P.G. Diploma in Watershed Technology and Management **Prospectus No. 20131239**

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

PROSPECTUS
OF
P.G. DIPLOMA IN WATERSHED TECHNOLOGY AND MANAGEMENT

2012

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Price Rs. /-

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D.K.Joshi
Registrar
Sant Gadge Baba
Amravati University
Amravati-444602

SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/ provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Inprovement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments

Ordinance No. 19	:	Admission of Candidates to Degrees.
Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.
Ordinance No. 138	:	For improvement of Division/Grade.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

D.K.Joshi
Registrar
Sant Gadge Baba Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be boradly based on the following pattern.

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.

(5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

% Ordinance No. 8 of 2009

Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Ordinance, 2009.

Whereas it is expedient to frame an Ordinance in respect of Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Ordinance, 2009, for the purposes hereinafter appearing the Management Council is hereby pleased to make the following Ordinance.

1) This Ordinance may be called "Examinations leading to the Post Graduate Diploma in Watershed Technology and Management[Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Ordinance, 2009."

2) This Ordinance shall come into force w.e.f. the date of its approval by the Management Council.

3) Following shall be the Examinations leading to the Post-Graduate Diploma in-

   (i) Post Graduate Diploma in Watershed Technology and Management, Semester-I-Examination

   (ii) Post Graduate Diploma Watershed Technology and Management, Semester-II-Examination

4) Duration of each of the above semester shall be six months with an examinations at the end of each semester.

5) (i) The examinations specified in paragraph 3 above shall be held twice a year at such places and on such dates as may be appointed by the Board of Examinations.

   (ii) Main Examination of Semester-I shall be held in Winter and Supplementary Examination in Summer.

   (iii) Main Examination of Semester-II shall be held in Summer and Supplementry Examination in Winter.

6) Subject to his/her compliance with the provisions of this Ordinance and other Onrdinances in force from time to time following candidates are eligible for admission to the Post-Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year(Full Time) P.G.Diploma Course]:- M.Sc.(Geology) or M.Sc.(Tech.) Geophysics or M.Sc. Earth System Science or M.Sc. Remote Sensing and GIS or M.Sc.(Tech.) Applied Geology or M.Sc. Geoinformatics or M.Sc. Environmental Science or M.A.,M.Sc. Geography or B.Tech./ B.E. Remote Sensing/Civil Engineeing/Water Resources.

% As approved by M.C. Dt.21/4/2009, vide item No. 114. and amended wide ordinance No.7 of 2010

7) Subject to his/her compliance with the provisions of this Ordinance and of other Ordinances (Pertaining to examination in General) in force from time to time, the applicant for admission to examination at the end of the course of study of a particular Semester shall be eligible to appear at it, if: (i) He/She satisfied the condition in the table and the Provision there under:-

TABLE

Sr. No.	Name of examination	The student should have completed the term satisfactorily	he student should have passed following examination
1.	2.	3.	4.
1.	Diploma in Watershed Technology and Management Semester-I	Semester-I	As indicated in Para 6
2.	Diploma in Watershed Technology and Management Semester-II	Semester-II	————

(**Note:-**Subjects prescribed and numbered in the scheme of Examinations shall be treated as separate subjects, however, the theory and practical, if any, of the subject shall be treated as separate Head of Passing.)

   (ii) He/She has complied with provisions of Ordinance pertaining to Examination in general.

   (iii) He/She has prosecuted a regular course of study in University Department/College affiliated to the University.

   (iv) He/She has in the opinion of the Head of the Department/ Principal, shown satisfactory progress in his/her studies.

8) Papers and the Practicals in which an examinee is to examined, maximum marksfor these and the minimum pass marks which an examinee must obtain in order to pass in the subject and the examination are declared in the Examination Scheme appended herewith as Appendix-A with this Ordinance.

9) Examination fees for each semester of the examination and also the practical examination shall be as prescribed by the University from time to time.

