

SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES



**KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA
UNIVERSITY, JALGAON**

REVISED SYLLABUS

UNDER CBCS

(With CGPA System)

For

M.A./ M. Sc. (Applied Geography)

w. e. f.

Academic Year 2019-2020

**Summary of Distribution of Credits under CBCS Scheme
for
M.Sc. Applied Geography
at
School of Environmental and Earth Sciences
[at University Campus under Academic Flexibility w.e.f. 2019-20]**

Sr. No	Type of course	Sem I	Sem II	Sem III	Sem IV
01	Core	16	16	16	12
02	Skill based	04	04	-	-
03	School Elective	-	-	04	04
04	Project	--	--	--	04
05	Audit	02	02	02	02
	Total Credits	22	22	22	22

Subject Type	Core	Skill based	School Elective	Audit	Project	Total Credits
Credits	60	08	08	08	04	88

Total Credits = 88

SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES
KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY,
JALGAON

Syllabus under CBCS for M.A. / M.Sc. (Applied Geography)
(w.e.f. Academic Year 2019-2020)

Course credit scheme

Semester	(A) Core Courses			(B) Skill Based / Elective Course			(C) Audit Course (No Weightage in CGPA)			Total Credits (A+B+C)
	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (Practicals)	Total Credits	
I	4	8 + 8	16	1	4 + 0	4	1	2	2	22
II	4	8 + 8	16	1	4 + 0	4	1	2	2	22
III	4	8 + 8	16	1	4 + 0	4	1	2	2	22
IV	4	8 + 8	16	1	4 + 0	4	1	2	2	22
Total Credits	64			16			8			88

(T-Theory; P-Practical)

Prologue

The School of Environmental and Earth Sciences has established on 1st July 1999. In short span of 19 years, the School has established excellent laboratories and library facilities to get quality education in the field of environmental and earth sciences. School offers four Post Graduate courses in Environmental Science, Applied Geology, Applied Geography, and M.Tech. in Environmental Science and Technology. In addition to this, the school has started a Certificate Course in Industrial Safety and Management under career-oriented certificate courses of UGC from the academic year 2013-14. Eco-friendly sustainable approach in the process of development is a unique culture developed at the School. The School has received research project grants from various agencies like DST, UGC, MoEF, UNICEF, DRDO, MoWR, and State Government agencies. The School is covered for financial assistance under Special Assistance Programme (UGC-SAP-DRS, Phase II) of UGC, New Delhi for a period of 5 years (2015-2020). The School was also covered under DST-FIST programme Level-I (2012-2017) for financial support.

Choice Based Credit System (CBCS)

The main feature of the CBCS is to make post graduate education student centric rather than system centric or teacher centric. For achieving these objectives, the CBCS strives to create a holistic syllabus. Thus, in addition to dedicated focus on a discipline through core papers whether in an honours curriculum or a regular curriculum, elective papers have been added which will give students the freedom to choose the allied or applied areas of their discipline and also the areas of other disciplines of their interest. Further in keeping with the vision of the Government, special emphasis has been given to ability enhancement and skill development of students through elective courses under these domains which every student is required to study. However, in keeping with the spirit of CBCS here also the students will have complete freedom to choose these courses from a pool suggested by the University. These elective papers provide them with the opportunity to develop competencies of students in their areas of strength, expertise, and specialization. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising a core, elective and skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marking system.

Department of Applied Geography, School of Environmental and Earth Sciences
Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon
 Syllabus under CBCS for M.A/M.Sc (Applied Geography)
 Syllabus Structure (w.e.f. 2019-20)

Semester I

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-101	Core	Principles of Geomorphology	04	--	04	40	--	60	--	100	--	04
GG-102	Core	Environmental Geosciences	04	--	04	40	--	60	--	100	--	04
GG-103	Skill Based	Fundamental of Cartography	04	--	04	40	--	60	--	100	--	04
GG-104	Core	Practicals in Physical Geography	--	08	08	--	40	--	60	--	100	04
GG-105	Core	Practicals in Cartographic Techniques With Help of GIS	--	08	08	--	40	--	60	--	100	04
AC-101	Audit Course	Practicing Cleanliness		02	02		100	--	--	--	100	02

Semester-II

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-201	Skill Based	Geoinformatics-I	04	--	04	40	--	60	--	100	--	04
GG-202	Core	Climatology	04	--	04	40	--	60	--	100	--	04
GG-203	Core	Statistical Methods in Geography	04	--	04	40	--	60	--	100	--	04
GG-204	Core	Practical's in Human Geography	--	08	08	--	40	--	60	--	100	04
GG-205	Core	Practicals in Climatology	--	08	08	--	40	--	60	--	100	04
AC- 201 A/ AC- 201 B/ AC- 201 C/ AC- 201 D	Audit Course	Choose one out of four (AC- 201 A/ AC- 201 B/ AC- 201 C/ AC- 201 D) (Personality and Cultural Development Related)		02	02		100	--	--	--	100	02

List of elective courses to be offered in Semester-II

AC-201 A: Soft Skills

AC-201 B: Sports Activities

AC-201 C: Yoga

AC-201 D: Music

Department of Applied Geography, School of Environmental and Earth Sciences
Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon
 Syllabus under CBCS for M.A/M.Sc (Applied Geography)
 Syllabus Structure (w.e.f. 2019-20)

Semester III

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-301	Core	Geography of Resources	04	--	04	40	--	60	--	100	--	04
GG-302	Elective	Choose One from GG-302(A) and GG-302(B)	04	--	04	40	--	60	--	100	--	04
GG-303	Skill Based	Geoinfometrics-II	04	--	04	40	--	60	--	100	--	04
GG-304	Core	Practical's in Remote Sensing and Image Processing	--	08	08	--	40	--	60	--	100	04
GG-305	Core	Practical's in GIS & GPS Techniques with Help of Computer.	--	08	08	--	40	--	60	--	100	04
AC- 301 A/ AC- 301 B/ AC- 301 C/ AC- 301 D	Audit Course	Choose one out of four (AC- 301 A/ AC- 301 B/ AC- 301 C/ AC- 301 D)		02	02		100	--	--	--	100	02

List of elective courses to be offered in Semester-III

GG-302 (A): Urban Geography

GG-302 (B): Medical Geography

AC-301 A: Computer Skills (T)

AC-301 B: Cyber Security

AC-301 C: Rainwater Harvesting

AC-301 D: Geo-tourism

Semester-IV

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
GG-401	Skill Based	Watershed Management	04	--	04	40	--	60	--	100	--	04
GG-402	Elective	Choose one from GG-402(A) and GG-402(B)	04	--	04	40	--	60	--	100	--	04
GG-403	Core	Disaster Management	04	--	04	40	--	60	--	100	--	04
GG-404	Core	Practicals in Surveying	--	08	08	--	40	--	60	--	100	04
GG-405	Core	Dissertation	--	08	08	--	40	--	60	--	100	04
AC- 401 A/ AC- 401 B/ AC- 401 C/ AC- 401 D	Audit Course	Choose one out of four. (AC- 401 A/ AC- 401 B/ AC- 401 C/ AC- 401 D)		02	02		100	--	--	--	100	02

List of elective courses to be offered in Semester-II

GG-402 (A): Agricultural Geography

GG-402 (B): Oceanography

AC-401A: Human Rights

AC-401 B: Current Affairs

AC-401 C: Surveying and Instrumentation

AC-401 D: Watershed Management

Program Objectives:

1. To produce skilled experts with applied aspects of Geography employable for positions in the field of education, industry and government and non-government organizations.
2. To impart knowledge on advances and challenges in Geographical challenges.
3. To enhance the quality and standards of Geography Education.
4. To provide a broad common framework, for exchange, mobility and free dialogue across the Indian Geography and associated community.
5. To prepare our graduates to become effective scientific communicators/collaborators in multidisciplinary teams providing technical leadership to engage with the challenging Geographical problems of local, national and global nature.

Program Outcomes (PO) for M.A. /M.Sc. Program:

Upon successful completion of the M.Sc. program, student will be able to:

PO No.	PO	Cognitive level
PO1	Understand the unifying themes of both human and physical geography as well as have a working knowledge of the discipline's diverse conceptual and methodological approaches.	II
PO2	Demonstrate an ability to develop research questions, critically understand quantitative and qualitative data sources, data bias, and data analysis and presentation, and conduct research using primary and/or secondary source material.	II
PO3	Students will be able to apply geographical knowledge for exploration of GIS, Remote Sensing and for geographical resources.	III
PO4	M. Sc. Applied Geography programme is structured for providing advances and by considering the overall development of students.	VI
PO5	Students will able to acquired knowledge to work in public and private sector companies working in the field of GIS, Tourism, and Cartographer.	III

Eligibility

Bachelor's degree in Geography from any recognized University with at least 50 % marks.

