet

Analog and Digital Signals, Modulations - Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM), Types of Computer Networks: LAN, MAN and WAN, Types of Connections - Dialup, Leased Lines, ISDN, VSAT, Internet: Websites, Web Browsing, Net Surfing, E-mail, Chatting, Search Engines. (1 Unit)

Practical

Word Processing

Introduction to word Processing, Word Processing Concepts and use of templates

Working with word document:

Opening an existing document/ creating a new document, Saving, Selecting text, Editing text, Finding and replacing text, Closing, Formatting, Checking and correcting spellings, Bullets and numbering, Tabs, Paragraph formatting, Indent, Page formatting, and Header and Footer.

Mail Merge

Tables, Formatting the table, Inserting filling and formatting a table

Spreadsheet and its Business Applications

Spreadsheet concepts, Creating a work book, Saving a work book, Editing a work book, Inserting, deleting work sheets, Entering data in a cell, Formula copying, Moving data from selected cells, Handling operators in formulae, Rearranging Worksheet, Project involving multiple spreadsheets, Organizing charts and graphs and Printing worksheet.

Generally used Spread sheet functions

Mathematical, Statistical, Financial, Logical.

Creating spreadsheet in the following areas

Loan & Lease statement, Ratio Analysis, Graphical representation of data, Payroll statements, Frequency distribution and its statistical parameters

Introduction to Internet

Meaning of Internet, Basic Internet Terminology, World Wide Web and e-mail, Usage of Internet to society, Social Networking and Search Engines.

Some Windows Command.

B. Sc. (Hons.) Second Year

Paper – V- Petrology (Igneous, Sedimentary, Metamorphic)

MM:10

Igneous Petrology

Igneous rocks, their structures and forms; geological occurrences; classification, texture and micro-structure of Igneous rocks, Magma and its character, Origin and crystallization of magma. (1 Unit)

Binary system, Bowen Reaction principal, Texture, Structure, mineral composition and mode of occurrence of granite, granodiorite, diorite, pegmatite, rhyolite, syenite, trachyte, gabbro, basalt, dolerite, phonolite, monzonite, dunite, peridotite rocks. (1 Unit)

Sedimentary Petrology

Nature and origin of sedimentary rocks, Texture, structure and classification of sedimentary rocks; Mineralogical composition, texture and geological occurrences of shale, arenite-sandstone, graywacke, arkose, conglomerate, braccia, limestone, dolomite rocks. (1 Unit)

Metamorphic Petrology

Important metamorphic texture, nomenclature of metamorphic rocks, metamorphic agents, grade and zone of metamorphic rocks, ACF, AKF and AFM diagrams, Facies concept and classification of facies. (1 Unit)

Texture, structure and significance of important metamorphic rocks: schist, gneiss, hornfels, phyllite, Blue schist, eclogite, charnockite, khondalite, amphibolite and marble. (1 Unit)

Paper – VI Palaeontology and Stratigraphy

MM:100

Palaeontology

Mode of fossilisation and preservation of fossils. Importance of fossils. Brief concept of nomenclature of species, Index Fossils. (1 Unit)

Morphology, geological history, classification and evolutionary trend of Foraminifera, Gastropoda, Cephalopoda, Bivalvia, Brachiopoda and Echinoidea. (1 Unit)

Fossil records of Gondwana Super group. (1/2 Unit)

Stratigraphy

Evolution of stratigraphic classification, code of stratigraphic nomenclature, Correlation of Lithostratigraphy, Biostratigraphy and Time Stratigraphic Unit, Distribution of micro-organisms in space and time and their role in stratigraphy. (1 Unit)

Study of important stratigraphic Units of India (Dharwar, Delhi, Vindhyan, Cuddapah, Gondwana, and Siwalik), Bundelkhand Complex. (1+1/2 Unit)

Practical

Study of Rocks in hand specimens, Petrography of important rocks, Identification of Fossils, Identification of Stratigraphic rocks.

Paper – VII Chemistry II

MM:100

Basic Concepts: Chemical concentrations-Calculations in grams and moles, Solutions and their concentrations. Preparing solutions: standard solutions, primary standards, secondary standards.