10) An examinee who is successful at Semester-I, Semester-II examination under this Ordinance and who obtained 75% or more marks in aggregate of Semester-I, Semester-II Examinations shall be placed in the First Division with Distinction, those obtaining 60% or more but less than 75% shall be placed in the First Division and all other successful examinees shall be placed in the Second Division.

11) (i) Scope of the subjects shall be as indicated in the syllabus

(ii) Medium of instruction shall be English.

12) Provision of Ordinance No. 18 of 2001 relating to an Ordinance to provide grace marks for passing in a head of passing and Improvement of Division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No. 18 and of Ordinance No.10 relating to Providing for Exemptions and Compartments shall apply to the examination under this Ordinance.

13) An examinee who does not pass or who fails to present himself/ herself for the examination shall be eligible for readmission to the same examination on payment of fresh fees and such other fees as may be prescribed.

14) As soon as possible after the examination, the Board of Examinations shall publish a result of the examinees. The result of the examination shall be classified as above and merit list shall be notified as per Ordinance No. 6.

15) Notwithstanding anything to the contrary in this Ordinance no one shall be admitted to an examination under this Ordinance, if he/she has already passed the same examination or an equivalent examination of any Statutory Univversity.

16) Examinees who have passed in all the subject prescribed for Semester-I, Semester-II of the examination of the Diploma course shall be eligible for award of the Post-Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course].

APPENDIX-A

POST GRADUATE DIPLOMA COURSE IN WATERSHED TECHNOLOGY AND MANAGEMENT

ONE YEAR POST GRADUATE DIPLOMA COURSE - SEMESTER PATTERN

T - THEORY
P- PRACTICAL
PW-PROJECT WORK

Sr. No.	Sub. Code No.	Subject	Teaching Scheme			Examination Scheme							Total
			T	P	Total Periods / Week	Theory				Practical			
						Duration of Papers (Hrs)	Max. Marks Theory Papers	Total	Min. Pass Marks	Max. Marks	Total	Min. Pass Marks	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Semester-I											
1	1T1	Fundamentals of Geology and Watershed	5	-	5	3	50	50	20	--	--	--	50
2	1T2	Advanced Remote Sensing in Geosciences and GIS	5	-	5	3	50	50	20	--	--	--	50
3	1T3	Exploration Geochemistry and Geophysical Exploration	5	-	5	3	50	50	20	--	--	--	50
4	1T4	Introduction to Watershed Technology and Management	5	-	5	3	50	50	20	--	--	--	50
5	1P1	Remote Sensing and GIS applications in Water resource Technology and Management	--	--	--	--	--	--	--	25	25	12.	25
6	1P2	Geochemical and Geophysical Exploration and Hydrogeology	--	--	--	--	--	--	--	25	25	12.	25
		Semester-II											
1	2T1	Basic of Information Technology and Digital Image Processing	5	-	5	3	50	50	20	--	--	--	50
2	2T2	Advanced Hydrogeology	5	-	5	3	50	50	20	--	--	--	50
3	2T3	Remote Sensing in Water Resource Management	5	-	5	3	50	50	20	--	--	--	50
4	2T4	GIS Applications in Natural Resources and Management	5	-	5	3	50	50	20	--	--	--	50
5	1P3	Remote Sensing interpretation in water resources	--	--	--	--	--	--	--	25	25	12	25
6	1P4	Project Report*	--	--	--	--	--	--	--	25	25	12	25

PROJECT WORK :- * Each student should undertake project work allotted by the concern teacher with prior approval of the Head of the Department in a given area pertaining to Watershed Management. Each student will be responsible for assessing the characteristics of at least one watershed and shall submit project report by the end of Semester-II.

Sang Gadge Baba Amravati University, Amravati
DIRECTION

No. : 20 / 2011 Date : 20.5.2011

Subject : Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, (Amendment), Direction, 2011.

Whereas, Ordinance No.8 of 2009 in respect of Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Ordinance, 2009 is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 30.3.2011 vide item No.24 (7) D) R-2 has resolved to accept for addition in eligibility criteria for admission to P.G. Diploma in Watershed Technology and Management and the Council further resolved to refer the matter to Ordinance Committee for amending the respective Ordinance.