Duration

The duration of M.A. / M.Sc. (Applied Geography) the degree program shall consist of two academic years divided into four semesters. Each Semester consists of 90 working days. Each theory course will be completed in 60 hours and practical course in 96 hours.

Medium of instruction

The medium of instruction and examination for each course shall be English.

Credit to contact hour.

One credit is equivalent to 15 periods of 60 minutes each for theory course lecture.

Attendance

The student enrolled must have 75% attendance in each course in order to appear for term end examinations, otherwise, the candidate may not be allowed to appear for term-end examination as per the Rules.

Examination

Each theory and practical course will be of 100 marks comprising of 40 marks for internal (20 marks of 2 internal examinations) and 60 marks external examination. Separate head of passing in Internal and External examination is mandatory. In case of failure in internal examination of a particular course, the student will have to appear for the same in next semester as per the schedule of the examination. In case a student fails in a particular course in a semester and the same course(s) are revised/removed from curriculum in due course, the student will have to appear as per the new curriculum and or pattern in a subsequent semester at his own responsibility.

SYLLABUS
M.A / M.Sc. Applied Geography
SEMESTER – I

GG-101: PRINCIPLES OF GEOMORPHOLOGY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Students will understand the concept of place and how it is connected to people's sense of belonging to the physical environment, landscape and culture. 2. Students will understand the fundamental concepts of spatial interaction and diffusion, which explain how human activities are influenced by the concept of distance. 3. Students will be exposed to the nature of physical systems such as geomorphologic processes and natural hazards. 4. Students will be able to read and interpret information on different types of physical features maps. 5. Students will learn how human, physical and environmental components of the world interact. 	
Unit 1	<p>Fundamentals of Geomorphology</p> <ol style="list-style-type: none"> 1. Nature and Scope; Definition and history of Geomorphology. 2. Concepts; Uniformitarianism and Catastrophism, Geomorphic Scale – Timescale (Cyclic, Graded and Steady) and Spatial Scale Ergodic Principal Process Geomorphology. 	10 L
Unit 2	<p>Tectonism and Geomorphology</p> <ol style="list-style-type: none"> 1. Interior of the Earth. Sources of Knowledge; Inferred Knowledge (Density, Temperature, Pressure), Surface Expressions, (Seismic Wave Evidence) Holmes Convection Current Theory. 2. Isostasy; Gravity Anomalies and Correction. 3. Wegener's Continental Drift Theory; Theory, Supporting Evidence and Validity. 4. Plate Tectonics and Sea Floor Spreading; Paleomagnetism, Oceanic Relief, Sea Floor Spreading, Plate Boundaries, Mechanics and Movements of Plates, Zone of Collision and Associated Landforms. 5. Endogenic Forces; Epiorogenic and Orogenic Movements, Compression, Tension, Folds, Types and Landforms, Faults, Types, and Landforms. 	15 L
Unit 3	<p>Weathering, Mass Movement Processes, and Hillslopes</p> <ol style="list-style-type: none"> 1. Weathering: Types and related landforms. 2. Mass Movement: Types of the mass movement. 3. Hillslope processes and forms. 4. Models of hillslope evolution. 	15 L
Unit 4	<p>Fluvial Processes and Glacial Processes</p> <ol style="list-style-type: none"> 1. Drainage Basin and Drainage Patterns. 2. Davisian Cycle of Erosion and Concept of Peneplanation. 3. Mechanics of Erosion, Transportation, and Deposition. 4. Erosional Landforms. Depositional Landforms. 	12 L
Unit 5	<p>Coastal Processes</p> <ol style="list-style-type: none"> 1. Sea waves, currents, and tides. 2. Coastal processes: erosion, transportation and deposition. Coastal landforms: erosional and depositional. 	08 L
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Migon, P. (2010): Geomorphological Landscapes of the World, Springer, London/New York. 2. Ollier, C. D. (1981) Tectonics and Landforms, Longman , London 3. Siddhartha, K. (2001): The Earth's dynamic surface, Kisalaya, Delhi. 4. Singh, S. (2011): Geomorphology, PrayagPustakBhawan, Allahabad. 5. Spark B. W. (1972): Geomorphology, Longman, New York 		

6. Steers, A. (1958): The Unstable Earth, Methuen, London.
7. Strahler A. H and Strahler, A. N. (1992) : Modern Physical Geography, John Wiley, New York
8. Thornbury, W. D. (1960): Principles of Geomorphology, John Wiley and Sons, New York.
9. Wooldridge and Morgan: Geomorphology

Course Outcomes (COs):

After completing this course graduate should be able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-101.1	Understand the nature, scope, and significance of geomorphology and fundamental concepts in the subject.	2
GG-101.2	examining the Origin and Evolution of the earth primary relief features by different theories in the subject.	3
GG-101.3	Understand the formation, process, and development of Fluvial and Karst Landforms.	2

GG-102: ENVIRONMENTAL GEOSCIENCES		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. The fundamental issues and debates that circulate around the intersection of geography and environmental science, with a particular focus on how humans affect and are affected by modifications of the physical environment. 2. The importance of ‘thinking ecologically’ when approaching complex environmental problems. 3. The key environmental inequalities that underpin contemporary globalization, and the ways that race, class, and gender frequently limit access to social and environmental justice. 4. The tensions that arise from global environmental change in particular places and geographic conditions. 	
Unit 1	<p>Basic issues in environmental sciences:</p> <ol style="list-style-type: none"> 1. Definition, principles and scope of environmental science. 2. Components of environment. 3. Geography and environment. 4. Man and nature, Environment and resources. 5. Man – Environment Relationships: i. Approaches to the study ii. Environmental deterministic approach iii. Teleological approach, iv. Possibilistic approach v. Economic deterministic approach, vi. Ecological approach. 6. Environment and man; Man’s interaction with the environment. 	10 L
Unit 2	<p>Ecological systems:</p> <ol style="list-style-type: none"> 1. Ecological concepts i. Meaning and definitions ii. Ecosystem concepts and Components. 2. Ecosystem; form and functions, Food chain, Food web, Tropic level, Ecological niche. 3. Biosphere and Ecosystem; Material circulation through ecosystem, Natural system, and man-induced changes, Energy cycle, Hydrological cycle, Nutrient cycle (carbon, nitrogen, phosphorous). 	15 L
Unit 3	<p>Environmental Degradation</p> <ol style="list-style-type: none"> 1. Concepts and types of environmental degradation. 2. Causes of environmental degradation. 3. Population growth and development, urbanization, land degradation. 4. Environmental Pollution; i. Sources and types of pollution, ii. Air pollution, adverse effects of air pollution on weather and climate-ozon, depletion, iii. Greenhouse effect, iv. Effects on human health, v. Water pollution, vi. Surface and groundwater, vii. Adverse effects on human health. 	15 L
Unit 4	<p>Atmospheric Changes and the Biosphere</p> <ol style="list-style-type: none"> 1. Climatic Factors shaping the Geographical, Zoning and its Periodicity. 2. Changing Climate of the World. 3. Climatic Hazards and Management, Social Response to Climatic Hazard. 4. Biomes and their relationships to Climate and Hydrological Cycle. 	10 L
Unit 5	<p>Environmental Degradation and Hazards</p> <ol style="list-style-type: none"> 1. Water, Air and Noise problems in urban-industrial Environment; Water and soil pollution in rural landscape. 2. Impact of Green Revolution; Problems of Solid waste and nuclear fallout. 3. Human response to Flood, Drought, Landslide, Earthquake, and Cyclone. Disaster Management. 	10 L
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Chandna R. C., 2002: Environmental Geography, Kalyani, Ludhiana. 2. Cunningham W. P. and Cunningham M. A., 2004: Principals of EnvironmentalScience: Inquiry 		

and Applications, Tata Macgraw Hill, New Delhi.