Errors in chemical analysis: Significant figures, Types of errors, Accuracy and Precision, Absolute and relative uncertainty, Mean and standard deviation, Statistical tests of data (the F test, the t test, Q test for bad data). (1 Unit)

Laboratory Operations: Description and use of common laboratory apparatus: Volumetric flasks, burettes, pipettes, meniscus readers, weighing bottles, different types of funnels chromatographic columns, chromatographic jars, desiccators, drying ovens, filter crucibles, rubber policeman. Calibration and use of volumetric glass ware. (1 Unit)

Practical Analytical Chemistry: Use and calibration of volumetric equipment (volumetric flasks, pipette's and burette's). Preparation of standard solutions of acids and bases, Estimation of sodium carbonate by titrating with hydrochloric acid, Estimation of magnesium using EDTA. Use of pH meter: Determinations of pH of given dilute solutions of shampoos and soaps. Titration of acid-base using pH meter. (1 Unit)

Quantitative methods of analysis: Gravimetric analysis Precipitation methods, Properties of precipitates and precipitating reagents, particle size, filterability of Precipitates (factors that determine particle size, formation of precipitates and particle size). Colloidal Precipitates (coagulation of colloids, peptization of colloids, treatment of colloidal precipitates), Co-precipitation, Drying and ignition of precipitates. (1 Unit)

Titrations: Definitions Titrimetry, Volumetric titrimetry, Gravimetric titrimetry, Redox titrations, Complexometric titrations. Centrifugation methods- Introduction, Sedimentation and relative centrifugal force,

Different types of rotors, Density gradient and Types of centrifugation techniques. Introduction to Environmental Analysis- Sampling method, Environmental pollution from industrial effluents and radiochemical waste. Introduction to water and waste analysis. (1Unit)

Practical

MM 50

Double Titration, redox titration, complexometric titration, estimation of Ba as BaSO₄, identification of given organic compound.

Paper – VIII Mathematics and Computer Science-II

MM:100

Programming and Graphics

Program Concept, Characteristics of Programming, and Various stages in Program Development Programming aids Algorithms, Flow Charts - Symbols, Rules for making Flow chart, Types of flowchart, Advantage & Disadvantage, Pseudo codes, Decision Table, Programming techniques & tools Programming Techniques – Top down, Bottom up, Modular, Structured - Features, Merits & Demerits, Comparative study, Programming Logic- Simple, Branching, Looping, Recursion, Cohesion & Coupling, Programming Testing & Debugging & their Tools. (1Unit)

Introduction & features of C, Structure of C program, Variables, Expressions, Identifiers, Keywords, Data Types, Constants, Operator and expression Operator: Arithmetic, Logical, Relational, Conditional and Bit wise Operators, Precedence and Associativity of Operators, Type conversion in expression, Basic input/output and library functions Single character input/output i.e. getch(), getchar(). getche(), putchar(),Formatted input output i.e. printf() and scanf(), Library functions - concepts, Mathematical & Character functions. (1Unit)

If statement, If....Else statement, Nesting of If....Else Statement, else if ladder, The ?: operator, goto statement, Switch statement, Compound statement, Loop controls, for, while, do-while loops, break, continue, goto statement, ARRAYS Single and Multi Dimensional arrays, Array declaration and initialization of arrays, Strings : declaration, initialization, functions. (1Unit)

Computer Graphic Applications, Display Devices, Raster Scan Devices, Input Devices for Interactive graphics, Programmer Model of Interactive Graphics System. (1Unit)

Basic concept of Digital Image Processing, Image formation, Image Enhancement, Image Segmentation, Image Restoration and Image Recognition. (1Unit)

Practical

Some General "C" programs such as adding, subtracting, finding odd or printing, printing prime numbers, Fibonacci Series, printing * in pyramid form, Matrix addition and Multiplication etc.

By using C Language draw and Draw small graphics

Image Processing- Coral draw and Photoshop.

Some simple geological examples programs MS Office (MS word, Power Point Presentation, Photo Shop) and Application of Internet. Application of Excel, Graphics (Origin), Coral draw and Internet surfing.

B. Sc. (Hons.) Third Year

Paper – IX Engineering Geology and Hydrogeology

MM: 1

Engineering Geology

Engineering geology and its importance in contact to planning, design and construction of projects. Various engineering properties of rock i.e., specific gravity, porosity, absorption value, compression strength, tensile strength, shear strength, modulus of elasticity and modulus of compression etc. (1 Unit)

Classification of Dams reservoirs, geological and geotechnical consideration for dam site, terminology and purpose of dams. Role of geological studies in selection of tunnel sites, highways and bridges (1 Unit)

Classification of landslides, Natural and anthropogenic factors responsible for landslides, Corrective measures construction materials and its uses. (1/2 Unit)

Hydrogeology

Surface runoff, Hydrological cycle, porosity, permeability, Darcy law, Burnaully theory. (1/2 Unit)

Utilization and scope of groundwater studies. Groundwater in the Hydrogeological cycle, Vertical distribution of groundwater, rock properties effecting groundwater. (1 Unit)