AND

Whereas, the matter relating to amendment in eligibility criteria for admission to P.G. Diploma in Watershed Technology and Management is required to be regulated by an Ordinance.

AND

Whereas, making amendments in Original Ordinance No.8 of 2009 is likely to take some time.

AND

Whereas, the admission to student for P.G. Diploma in Watershed Technology and Management course are to be made in the Academic Session 2011-12.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called " Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, (Amendment), Direction, 2011".
2. This direction shall come into force from the date of its issuance.
3. The students passing B.Tech.in Agriculture Engineering and M.Sc. Agriculture shall be eligible for admission in the course of Post Graduate Diploma in Watershed Technology and Management.

Sd/-
Amravati (Dr.Mohan K.Khedkar)
Date : 19./5/2011 Vice-Chancellor

Sang Gadge Baba Amravati University, Amravati
DIRECTION

No. : 18 / 2012 Date : 20/4/2012

Subject : Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Direction, 2012.

Whereas, Ordinance No.8 of 2009 in respect of Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Ordinance, 2009 is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 13.1.2012 vide item No.14 (5) D) R-2 has resolved to accept the revised syllabi of P.G. Diploma in Watershed Technology and Management.

AND

Whereas, the Academic Council further resolved to refer the matter regarding changes in the title of the paper in the scheme of examination to Ordinance Committee for amending the Ordinance.

AND

Whereas, making amendments in Original Ordinance No.8 of 2009 is likely to take some time.

AND

Whereas, the syllabi for the Session 2012-13 has to be sent for printing and the admission to student for P.G. Diploma in Watershed Technology and Management course are to be made in the Academic Session 2012-13.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called " Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G. Diploma Course] in the faculty of Science, Direction, 2012".
2. This direction shall come into force from the date of its issuance.
3. In Appendix-A, appended to Ordinance relating to Examinations leading to the Post Graduate Diploma in Watershed Technology and Management [Semester Pattern.....One Year (Full Time) P.G.

Diploma Course] i.e. Original Ordinance No.8 of 2009, following corrections shall be carried out.

i) under the column No.3 of subject, the subject title of papers No.2 and 3 be substituted as "Remote Sensing in Geosciences and **GIS**" and "Ground Water Hydrology and Geophysical Exploration" respectively.

ii) the notes printed under Appendix-'A' regarding 'PROJECT WORK' shall be substituted as given below-
PROJECT WORK :- * Each student should undertake PROJECT WORK allotted by the Head of the Department in a given area pertaining to Watershed Management. Each student will be responsible for assessing the characteristics of at least one watershed and should submit Project Report (Two copies) by the end of Semester Second.

Sd/-

Amravati
Date : 19/4/2012

(Dr.Mohan K.Khedkar)
Vice-Chancellor

*****

Syllabus Prescribed for
P. G. Diploma in Watershed Technology and Management
First Semester

Theory		**Marks**
Paper I	Fundamentals of Geology and Watershed	50
Paper II	Remote Sensing in Geosciences and GIS	50
Paper III	Groundwater Hydrology and Geophysical Exploration	50
Paper IV	Introduction to Watershed Technology and Management	50
Practicals		
Practical I	Remote Sensing and GIS applications in Water Resource Technology and Management.	25
Practical II	Geochemical, Geophysical Exploration and Hydrogeology	25
		Total – 250

Second Semester

Theory		**Marks**
Paper V	Basics of Information Technology and Digital Image Processing	50
Paper VI	Advance Hydrogeology	50
Paper VII	Remote Sensing in Water Resource Management	50
Paper VIII	GIS Applications in Water Resource Management	50
Practicals		
Practical III	Remote Sensing interpretation in Water Resources	25
Practical IV	Project Report*	25
		Total – 250
		Grand Total - 500

Project Work

* Each student should undertake Project Work allotted by the Head of the Department in a given area pertaining to Watershed Management. Each student will be responsible for assessing the characteristics of at least one watershed and should submit Project Report (Two copies) by the end of Semester Second.