3. Goudie A., 2001: The Nature of the Environment, Blackwell, Oxford.
4. Mal, Suraj., and Singh, R.B. (Eds.) (2009) Biogeography and Biodiversity. Rawat Publication, Jaipur
5. Miller G. T., 2004: Environmental Science: Working with the Earth, Thomson BrooksCole, Singapore.
6. MoEF, 2006: National Environmental Policy-2006, Ministry of Environment and Forests, Government of India.
7. Singh, R.B. and Hietala, R. (Eds.) (2014) Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India. Advances in Geographical and Environmental Studies, Springer
8. Odum, E. P. et al, 2005: Fundamentals of Ecology, Ceneage Learning India.
9. Singh S., 1997: Environmental Geography, Prayag Pustak Bhawan. Allahabad.
10. UNEP, 2007: Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme.
11. Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) (2014) Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1. Advances in Geographical and Environmental Studies, Springer
12. Singh, R.B. (1998) Ecological Techniques and Approaches to Vulnerable Environment, New Delhi, Oxford & IBH Pub.
13. Singh, Savindra 2001. Paryavaran Bhugol, Prayag Pustak Bhawan, Allahabad. (in Hindi)

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-102.1	Understand Structure, Components of atmosphere, acquire knowledge about biodiversity.	2
GG-102.2	To understand and identify the value of the Resources, environmental problems there Cause, Effect, and Remedies.	2
GG-102.3	Get knowledge about environmental hazards and management.	3

GG-103: FUNDAMENTAL OF CARTOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Create professional and aesthetically pleasing maps through thoughtful application of cartographic conventions. 2. Select and combine appropriate visual variables to clearly represent geospatial data and communicate map content. 3. Classify and generalize data, apply principles of color and contrast, and choose projections and scales for maps of varying purpose. 4. Discuss current trends in cartographic science & technology, including virtual reality, open-source web tools, and geo-visual analytics. 5. Demonstrate mastery in map production for communication and research; analyze, critique, and share high-quality maps. 	
Unit 1	<p>Fundamental of Cartography</p> <ol style="list-style-type: none"> 1 Definition, Nature, Scope, History, Types, Developments. 2 Significance. 3 Advance Cartographic techniques. 4 Application of cartography. 	10 L
Unit 2	<p>Qualitative Cartography</p> <ol style="list-style-type: none"> 1 Map i. Definition ii. Elements iii. Types iv. Characteristics v. Map Making Methods. 2 Scale i. Definition ii. Types of Scale, Presentation Techniques & Conversion of Scale iii. Characteristics iv. Scaling Methods & Uses. 3 Relief: i. Definition ii. Types iii. Characteristics iv. Relief Presentation Techniques: hachure's, shading, contours, and layer tints) & Uses. 4 Profiles: i. Definition ii. Types iii. Characteristics iv. Drawing of profiles v. Significance. 5 Gradient & Slope i. Definition ii. Types iii. Characteristics iv. Slope analysis methods v. Significance. 	15 L
Unit 3	<p>Quantitative Cartography</p> <ol style="list-style-type: none"> 1 Representation of numerical data: i) line graphs ii) bar graphs iii) Proportional Circle iv) Divided Circle v) Histogram vi) Thematic Mapping- Choropleth and Isopleths. 2 Methods of Area Measurement. 3 Methods of Map enlargement and reduction. 	10 L
Unit 4	<p>Computer Cartography</p> <ol style="list-style-type: none"> 1 Fundamentals of computer cartography i. Digital cartography ii. History iii. Developments and advantages of computerize cartography. 2 Representation of geographic data with the help of Advance Techniques: CAD, GIS, and GPS. 	10 L
Unit 5	<p>Map Interpretation Techniques</p> <ol style="list-style-type: none"> 1 Study of Survey of Indian topographical maps i. Classification scale and Indexing of Toposheets ii. Introduction to SOI topographical maps: numbering, scales, and grid reference, signs and symbols, color system, etc. 2 Interpretation of SOI maps i. Hilly, Mountainous, Plain, Desert, Coastal Areas. 3 Interpretation of Foreign Toposheets i. Ordnance Survey Map of UK ii) Geological Survey of USA. 	15 L
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Anson, R., and Ormelling, F. J., 1994: International Cartographic Association: Basic Cartographic Vol., Pergmen Press 2. Campbell, J., (1984): Introductory Cartography Prentice Hall, Inc., Englewood Cliff, New Jersey. 		

3. Cromley, R.G., (1992): Digital Cartography Prentice Hall, New Jersey.
4. Fraser Taylor (1991): Geographical Information System, Pergmon Press, U.K.
5. Glodard R. H., (1982): Field Techniques and Research Methods in Geography Dubuque.
6. Gupta, K. K., and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi
7. Mahmood A., (1977): Statistical Methods in Geographical Studied Rajesh Publication, Delhi.
8. Maquire, D.J (1991): Geographical Information Systems - Principles and Application Good Child, M.F. and Rhind, D.W., Taylor and Francis Publication Washington,.
9. Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi
10. Monkhouse, F. J., and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London
11. Monmonier, M. S. (1982): Computer Assisted Cartography: Principles and Prospects Prentice Hall, New Jersey.
12. National Atlas and Thematic Maps Organization (NATMO): National Atlas of India Calcutta.
13. Robinson, A. H., 2009: Elements of Cartography, John Wiley and Sons, New York
14. Robinson, A.H., John Willey and Sons: Elements of Cartography (New edition):, New York.
15. Sarkar, A. 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi.
16. Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-103.1	Having completed cartography programme, a graduate has a complex understanding between functions and interaction of nature and anthropogenic structures; principles of sustainable development; systematic and critical approach.	2
GG-103.2	Ability to formulate scientific and applied research objectives, shape content and possible results.	6
GG-103.3	Use varied technologies for scientific research, information search, evaluation, and recall.	3

GG-104: PRACTICALS IN PHYSICAL GEOGRAPHY

	Course Objectives: <ol style="list-style-type: none">1. To introduce some basic research method to the students to be applied to various themes in Physical Geography.2. To indicate the assumptions, limitations, and interpretation of these methods and results.
Unit 1	Drainage Network Hierarchy: <ol style="list-style-type: none">1. Drainage network hierarchy i) Horton's method ii) Strahler's method.2. Laws of drainage composition;<ol style="list-style-type: none">a. Law of stream order: i) Measurement of order wise stream number ii) Stream number v/s Stream order. (Preparation of graph) iii) Bifurcation ratio.b. Law of stream length i) Measurement of stream length and average. ii) Stream order v/s average stream length. (Preparation of graph) iii) Length Ratio.
Unit 2	Measurement of the catchment area of the drainage basin unit: <ol style="list-style-type: none">i) Drainage Frequency ii) Drainage Density iii) Constant of Channel Maintenance.iv) Basin Elongation vi) Ruggedness Number vii) Stream order v/s mean area Interpretation of the results of all subunits.
Unit 3	Relief and Slope Analysis <ol style="list-style-type: none">i) Absolute Relief Map, ii) Relative Relief Map, iii) Dissection Index Map, iv) Hypsometric Integral, Miller's Isotan Map, Slope Map by Wentworth's Method
Unit 4	Geological Maps: <ol style="list-style-type: none">1. Introduction of Geological Maps: i) Dip ii) Strike Line iii) Bedding Plane iv) Plane of Unconformity v) Out Crop.2. Drawing of Geological Section and its Interpretation.
Unit 5	Sediment Analysis: <ol style="list-style-type: none">1. Sieving and pipette method; i) Analysis of 1 sandy and 1 Clayey sample, ii) Plotting of data on probability graph paper and estimation of grain size parameters, iii) Interpretation of processes.2. Study of Sedimentary sequences and weathering profile, i) Study of 1 sedimentary sequence of river or costal sediments and 1 weathering profiles, ii) Interpretation in terms of past and present processes.
Suggested reading: <ol style="list-style-type: none">1. Anson, R., and Ormelling, F. J., 1994: International Cartographic Association: Basic Cartographic Vol., Pergmen Press2. Campbell, J., (1984): Introductory Cartography Prentice Hall, Inc., Englewood Cliff, New Jersey.3. Cromley, R.G., (1992): Digital Cartography Prentice Hall, New Jersey.4. Fraser Taylor (1991): Geographical Information System, Pergmon Press, U.K.5. Glodard R. H., (1982): Field Techniques and Research Methods in Geography Dubuque.6. Gupta, K. K., and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi7. Mahmood A., (1977): Statistical Methods in Geographical Studied Rajesh Publication, Delhi.8. Maquire, D.J (1991): Geographical Information Systems - Principles and	

Application Good Child, M.F. and Rhind, D.W., Taylor and Francis Publication Washington,.