Geological formations as aquifers, type of aquifers and springs and artesian well. (1 Unit)

Paper – X Remote Sensing & GIS Applications

MM: 100

Concepts and principles of aerial photography and photogrammetry, types of films, scale, mosaics, stereoscopy, vertical exaggeration and depth perception. (1 Unit)

Elements of aerial photo-interpretation; photographic tone, texture, shape and size of objects etc, interpretation of different types of rocks, Drainage pattern, landforms, Geological structures, Ground water survey, and Mineral exploration. (1 Unit)

An introduction to Remote Sensing: electromagnetic spectrum, radiation laws, remote sensing observation platforms and sensors. (1 Unit)

Satellites programmes and their characteristics: Landsat, Seasat, Meteosat, SPOT, and IRS series etc. False colour composites, characteristics of infrared, thermal infrared and Radar images. (1 Unit)

An introduction to Geographical Information Systems (GIS) and Global Positioning System (GPS)- principles, components and their applications. (1 Unit)

Paper – XI Economic Geology, Mining Geology and Geochemistry

MM: 100

Economic Geology

Historical introduction to economic geology, Definition of ore, Structure and Form of ore deposits, Control of ore deposition, Process of formation and transformation of ores: Endogenous, Magmatic, Pegmatitic, Contact metasomatic and hydrothermal deposits, Exogenous: Sedimentary, residual and mechanically concentrated deposits. (1 Unit)

Introduction to coal and petroleum and distribution in India, Distribution and mode of occurrence of important metallic minerals (Iron, Base metal, Aluminium, Gold) in India. (1 Unit)

Mining Geology

Introduction and common terminology in mining, Elementary concept and important factors for mining, Different type of opencast and underground mining methods. (1 Unit)

Geochemistry

Abundance of elements in the cosmos and earth, composition of earth with special reference to the upper mantle and the crust, Goldschmidt's geochemical classification and differentiation of earth, Geochemical cycle and Basic ideas about Meteorites. (1 Unit)

Geochemical characteristics of Magma, importance of isotopes, Isomorphism, Polymorphism, weathering and soil formation, elemental mobility in surface environment, Surface and ground water chemistry. (1 Unit)

Paper – XII Environmental Science

MM 100

Unit 1: The multidisciplinary nature of environmental studies (2 lectures): Definition. Scope and importance, Need for public awareness

Unit 2: Natural Resources: Renewable and non-renewable resources (8 lectures): Natural resources and associated problems.

a. Forest resources: Use and over – exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

- b. Water resources: Use and over utilization of surface and ground water. Floods, drought, conflicts over water, dams benefits and problems.
- c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d. Food resources: World food problems, changes caused by agriculture and over grazing effects of modern agriculture, fertilizer, pesticide problems water logging, salinity, case studies
- e. Energy resources: Growing energy needs renewable and non-renewable energy sources, Use of alternate energy sources, case studies.
- f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems (6 lectures): Concept of an ecosystem; Structure and function of an ecosystem; Procedures, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction types characteristic features, structure and function of the following ecosystem- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: Biodiversity and its conservation (8lectures): Introduction- Definition: genetic, species and ecosystem diversity; Biogeographically classification of India; Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. (1 Unit)

Unit 5: Environmental Population (8 lectures): Definition; Causes, effects and control measures of- a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Thermal pollution, g. Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial Wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Unit 6: Social Issues and the Environment (7 lectures): From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case studies; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents; and holocaust. Case studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and control of Pollution) Act; Water (prevention and control of pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Unit 7 : Human Population and the Environment (6 lectures): Population growth, variation among nations; Population explosion -Family welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child welfare; Role of Information Technology in Environment and human health; Case studies.

Unit 8: Field work: Visit to a local area to documents environmental assets - river/forest/grassland/hill/Mountain; Visit to a local polluted site- Urban / Rural / Industrial / Agricultural; Study of common plants, insects, birds; Study of simple ecosystems - pond, river, hill slopes etc. (Field work Equal to 5 lecture hours.).

Practical VII (Paper IX, X, XI XII)

MM: 100

Geological history and comments on Engineering problem, Study of hydrological maps.
 Drainage analysis, Geomorphological models, study of seismic zones and flood prone areas in India, Photogeology, geological interpretation of photographs and satellite imageries.
 Identification of economic minerals, megascopic and microscopic identification of ore minerals, measurement of vertical and true thickness of coal seams.
 IUGS classification of igneous rocks based on chemical composition, preparation of A and B solution and determination of SiO₂, Al₂O₃.

Field Training

MM: 100

A Field Training Program to understand geological and structural mapping.