FIRST SEMESTER
Theory

Paper I
Fundamentals of Geology and Watershed

Unit-I : **Introductory Geology:** Geological time scale. A brief history of the earth through geological time. Rock as a aggregate of minerals. Types of rocks – Igneous, Sedimentary and metamorphic. Main geological formations of India as Water bearing strata.

Unit-II : **Geomorphology :** Geomorphic processes, endogenic and exogenic. Geological agents, their erosional and depositional activities. Brief introduction to types of landforms. Classification of valleys – drainage pattern and their significance. Morphometric and hypsometric analysis of drainage basin

Unit-III : **Earth System:** Atmosphere, hydrosphere and lithosphere. Idea about the age and interior of the Earth. Weather and Climate, types of rainfall distribution. Recording of rainfall, rain gauge, methods of determining mean areal depth of rainfall.

Unit IV : **Watershed** – Objectives of watershed development, need, integrated and multidisciplinary approach for watershed management. Watershed – definition, significance, delineation. Characterization and identification of watershed. Watershed characteristics, causes of deterioration. Socio-economic characteristics, basic data of watershed. Principal factors influencing watershed operation.

Unit- V : Irrigation water management- crop selection, depth and frequency application of water irrigation schedules. Water use of efficiency, Water conveyance and application methods – lined and unlined canals, control and diversion structures in field channels and drains, their design. Drip and sprinkler irrigation systems. Drainage – causes of water logging, design of surface and subsurface drains, saline and alkaline lands. Reclamation and management of salt affected lands.

Paper – II
Advanced Remote Sensing in Geo-Sciences and GIS

Unit – I : Elements of photogrammetry, Aerial photo-interpretation techniques, recognition of photo-elements and terrain elements, landform characteristics, erosion behavior of rocks and soil material, vegetation characteristics, land use and associations.

Unit- II : Physics of Remote Sensing, Electromagnetic radiation – characteristics, remote sensing regions and bands, microwave and thermal remote sensing, general orbital and sensor characteristics of remote sensing satellites; Spectra of common natural objects – soil, rock, water and vegetation, Indian Remote Sensing Satellite, Remote Sensing techniques in geo-sciences, Visual interpretation of satellite images.

Unit-III : Photo-interpretation of structural and landform elements, tectonic features, Interpretation of lithology, rock types, Geomorphologic mapping and terrain evaluation, terrain classification, terrain mapping by remote sensing.

Unit IV : Remote sensing applications in interpreting geomorphology, structure and tectonics. Lithological mapping, groundwater potentials and environmental monitoring. Study of soils and relationship of rock type and geomorphology to various types of soils, soil mapping, land use and land cover mapping.

Unit V : Geographic information System – Principals and components, data presentation, Vector and raster methods, database design and structure and analysis, Digital elevation model. Remote sensing data integration with GIS, applications of GIS in various watershed studies.

PAPER – III
Groundwater Hydrology and Geophysical Exploration

Unit – I : Role of groundwater in the hydrological cycle; Controls of geology on groundwater occurrence and distribution; Classification of aquifers and aquifer systems, geological formations as aquifers, types of aquifers. Mode of occurrence of groundwater in different geological terrains of India.

Unit II : Darcy's law, Porosity, Permeability, Hydraulic conductivity, transmissivity, storage coefficient, specific coefficient, specific yield, specific retention. Water table contour maps. Groundwater fluctuation map.Groundwater quality map.

Unit-III : Groundwater exploration. Geological and surface geophysical methods for the selection of suitable site for well construction. Type and design of wells, methods of well construction, well completion and well development .

Unit-IV : Geophysical Exploration - Resistivity method: basic principles, types of electrode configuration, field procedure, profiling and sounding, application of electrical methods in ground water prospecting. Interpretation of data and applications.