9. Mishra, R. P., and Ramesh, A., 1989: Fundamentals of Cartography, Concept, New Delhi
10. Monkhouse, F. J., and Wilkinson H. R., 1973: Maps and Diagrams, Methuen, London
11. Monmonier, M. S. (1982): Computer Assisted Cartography: Principles and Prospects Prentice Hall, New Jersey.
12. National Atlas and Thematic Maps Organization (NATMO): National Atlas of India Calcutta.
13. Robinson, A. H., 2009: Elements of Cartography, John Wiley and Sons, New York
14. Robinson, A.H., John Willey and Sons: Elements of Cartography (New edition):, New York.
15. Sarkar, A. 2015: Practical Geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi
16. Singh, R. L., and Singh, R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-104.1	To describe the fundamentals of Physical Geography.	2
GG-104.2	To create a drawing of Scale Diagram for representing geographical data	6
GG-104.3	Able to prepare a drawing of map, grapes, diagrams scale.	6

GG-105: PRACTICALS IN CARTOGRAPHIC TECHNIQUES WITH HELP OF GIS

	Course Objectives: 1. To introduce GIS (Geographic Information System) as a tool of spatial science. 2. To indicate the basic elements of GIS and methodology of GIS. 3. To outline the steps and areas of application of GIS.
Unit 1	Introduction to Auto CAD Map Software: Interface, Menu bar, Toolbar, Data import, Scale, factor, Layer Properties.
Unit 2	Spatial Database Layer Generation 1. Raster: Full Grid, Chain Codes, and Run Length Codes. 2. Vector: Manual Digitization, Digitization Errors and Topology Building.
Unit 3	Cartographic Techniques with the help of GIS: Techniques to Prepare Following Maps; Choropleth Map: i) Shading ii) Colour, Dot Map, Transformation of Dot map into Isopleth Map, Proportional Circle Map Query in GIS Simple and advanced, Spatial and nonspatial, Topological, SQL.
Unit 4	Overlay Analysis Polygon-on-polygon overlay, line-in-polygon overlay, point-on-polygon-overlay Network Analysis Principle and computation; Pathfinding. Shortest path, Location Allocation: Supply and demand. Proximity Analysis Point, Line, Polygon Buffer Zone
Unit 5	Excursion: a) Visit a place or a region of geographical interest. b) The report should include the following points: Landforms- More emphasis should be given on the formation of the landforms, Economy, Settlements, Transport, and General Observations. While writing the report students may. Write a report on anyone point or may consider all points. a) Maps Photographs & Diagrams are necessary for the report. b) Collection of rock specimens is also expected. Students should bring them at the time of examination & show them to the examiner. Examiners are requested to give weightage to such students.
Suggested reading: 1. Agricultural Geography (1984): Sing J. and Dhillon. 2. Agricultural Geography: Majid Hussen. 3. An Introduction to Quantitative Analysis in Human Geography (1974): Yeats M.H. 4. Geography of Settlement (1976): Hudson F.S. 5. Maps and Diagram: Monkhouse. 6. Mastering Auto CAD: George Omura, BPB Publication, B14 Connaught place, New Delhi 7. Readings in Rural Settlement Geography: Sing R.L. 8. Statistic for Geography and Social Science: R. B. Mandal. 9. The Study of Urban Geography: Edward Arnold. 10. Transportation Geography: Michael E. and E. Hurse.	

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-105.1	Understand the introductory part of GIS software, its tool, functions, data import, scale factors, and basics of digitization.	2
GG-105.2	Applied this software and cartographic techniques for analysis and study in rural settlement geography and urban settlement for planning and development.	3
GG-105.3	Understand the cartographic techniques and their tools, functions, applied in agriculture geography and physical geography for assessment and visualization purposes.	5

M.A./ M.Sc. Part I Semester Applied Geography: Audit Courses

AC-101: Practicing Cleanliness (Compulsory; Campus-level Audit Course; Practical; 2 Credits)		
Course Objectives (COs): <ul style="list-style-type: none">To make students aware of Clean India Mission and inculcate cleanliness practices among them.		
	<ul style="list-style-type: none">Awareness program on<ul style="list-style-type: none">Swachh Bharat Abhiyan (Clean India Mission)Clean Campus MissionRole of youth in Clean India MissionCleaning activities inside and surroundings of Department buildings.Tree plantation and further care of planted treesWaste (Liquid/Solid/e-waste) Management, Japanese 5-S practicesPlanning and execution of collection of Garbage from different sections of University campusRole of youth in power saving, pollution control, control of global warming, preservation of ground water and many more issues of national importance.Cleanest School/Department and Cleanest Hostel contestsPainting and Essay writing competitions	

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC101.1	Identify need at of cleanliness at home/office and other public places.	2
AC101.2	Plan and observe cleanliness programs at home and other places.	4
AC101.3	Practice Japanese 5-S practices in regular life.	3

SEMESTER – II

GG-201: GEOINFOMETICS- I		
	<p>Course Objectives:</p> <ol style="list-style-type: none">1. Maximize the efficiency of decision making and planning.2. Provide efficient means for data distribution and handling.3. Elimination of redundant database-minimize duplication.4. Capacity to integrate information from many sources.5. Complex analysis/queries involving geographical reference data to generate new information.6. It will be teaching about the important elements of Geospatial technology.7. Update data quickly and cheaply.	
Unit 1	<p>Introduction to GIS</p> <ol style="list-style-type: none">1. Definition, potential of GIS, concept of space & time.2. Spatial Information Theory.3. History of GIS.4. Objectives of GIS.5. Elements of GIS, hardware & software requirements.6. GIS Applications.7. GIS Tasks- input, manipulation, management, query & analysis, visualization.	15 L
Unit 2	<p>Database and Data Models</p> <ol style="list-style-type: none">1. Spatial: spatial relationship, functional relationship, logical relationship.2. Non-spatial: nominal, ordinal, ratio and cyclic.3. Spatial: Geometric primitives, Raster, Vector, comparative overview of raster and vector models, layers and coverage.4. Non-spatial: DBMS Advantages, conceptual models; Implementation models hierarchical, network and relational.	15 L
Unit 3	<p>Structuring of Spatial Data</p> <ol style="list-style-type: none">1. Digitizers: manual, semi-automatic & automatic.2. Editing error: detection & correction, topology building.	10 L
Unit 4	<p>Data Analysis (I)</p> <ol style="list-style-type: none">1. Attribute databases: operations from algebraic theory. Operations from set theory SQL: attribute query.	10 L
Unit 5	<p>Data Analysis (II)</p> <ol style="list-style-type: none">1. Spatial Databases: map algebra, grid Operations: Local, Focal. SQL: spatial query.	10 L
<p>Suggested reading:</p> <ol style="list-style-type: none">1. Burroughs, P. A. and McDonnell, R.A. (2002): Principles of Geographical Information System, Oxford University Press.2. George J. (2004): Fundamentals of Remote Sensing, Universities Press Pvt. Ltd., Hyderabad.3. Jensen, J. R. (2003): Remote Sensing of Environment, An Earth Resource Perspective, Pearson Education Pvt. Ltd., New Delhi.4. Kang- Tsung-Chang, Introduction to Geographical Information System, 2002, McGraw Hill.		

5. **Lillesand, T. M. and Kiefer R. W. (2002):** Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
6. **Lo C. P. and Yeung, A.K.W. (2002):** Concepts and Techniques of Geographic Information System, Prentice Hall, India.
7. **Paul A. Lonfley, Michel F. Goodchild, D J. Maguire and D W. Rhind, (2002):**Introduction to Geographic Information Systems and Science, John Wiley and Sons Ltd.
8. Fundamentals of Remote Sensing, A Canada Centre for Remote Sensing Remote Sensing Tutorial.
https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutorial/fundamentals_e.pdf

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-201.1	Students will demonstrate knowledge of the foundations and theories of geographic information systems (GIS) and use the tools and methods of GIS.	2
GG-201.2	Understand the modern techniques in geography under this course such as remote sensing and aerial photography.	3
GG-201.3	Students will be facilitated with modern techniques in Geography.	6

GG-202: CLIMATOLOGY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Climatology is important since it helps determine future climate expectations. 2. Through the use of latitude, one can determine the likelihood of snow and hail reaching the surface. 3. You can also be able to identify the thermal energy from the sun that is accessible to a region. 4. Provide training in theoretical and applied aspects of atmospheric physics and dynamics, quantitative modeling techniques, weather forecasting, climate prediction and observation of atmospheric processes. 5. Equip you with the skills of quantitative and statistical analysis with regards to atmospheric data processing and management. 6. Enable you to apply theoretical concepts and analytical techniques to the resolution of environmental and socio-economic problems that have an atmospheric origin. 7. Develop your independent research ability. 8. Convert participants with non-environmental backgrounds to applied meteorologists and climatologists. 	
Unit 1	<p>Introduction Nature and scope; Weather, Climate, Subdivisions of Climatology, Development of Modern Climatology, Tropical Climatology</p> <p>Earth`s atmosphere</p> <ol style="list-style-type: none"> 1. Composition; Physical properties, Chemical composition. 2. Vertical structure; Temperature changes, Vertical variations in the composition, Ionosphere and aurora. 	08 L
Unit 2	<p>Insolation and Heat Balance</p> <ol style="list-style-type: none"> 1. Solar radiation; Electromagnetic spectrum, Factors affecting insolation. 2. Distribution; Latitudinal and Seasonal, variation of insolation. 3. Effect of Atmosphere; Scattering, Diffusion, Absorption, Reflection, Albedo, Green House Effect. 4. Terrestrial Radiation; Heat Budget, Latitudinal Heat Balance, Atmospheric window. <p>Temperature Basic concept; Difference between Heat and Temperature, Controls of temperature Horizontal and Vertical distributions, Inversion of temperature.</p>	15 L
Unit 3	<p>Atmospheric Pressure and Winds</p> <p>Pressure measurement and distribution; ii. Factors affecting distribution of pressure, iii. Wind observation and measurement, iv. Factors affecting wind, v. Geostrophic wind and Gradient wind, vi. Models of general circulation of the atmosphere, vii. Eddy theory, viii. Local winds, ix. Jet stream, x. Cyclones and Anticyclones</p>	12 L
Unit 4	<p>Atmospheric Moisture</p> <ol style="list-style-type: none"> i. Atmospheric moisture ii. Hydrologic cycle iii. Evaporation and condensation iv. Forms of condensation v. Precipitation vi. Types of precipitation vii. Measurement of humidity. 	10 L