Unit-V : Seismic methods - principles of wave propagation, refraction and reflection surveys for single interface. Seismic velocity and interpretation of seismic data in water exploration / Hydrocarbon. Well logging methods - electrical logging, Resistivity logging, Self potential logging and its application in groundwater exploration.

Paper – IV
Introduction to Watershed Technology and Management

Unit – I : Basics for watershed Management, Watershed problems (water supply/quality/flooding, etc.) Goals/objectives, Stakeholders (governmental/environmentalists), Watershed managements practices, Policies, and coordination.

Unit –II: Mitigating measures for watershed harvesting- Rainwater harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks. Measures to control erosion – counter trenching, plouging, furrowing, trenching, bunding, terracing, gully control, rock fill dams, brushwood dams, and gabion.

Unit-III : Land use / land cover management, crop pattern management. Forest, agriculture, grassland and wasteland management. Soil enrichment. Inter, mixed and strip cropping pattern. Sustainable agriculture, dry land agriculture. Social forestry and aforestation.

Unit IV : Soil and Water Conservation - Soil and water conservation practices. Water Conservation – Conservation measures, gully control, terracing, building check dams, reclamation of soils, a forestation. Water harvesting, rainwater harvesting, roof water harvesting, artificial recharge.

Unit-V : GIS as a watershed tool for developing a watershed management plan, GIS delineation of watershed, Development of a watershed Management plan, activity, people participation, preparation of action plan, administrative requirements.

Practical - I
Remote Sensing and GIS Application in Water Resource Technology Management

Interpretation of aerial photographs and satellite imageries: resolution mosaics symbols, gully pattern and drainage analysis, vertical exaggeration and image distortion. Exercise on Photographs and

imageries for geological and geomorphologic mapping, geo-resources (vegetation, water and mineral) evaluation. Study of water recourses, environmental hazard maps, Exercise on ground water exploration using remote sensing techniques and preparation of theme based maps, pre-field interpretation and field checks.

Practical – II
Geochemical, Geophysical Exploration and Hydrogeology

Calculation of mineral formulae from concentration of oxides in minerals, calculation of weathering indices in soil and sediment, presentation and interpretation of analytical data, electrical Resistivity sounding for delineation of fresh and saline aquifers, Field exercise of electrical Resistivity survey, collection of Resistivity data, plotting and interpretation. Delineration of hydrogeological boundaries on water table contour maps, estimation of permeability, analysis and interpretation of hydrographs and estimation of infiltration capacity. Chemical analysis of groundwater, pumping tests; time draw down and time tests, evaluation of aquifer parameters.

Seminar, assignment and field visit to different watersheds.

SECOND SEMESTER
Theory

Paper V
Basics of Information Technology and Digital Image Processing

Unit-I : Computers :Components – CPU, Input devices , key-board, floppy, scanner, CD ROM, output devices, Monitor, printer, and plotter, Operating system : DOS Windows, Unix, Local Area Network, file management, function keys.

Unit-II : Information Technology: Communication- types- evolution- significance of communication in the modern world - global village and information revolution.

Unit-III : Internet and World Wide Web browsing- advantages and limitations in information revolution- Computer viruses and management, multimedia; tools, applications- graphic effects and techniques.

Unit-IV : Study of digital image processing system, Histogram generation/Equalization, local and global contrast enhancement, arithmetic manipulations, statistical enhancement and Filtering, Generation of Linearly Stretched and Non-linearly stretched outputs and their analysis, generation of different filtered outputs and analysis

Unit-V : Generation of images using image processing system, data fusion , change detection, supervise classification using image processing system, Geo-referencing, projection, on screen digitization and preparation of vector and raster layers, GIS data presentation.

Paper VI
ADANCED HYDROGEOLOGY

Unit-I : Hydrologic cycle, hydrographic analysis water balance studies, ground water in hydrological cycle.

Unit-II : Distribution of groundwater in Earth's crust, Springs, (including thermal);origin and movement of water, geologic structures favouring groundwater occurrence, methods of identification of groundwater reservoir properties.