Unit 5	Atmospheric Stability i. Lapse Rate: normal, environmental, dry adiabatic lapse rate and wet adiabatic lapse rate, ii. Stable and unstable air, iii. Absolute stability, iv. Absolute instability, v. Conditional instability. Air Masses and Fronts i. Introduction to air masses and fronts, ii. Types of air masses, iii. Types of fronts.	15 L
Suggested reading: <ol style="list-style-type: none"> 1. Critchfield, H.J. (Rep. 2010): General Climatology. Prentice Hall, New Delhi. 2. Lal, D.S. (1998): 'Climatology', Chaitanya Publishing House, Allahabad. 3. Lutgens, Frederic K. & Tarbuck, Edward J. (2010): 'The Atmosphere: An Introduction to Meteorology', Pearson Prentice Hall, New Jersey. 4. Oliver, John E. & Hidore, John J. (2003): Climatology: An Atmospheric Science, Pearson Education, Delhi 5. Savindra Singh (2005): Climatology, Prayag Pustak Bhawan, Allahabad. 6. Trewartha: Introduction to Weather and Climate. 7. More, Pagar, Thorat (2014): (Marathi), Elements of Climatology & Oceanography, Atharv Publication, Pune. 		

Course Outcomes (COs):

After completing this course graduate should be able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-202.1	Understand the introduction to Climatology considering weather & climate, the role of climate in human life, aims, nature, scope, and some other subdivision of the course.	2
GG-202.2	Determine the Atmosphere and its process and function, origin, composition, the structure Atmosphere.	3
GG-202.3	To examine the Insolation and Heat Budget and its factors effects and their relations to other some elements.	3

GG-203: STATISTICAL METHODS IN GEOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To change a descriptive character of geography and make it a scientific discipline. 2. To explain and interpret the spatial patterns of geographical phenomena in a rational, objective & cogent manner. 3. To use mathematical language instead of the language of literature like 'Af' in the koeppen's classification of climate this stands for 'tropical rainforest climate'. 4. To make precise statements about locational order. 5. To test hypothesis and formulate models, theories and laws. 6. To identify the ideal locations for the various economic activities so that profit may be maximized. 7. To provide geography a sound philosophical theoretical base. 	
Unit 1	<p>Geographical data</p> <ol style="list-style-type: none"> 1. Nature; Spatial and Temporal, Discrete and Continuous Data, Grouped and Ungrouped data 2. Scales of measurement; Nominal, ordinal, Interval and ratio scale descriptive and Inferential <p>1. Types of statistics.</p>	10 L
Unit 2	<p>Descriptive statistics and Probability</p> <ol style="list-style-type: none"> 1. Analytical methods; Meaning, description and calculation of mean, median, variance, standard deviation, skewness, and kurtosis. <p>Methods of Determination; Normal probability distribution, central limit theorem, the Confidence interval for means, Determination of the probability of a continuous random event using the normal distribution, Determination of the probability of a discrete random event using Binomial and Poisson distributions.</p>	15 L
Unit 3	<p>Sampling & Sampling plan in Geographic Science system</p> <p>Meaning, and Definition of time series, Methods of analysis.</p> <ol style="list-style-type: none"> 1. Meaning and types of sampling <ol style="list-style-type: none"> i) Simple Random sampling- point, line, and area sampling. ii) Restricted Random Sampling- Systematic or grid, stratified and cluster sampling. 2. Designing and conducting a sample survey <ol style="list-style-type: none"> i) Planning ii) Data collection <p>1. Data Analysis and conclusion</p>	10 L
Unit 4	<p>a) Designing and conducting a Sample Survey</p> <ol style="list-style-type: none"> 1. Planning 2. Data Collection 3. Data analysis and Conclusions. <p>b) Regression Analysis</p> <ol style="list-style-type: none"> 1. Semi-Average method 2. Least-Square method <p>c) Exponential regression equation.</p>	10 L

Unit 5	Inferential statistics 1. General requirements for conducting an inferential Statistical test; Population and sample, Meaning of unbiased random sample, Standard error estimates of mean and standard deviation. 2. Testing of hypothesis; Null and Alternative hypothesis, Level of significance (Rejection level), Degrees of freedom, Parametric and Nonparametric tests, 3. Application of following tests, i) non-parametric test, chi-squared test. a. Two or more samples, b. Using relative frequency table, ii) Parametric tests. a. Student's test (comparison of sample means), a. b. ANOVA (Analysis of variance)	15 L
Suggested reading: 1. Borradaile, G. (2003): Statistics of Earth Science Data, Springer, New York 2. Ebdon David (1989). Statistics for Geographers 3. Frank, H. and Althoen, S. C. (1994): Statistics: Concepts and Applications, Cambridge University Press, Cambridge 4. Hammond, R. and Mc Cullagh, P. (1991): Quantitative Techniques in Geography, Clarendon Press, Oxford 5. King, (1975). Statistical Geography 6. Mann, P. S. (2007): Introductory Statistics, John Wiley and Sons, New Delhi 7. Norcliffe G.B. (1977). Inferential statistics for Geographers (Hutchinson, London) 8. Rogerson P.A. (2001). Statistical methods for Geography (SAGE pub., London, New Delhi) 9. Rogerson, P. A. (2010): Statistical Methods for Geography, Sage Publications, London Shaw G. & Wheller D. (1985). Statistical Techniques in Geographical Analysis, John Wiley & Sons, New York.		

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-203.1	Get knowledge about Geo Statistical Methods.	3
GG-203.2	Demonstrate the representation of Statistical data.	2
GG-203.3	Understand the introduction of the geo-sciences system and statistical techniques and characteristics of data.	3

GG-204: PRACTICAL'S IN HUMAN GEOGRAPHY

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To introduce some basic research method to the students to be applied to various themes in Human Geography. 2. To indicate the assumptions, limitations, and interpretation of these methods and results.
Unit 1	<p>Introduction to Microsoft Excel Workbook and Presentation Techniques:</p> <ol style="list-style-type: none"> 1. Microsoft Excel; Worksheets Workbooks & Worksheets, Data Analysis tools and Techniques, Development of Syntax on Formula Bar, Data Presentation Techniques. 2. Presentation Techniques; Introduction to Microsoft Office PowerPoint, Preparation of Slides, Maps, and Graphs import techniques for a slide show
Unit 2	<p>Data Analysis Techniques in Population Geography:</p> <ol style="list-style-type: none"> 1. Density; Arithmetic Density of Population, Economic Density of Population, Nutritional Density of Population, Agricultural Density of Population, Critical Density of Population 2. Measures; Fertility Rates, Birth Rates: Crude & Age Specific, Mortality Rate, Child-Women Ratio, 3. Sex Ratio: Sex Ratio of all groups of Population 4. Population Change: Annual or Decadal 5. Dependency Ratio 6. Religious Composition:
Unit 3	<p>Data Analysis Techniques in Rural and Urban Settlement Geography:</p> <ol style="list-style-type: none"> 1. Dispersion of Rural Settlements; Bernhard's method, Demangeon method, Debouvrie's method 2. Classification of Villages according to the size of Population 3. Growth Rate of Rural Population 4. Growth of Urban Population 5. Degree of Urbanization 6. Functional Classification of Towns by Thompson.
Unit 4	<p>Techniques:</p> <p>Proportion of Cropped Land, Crop Concentration by Bhatia, Crop Diversification by Bhatia, Crop Combination by Weaver's & Doi's Methods, Correlation of Coefficient, Quartile Deviation, Standard Deviation, Coefficient of Variation, Calculation of 'r' values to draw circles.</p>
Unit 5	<p>Preparation of Following Maps:</p> <p>Density of Population, Concentration of Population, Sex Ratios, Proportion of Category Wise Population, Religion wise composition, Literacy Rate</p> <p>Cartographic Techniques in Rural Settlement Geography</p> <p>Classification of Rural Settlements according to size of Population, Proportion of Rural Population, Dispersion of Settlements,</p> <p>Cartographic Techniques in Population Geography</p> <p>Classification of Towns according to the size of Urban Settlement, Proportion of Urban Population, Degree of Urbanization, Functional Classification of Towns,</p> <p>Cartographic Techniques in Agricultural Geography</p> <p>Proportion of Crops, Crop Concentration, Crop Diversification, Crop Combination, Land use, and Land Classification</p>
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. R.B.Mandal: "Statistic for Geography and Social Science". 	

2. Monkhouse: “Maps and Diagram”.
3. Masjid Husen “: Agricultural Geography”.
4. Hudson F.S. (1976): “Geography of Settlement”.
5. Yeats, M.H. (1974): “An Introduction to Quantitative Analysis in Human Geography”.
6. Sing J. and Dhillon (1984) “Agricultural Geography”.
7. Sing R.L. “Readings in Rural Settlement Geography”.
8. Michaele E. and E. Hurse: ‘Transportation Geography”.
9. Edward Arnold: “The Study of Urban Geography”.
10. George Omura: Mastering Auto CAD, BPB Publication, b14 Conneaut place, New Delhi
11. Grini Courter and Annette Marquis (1999): “OFFICE 2000” BPB Publication.

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-204.1	Students understand the Microsoft Excel, worksheet and learn the basics about the preparation of graphs, maps, in software for Presentation Techniques.	2
GG-204.2	To evaluate and investigate the population data in Microsoft Excel software.	5
GG-204.3	Evaluate the Data Analysis Techniques in Agricultural Geography and Climatology.	5

GG-205: PRACTICAL'S IN CLIMATOLOGY

	Course Objectives:	<ol style="list-style-type: none"> 1. Knows the measurement principles of standard atmospheric instrumentation for pressure, air temperature, humidity, wind and precipitation 2. Knows the measurement principles of standard oceanographic instrumentation for temperature, salinity and ocean currents 3. Knows the relevance of choosing a representative measurement location 4. Knows the main error sources and typical accuracies of atmospheric and oceanographic instrumentation 5. Knows the development and limitations of present operational observing systems.
1	Weather Elements:	Processing of weather data; Instrumentation and measurement techniques of weather elements and processing of weather data (5-10 years data)
2	Water balance - Principle and computation:	Computation of water balance for 4 stations in different rainfall zones and irrigation scheduling.
3	Preparation of Climatic Maps & Diagrams:	Simple temperature and rainfall graph, Climatograph, Climograph, Hythergraph, Foster's Climograph, Wind Roses: Simple, Compound & Octagonal, Rainfall Dispersion.
4	Station Model:	<ol style="list-style-type: none"> 1. Preparation of Station Model; Synoptic data: Coding, decoding and plotting of synoptic data, Use of weather data with the help of symbols. 2. Estimation of Potential Evapotranspiration by Thornwaite's; Method and Construction of graphs showing Surplus, Deficit Water Budget, and their Analysis.
5	Indian Daily Weather Report (IDWR):	<ol style="list-style-type: none"> 1. Study of Indian Daily Weather Report 2. Analysis of Indian Daily Weather Report; Temperature, Air Pressure, Humidity, Wind, Rainfall, etc. for various stations. 3. Weather forecasting
Suggested reading:		
<ol style="list-style-type: none"> 1. WMO No. 8 (1983): Guide to meteorological instruments and methods of observations 2. Thornthwaite, C. W. & Mather, J. R. (1957): Instructions and Tables for computing potential evapo - transpiration and water balance, Drexel Institute of Technology, Laboratory of Climatology. 4. Indian Daily Weather Report, IMD, Pune. 3. Oliver, John E. (1973): Climate and Man's Environment, John Wiley and Sons, New York. 4. Critchfield, H.J., General Climatology, Prentice Hall, N.J., 1975. 		

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-205.1	To discuss the student to a toposheet, weather map.	2
GG-205.2	Explaining the mechanism function of topographical maps.	3
GG-205.3	Understand interpretation of weather images.	2

M.A./ M.Sc. Part I Semester II (Applied Geography): Audit Courses

AC-201(A): Soft Skills (Personality and Cultural Development Related Audit course; Practical; 2 Credits) (Optional: Campus-level)		
	Course Objectives (COs): <ul style="list-style-type: none"> • To inculcate different soft skills among students. 	
Unit 1	Introduction to soft skills Formal definition, Elements of soft skills, Soft vs. Hard skills, Emotional quotient, Goal setting, life skills, Need for soft skills, Communication skills, Etiquettes & Mannerism.	2 hrs.
Unit 2	Self-Assessment Goal setting, SWOT analysis, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements, positive attitude, positive thinking and self-esteem. Activity: The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.	4 hrs.
Unit 3	Communication Skills Types of communication: Verbal, Non-verbal, body language, gestures, postures, gait, dressing sense, facial expressions, peculiarity of speaker (habits). Rhetoric speech: Prepared speech (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver, Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic), Storytelling (Each student narrates a fictional or real-life story for 5 minutes each), Oral review (Each student orally presents a review on a story or a book read by them) Drafting skills: Letter, Report & Resume writing, business letters, reading & listening skills Activity: The teacher should teach the students how to write the letter, report and build resume. The teacher should give proper format and layouts. Each student will write one formal letter, one report and a resume.	8 hrs.
Unit 4	Formal Group Discussion, Personal Interview & Presentation skills Topic comprehension, Content organization, Group speaking etiquettes, driving the discussion & skills. Preparation for personal interview: dress code, greeting the panel, crisp self-introduction, neatness, etiquettes, language tone, handling embarrassing & tricky questions, graceful closing. Activity: Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback. Mock interview are to be conducted.	4 hrs.
Unit 5	Aptitude and analytical skills Quantitative aptitude, Numerical reasoning, verbal reasoning, diagrammatic test, situational tests, logical thinking. Analytical skills: Definition, Types, problem solving	8 hrs.
Unit 6	Life skills Time management, critical thinking, sound and practical decision making by dealing with conflicts, stress management, leadership qualities Activity: The teacher can conduct a case study activity to train students for decision making skills. The teacher should conduct a session on stress management and guide students on how to manage stress. The teacher may conduct a stress relieving activity in the class. He/she may counsel students individually to know their problems and guide them on dealing with them effectively.	4 hrs.
Suggested readings: <ol style="list-style-type: none"> 1. Basics of Communication In English: Francis Sounderaj, MacMillan India Ltd. 2. English for Business Communication: Simon Sweeney, Cambridge University Press 3. An Introduction to Professional English and Soft Skills: Das, Cambridge University Press 4. Quantitative Aptitude: R.S. Agrawal 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC201A.1	Identify their lacunas about some soft skills and try to overcome the same.	2
AC201A.2	Practice learned soft skills in real life and do their jobs more effectively.	3

AC-201(B): Practicing Sports Activities (Personality and Cultural Development Related Audit course; Practical; 2 Credits) (Optional: Campus-level)				
Course Objectives (CObs):				
<ul style="list-style-type: none"> To motivate students towards sports and provide them required training. 				
SR NO.	NAME OF THE SPORT/GAME (Select ONE of the Following)	SYLLABUS OF THE COURSE	TIMING (02 Hours in a Week)	SEMESTER
1	Volleyball	<ul style="list-style-type: none"> General Fitness Basic Fitness Specific Fitness History of the Game Basic Skill of the Game Major Skill of the Game Technique & Tactics of the Game Game Practice 	<p>Morning : 07 to 09 AM</p> <p>OR</p> <p>Evening : 05 to 07 PM</p>	Total 30 Hours in Each Semester
2	Athletics			
3	Badminton			
4	Cricket			
5	Basketball			
6	Handball			
7	Kabaddi			
8	Kho-Kho			
9	Table-Tennis			
10	Swimming			

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC201B.1	Identify one or more sports of their choice and develop more interest to participate at University/National level sport events.	2
AC201B.2	Practice the learned sports activities regularly in real life.	3

AC-201(C): Practicing Yoga
(Personality and Cultural Development Related Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives:

- To motivate students towards yoga and provide them required training.