Unit-III : Force and laws of groundwater movement, groundwater recharge, artificial and natural. Factors controlling recharge, conjunctive and consumptive use of groundwater .

Unit-IV : Groundwater in arid, semi arid, coastal and alluvial regions, Groundwater in hard rocks, and limestone terrains with reference to Indian conditions. Chemical characteristics of groundwater in relation to various uses-domestic; industrial and irrigation.

Unit-V : Rainwater harvesting technique: Water pollution and treatment environmental impact of groundwater extraction. Well construction and design, Prospecting of groundwater, Watershed management techniques.

Paper – VII
Remote sensing in Water Resource Management

Unit-I : Rainfall, Infiltration, Run off, Evapo-transpiration-Global Distribution of Surface water bodies, Surface Water Resources Budgeting –Spectral Response pattern of water. Drainage Morphometric analysis: through Remote Sensing and its interpretation.

Unit-II : Water quality: Monitoring and mapping through remote sensing, Basic principles of groundwater Hydrology, Crystalline Aquifer Systems; Characteristics-Lithological Assemblage, aspects of Weathering, Mapping of modeling of Fractures.

Unit-III : Modeling the characteristics of crystalline Aquifer Systems. Sedimentary Aquifer systems: process of Sedimentation-Identification of Multi layered complexes- Primary and Secondary porosities and Aquifer characteristics- Techniques of mapping sedimentary Aquifer system through Remote Sensing.

Unit-IV : Geomorphic Aquifer Systems: Mapping of Hydro geomorphic Horizons using Remote Sensing and the Evaluation of Aquifer Characteristics.
Ground water Modeling : Stochastic, Flow and Linear Modeling Techniques- Input of Remote Sensing in modeling- Salt Water intrusion .

Unit-V : Artificial Recharge : Definition: Methods of Artificial Recharge-Remote sensing application. GIS Case studies- Surface water studies- Groundwater Targeting- Artificial Recharge . Water resources budgeting and management.

Paper VIII
GIS Applications in Natural Resources and Management

Unit-I : Natural resource evaluation: Need-objectives-sources of data-limitations-need for evaluation in development planning. Interpretation of Aerial Photographs and Satellite Images for geomorphic Mapping

Unit-II : Land Evaluation: objectives-principles-procedures-approaches-land use requirements and land quality parameters-layer creation-matching-classification- case studies.

Unit-III : Wastelands: Types- identification- management- eroded lands-types- layer creation- case studies. Interpretation of Remotely Sensed Data for Mineral Targeting. Interpretation of Remotely Sensed Data for Oil Exploration.

Unit-IV : Water Resources: Surface water precipitation-space time analysis-overland flow- storage- groundwater potential-quality- layer creation- over layer analysis- integrated watershed development- case studies.

Unit-V : Natural vegetation: Forests-classification (NRSA) – Grasslands- layer creation – overlay management- case studies. Interpretation of Remotely Sensed Data for Engineering Geological Exploration. Interpretation of Remotely Sensed Data for Environmental Assessment. Land use / land cover, land degradation, wasteland and wetland mapping.

Practical – III : Remote Sensing Interpretation in water resources.

1. Spectro Radiometric Survey of Water bodies.
2. Analysis of Aerial photographs and satellite images for drainage morphometry and watershed demarcation.
3. Analysis of satellite and aerial photographs for surface water resources mapping.
4. Analysis of satellite and aerial photographs for mapping Lithologically and structurally controlled aquifer systems.
5. Mapping of geomorphic aquifers
6. Identification of recharge areas using remotely sensed data.
7. Analysis of thermal and microwave data for ground water Targeting.
8. Land use/land cover mapping up to level II using aerial photos and satellite images.

Practical IV

Project Report*

* Each student should undertake Project work allotted by the Head of the Department in a given area pertaining to watershed management. Each student will be responsible for assessing the characteristics of at least one watershed and should submit project report by the end of Semester II.

Seminar, assignment and field visit to different watersheds :

Educational tour to visit different watersheds, soil and conservation structures, government organizations, laboratories and NGO's.

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