- Yog: Meaning, Definition & Introduction, Objectives
- Primary Introduction of Ashtanga Yoga
- Preparation of Yogabhyas
- Omkar Sadhana, Prayer, Guru Vandana
- Sukshma Vyayamas
- Suryanamaskar (12 Postures)
- Asanas :
 - Sitting (Baithaksthiti) - Vajrasana, Padmasan, Vakrasan, Ardha-Pashchimotanasan
 - Supine (Shayansthiti) - Uttan Padaasan(Ekpad/Dwipad), Pavanmuktasana, Viparitakarani Aasan, Khandarasan, Shavasana
 - Prone (Viparitshayansthiti) - Vakrahasta, Bhujangasana, Saralhasta Bhujangasana, Shalabhasana(Ekpad/Dwipad), Makarasana
 - Standing (Dhandsthiti) - Tadasana , TiryakTadasana, Virasana, Ardh Chakrasana
- Primary Study of Swasana: Dirghaswasana, Santhaswasana, JaladSwasana - 6 Types
- Pranayama : Anuloma-viloma, Bhramari

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC201C.1	Identify and practice some Yoga asanas regularly in their life to remain healthy.	2
AC201C.2	Provide guidance and practice about Yoga to their friends, parents and relatives.	3

AC-201(D): Introduction to Indian Music
(Personality and Cultural Development Related Audit course; Practical; 2 Credits)
(Optional: Campus-level)

	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To motivate students towards Indian music and provide them minimum required training.
	<ul style="list-style-type: none"> • Definition and brief about generation of Swar, Saptak, Thaata, Raaga, Aavartan, Meend, Khatka, Murkee, Taal, Aalaap etc. • Taal and its uses - Treetaal, Daadraa, Zaptaal, Kervaa. • Information of Badaakhyaal, Chhotaakhyaal (one), Sargam, Lakshangeet (information) • Detailed information of Tambora • Detailed information of Harmonium and Tablaa. • Five filmy songs based on Indian Classical Music (Theory and Presentation) • Sound Management - Basic information of Sound Recording (including Practicals) • Composition of Music as per the Story • Preparing news write-ups of the Seminars, Library Musical Programmes held at the nearest Akashwani, by personal visits.

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC201D.1	Identify different types of Indian music.	3
AC201D.2	Develop more interest to learn and practice Indian music.	4

SYLLABUS

M.A / M.Sc. Applied Geography

SEMESTER – III

GG-301: GEOGRAPHY OF RESOURCES		
	<p>Course Objectives:</p> <ol style="list-style-type: none">1. To acquaint the pupils with the living conditions of men in different parts of the globe.2. To enable the pupils to acquire a knowledge of natural resources.3. To develop in pupils an understanding of how the environment and climatic factors have influenced our life.	
Unit 1	<p>Introduction to Resource Geography Meaning and Definition of Resource, Importance of the study of resources, Components of resources, natural and human. Classification of Resources Basis of Classification: renewable and non-renewable resources, Importance of biotic and abiotic renewable resources, Importance of biotic and abiotic non-renewable resources.</p>	10 L
Unit 2	<p>Forest Resources Use of forest resources, Environmental significance of forests, Distribution of Forest resources in Maharashtra and India, Meaning causes, significance, and utilization of forest and effects of deforestation, Remedial measures to conserve forest resources, Methods of conservation of Forest resources. Water Resources Water as a resource, Sources of water, significance and utilization of water resources, Distribution of water resources in Maharashtra and India, Uses of water resources – i) domestic, ii) agriculture, iii) industry, iv) transportation, v) tourism, etc., Methods of conservation of water resources. Land Resources Significance and utilization of land resources, Distribution of land resources in Maharashtra and India, Use of land resources: agriculture, forest, mining, settlements & other, Land degradation due to agriculture, and deforestation. Methods of conservation of land resources.</p>	15 L
Unit 3	<p>Mineral Resources World distribution and production of iron ore, bauxite in major Countries, Distribution and production of iron ore, bauxite in India, Distribution, and production of iron ore, bauxite in Maharashtra. Energy Resources; Distribution and production of coal, petroleum and natural gas in World, India & Maharashtra, Significance and utilization of solar, wind and nuclear energy resources in World, India, and Maharashtra. Human Resources Population as a resource, World distribution of population, Population distribution in India, Population distribution in Maharashtra, Concepts of over, optimum and under population.</p>	15 L
Unit 4	<p>Resources and Economic development Role of land resources in economic development, Role of water resources in economic development, Role of mineral resources in economic development, Role of energy resources in economic development, Role of human resources in economic development</p>	10 L
Unit 5	<p>Planning and Management of Resources. Concept of resource planning, Need for resource planning, Resource planning with reference to Maharashtra and India.</p>	10 L

Suggested reading:

1. Chemprema J. D. (1989): Geography and Energy, Longman Scientific and Technical Series. U. K.
2. Daji J. A., Kadam J. R. and Patil, N. D. (1996) : A Textbook of Soil Science, Media Promoters & Publishers Pvt. Ltd. Bombay.

3. Gurjar & Jat (2008): Geography of Water Resources, Rawat Publications, Jaipur.
4. Negi B. S. (1997) : Geography of Resources, Kedarnath Ramnath, Meerut.
5. Owen S. and Owens P.L. (1991) : Environment Resources and Conservation, Cambridge University Press, New York.
6. Ray S. (2008) : Natural Resources, Organization & Technology Linkages, Rawat Publication, Jaipur.
7. Saxena H. M. (2006) : Environmental Geography, Rawat Publications, Jaipur.
8. Singh S. (2004) : Environmental Geography, Prayag Pustak Bhawan, Allahabad.
9. Skinner B. J. (1969) : Earth Resources, Prentice-Hall, Englewood Cliffs, N. J.
10. World Resources Institute (WRI) 1994: World Resources 1994-95, Oxford University Press, New York. Zimmerman E. W. (1951) : World Resources & Industries.

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-301.1	Develop an idea about the resource.	3
GG-301.2	Understand the concept of different types of resources.	2
GG-301.3	Acquire knowledge about different types of power resources.	3

GG-302 (A): URBAN GEOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To produce original, innovative scholarship in urban geography, smart urbanism, and postcolonial urban theory by extending the research to the much neglected but dynamic context of 'small cities' 2. To critically learn from how State, urban authorities and citizens of small cities living through rapid and radical urban transformations imagine and realize new urban futures. 3. To produce a detailed evidence base and learn from innovative practices within the three cities that can be communicated widely to policy-makers, practitioners, municipal authorities, civil society organizations and community groups. 4. To build research capacity on smart cities and urban futures in India and elsewhere. Societal partners are key to the formation, execution, and dissemination of this project through access to their networks and their role in the delivery of pathways to impact activities. 5. To develop evidence-based policy interventions on smart cities and urban futures in India and elsewhere. 	
Unit 1	<p>Introduction Nature and scope, Significance, Relation to other disciplines.</p> <p>Urbanization Concept and Process; Meaning of Urban settlement and urbanization, Criteria used to distinguish urban settlements, Behavioral, the structural and demographic concept of urbanization, Brief review of spatial-temporal variations in urbanization in the world, Urbanization curve, Contemporary factors of urbanization.</p>	10 L
Unit 2	<p>Urban Morphology Models of urban structure; Park and Burgess Model, Homer Hoyet Model, Harris and Ullman Model, Characteristics and demarcation of CBD.</p> <p>Urban Classification Various approaches to classification, Urban function, Functional classification of towns and cities by C.D. Harris and H. J. Nelson.</p>	15 L
Unit 3	<p>Urban Demography Characteristics and methods of demarcation; Growth of urban population, Urban explosion in developing countries, Density of population in cities, Age, sex and occupational structure.</p> <p>City and its Region Concept, characteristics, and demarcation; Concepts of city region and various, synonymous terms used, Criteria used to demarcate the city Region, Nature of urban influence.</p>	10 L
4	<p>Central place concepts Central place theory and urban Hierarchy; Christaller's Central Place Theory, Rank-size relationship and rank-size rule, Hierarchy of urban settlements</p> <p>Contemporary urban issues Nature of issues; Price of land and vertical and horizontal growth of cities, Urban sprawl, Scarcity of housing and growth of slums, Problems of civic amenities, Urban transport problem, Environmental pollution.</p>	
5	<p>Urban development policies and planning Policies of Urban development, Need of city planning, Elements of city plan, Master plan of towns, New towns, Urban development, and urban policy in India.</p>	

Suggested reading:

1. Bhattacharya: Urban development in India, Shree publication.
2. Brian.R.K. (1996): Landscape of Settlement Prehistory to the present, Routledge, London
3. Carter (1972): The Study of Urban Geography, Edward Arnold, London.
4. Hall P. (1992) Urban and Regional Planning, Routledge, London
5. Johnson: Urban Geography
6. K. Siddharth and S. Mukherji: Cities, Urbanizations and Urban Systems.
7. Kundu, A. (1992): Urban Development and Urban Research in India, Khanna Publication.
8. Mayer and Kohn: Readings in Urban Geography
9. Northam: Urban Geography
10. Raj Bala: Urbanization in India.
11. Roy Turner: Indian's Urban Future.
12. Shah Manzoor Alam: Urbanization in Developing Countries
13. Singh. K. and Steinberg. F.(eds) (1998): Urban India in Crisis. New Age Interns, Urban Geography: Tim Hall Verma: Urban Geography, Rawat, Jaipur

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-302(A).1	Critical understanding of the key approaches (theoretical frameworks) used in the study of urbanization and urban change.	2
GG-302(A).2	Understanding of current urban policies and programs	2
GG-302(A).3	Explain the concepts and models of the development, function, and distribution of cities.	4

GG-302 (B): MEDICAL GEOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To introduce the students to the special features of the development and the research areas of the science of health geography. 2. To present the indicators, values, and characteristics that can be used to describe, compare and contrast the state of health of the population. 3. To present the development, the main trends and research activities of this area of science. 4. We also intend to prove the interdisciplinary nature of health geography by showing the connections between different disciplines as well as raise interest about health geography as the area of science that deals with current social and environmental issues. 	
Unit 1	<p>Introduction Definition, development and significance, Dualism between Medical and Health Geography</p>	08L
Unit 2	<p>Human ecology of disease</p> <ol style="list-style-type: none"> 1. Landscape epidemiological approaches. 2. Social and spatial epidemiological perspectives. 3. Health transition. 	10 L
Unit 3	<p>Health Geography Disease and Wellbeing; Approaches to the Study of Health Geography: Ecological, Social and Spatial;</p> <ol style="list-style-type: none"> 1. Approaches to the Study of Wellbeing: Need-based, Relative Standard and Capability; Geographical Factors affecting Human Health and Wellbeing. 2. Diseases and their Typology: WHO Classification of Diseases and their Major Types: Genetic; Communicable and Non- communicable; Occupational and Deficiency Diseases; Epidemics and Pandemic. 	15 L
Unit 4	<ol style="list-style-type: none"> 1. Geographical perspective on health care provisions in developed and developing countries, Spatial aspects of health care planning 2. Indian health care delivery system: public and private sectors, reproductive and child health, millennium development goals 3. Climate change and public health, adaptation, and mitigation 	12 L
Unit 5	<ol style="list-style-type: none"> 1. Global Patterns of Human Health and Wellbeing Ecology, Etiology, Diffusion and Distribution Pattern of Malaria, Tuberculosis, Hepatitis, AIDS, Glycemia and Cardiovascular Diseases; Poverty; Food Security; Nutrition Deficiency; Health and Sanitation Facilities. 2. International and National Concerns: Role of WHO, UNICEF, Red Cross; Indian Health Care Planning: Child and Family Health Welfare, Immunization, Rural Health and Health for All Programmes, National Health Care Infrastructure. Health GIS. 	15 L
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Brown, T., McLafferty, S., Moon, G. (2010): A Companion to Health and Medical 2. Curtis, S. (2004): Health and Inequality: Geographical Perspectives, Sage Geography, Wiley Blackwell, UK 3. Hazra, J. (Ed.) (1997): Health Care Planning in Developing Countries, University of Calcutta, Calcutta 4. May, J. M. (1959): Ecology of Human Diseases, M.D. Publications, New York 5. Pati, B. and Harrison, M. (2009): The Social History of Health and Medicine in Colonial India, Routledge, London 6. Philips, D. R. (1990): Health and Health Care in Third world, Longman, 		

London Publications, London

7. Stamp, L. D. (1964): Geography of Life and Death, Cornell University, Ithaca
8. May, J.M. (1970). The World Atlas of Diseases, National Book Trust, New Delhi.
9. Narayan, K.V. (1997). Health and Development: Inter-sectoral linkages in India, Rawat Pub., Jaipur.
10. Rais, A. and Learmonth, A.T.A., (1986): Geographical Aspects of Health and Diseases in India, Concept Publishing Company, New Delhi. 22. Izhar, N. (2004).
11. Geography and Health; A study in Medical Geography, Saujanya Books, Delhi.
12. http://en.wikipedia.org/wiki/Health_geography
13. <http://www.esri.com/industries/health/geomedicine/index.html>

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-302(B).1	Understand the Ecology and epidemic Deciles.	2
GG-302(B).2	Find out the Geographical Background of Diseases.	3
GG-302(B).3	To discover the function of WHO, UNICEF, and RED CROSS.	2

GG-303: GEOINFOMETICS - II		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Maximizing the efficiency of planning and decision making 2. Integrating information from multiple sources 3. Facilitating complex querying and analysis 4. Eliminating redundant data and minimizing duplication 	
Unit 1	<p>Introduction to Remote Sensing (RS)</p> <ol style="list-style-type: none"> 1. Principles of RS; Definition, Historical Perspective-National & International Scenario. 2. Electromagnetic Spectrum; Spectrum, Spectral Quantities, Theories of EMR, Laws of Radiation, Concept of Blackbody radiation, Spectral Signatures. 3. Data sources; Primary and Secondary; Fieldwork and Surveys, Published data and Reports and maps, Remotely sensed data, GPS coordinates. 	10L
Unit 2	<p>Interaction of EMR Atmosphere and Surface;</p> <ol style="list-style-type: none"> 1. Scattering, Absorption, Refraction, Path Radiance Reflection, Transmission, Absorption Scattering. 2. Surfaces, Atmospheric Windows and Types of RS. <p>Satellite RS Platforms Orbits Scanning Sensors;</p> <ol style="list-style-type: none"> 1. Group – base, Air-borne, Spaceborne. 2. Geosynchronous, Susynchronous. 3. Across- track and Along –track. 4. Spectral, Spatial, Radiometric and Temporal characteristics. 5. Types of Sensor Landsat: MSS, TM, ETM, SPOT,: HRV, IRS: LISS,PAN, WiFS, OCM. 	15 L
Unit 3	<p>Aerial Photography Basics of Ariel Photography, Ariel Camera;</p> <ol style="list-style-type: none"> 1. Scale, Resolution, Projection, Flight Planning, Overlaps. 2. Optical accepts – Spherical Aberrations, Astigmatism, Chromatic Aberrations Components of camera. <p>Measurement</p> <ol style="list-style-type: none"> 1. Geometric characteristics of Ariel Photography, Measurement of scale and height on Ariel Photography. 	10 L
Unit 4	<p>Visual Interpretation and GPS</p> <ol style="list-style-type: none"> 1. Elements; Factors governing the interpretability, Elements of Interpretation of satellite images and aerial photographs. 2. Fundamental Concepts of GPS; Space Segment, Control Segment, and User Segment, Components and Types, GSP Signals. 	10 L
Unit 5	<p>Earth Resource Satellites</p> <ol style="list-style-type: none"> 1. Introduction, the early history of space imaging, platforms (ground, aerial and space) and sensors. 2. Indian Remote Sensing Programs: Aryabhata, Bhaskara I and II programs, IRS satellite missions and their capabilities. 3. Overview and scope of the future IRS Missions. 	15 L

Suggested reading:

1. Virginia (1966): Manual of Photogrammetry (3rd ed.) American Society of Photogrammetry.
2. Virginia (1975): Manual of Remote Sensing, American Society of Photogrammetry.
3. Avery, T. E. and G. L. Berlin (1983, 1992): Fundamentals of Remote Sensing and Airphoto Interpretation, 5th ed., MacMillan Publishing Co. New York.
4. Curran, P. J. (1988): Principles of Remote Sensing, Longman, ELBS edition, Hong Kong. 5. Kellaway, George P. (1956): Map Projection, Methuen & Co., London.
5. Lillesand, T. M., and Kieffer, R. W. (1979): Remote Sensing and Image Interpretation, John Wiley and Sons, New York.
6. Sabins, F. F. (Jr.) (1987): Remote Sensing Principles and Interpretation, 2nd ed., W.H. Freeman and Co., New York.
7. Steers, J. A. (1957): Map Projections, University of London Press, London.
8. Manual of Remote Sensing (1980): Vol I and II, American Society of Photogrammetry. 4th Ed., Falls Church.
9. Avery, T.E. and G.L. Berlin (1985): Interpretation of Aerial Photographs, 4th Ed., Bergess Minneapolis, Minn.
10. Bruno Marcolongo and Franco Mantovani (1997): Photogeology and Remote Sensing Applications in Earth Science, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
11. Pandey S.N. (1987): Principles and Applications of Photogeology by, Wiley Eastern.
12. W.G. Rees (1990): Physical Principles of Remote Sensing, Cambridge University Press.
13. Sabins, F.F. (1986): Remote Sensing Principles and Interpretations by, 2nd Ed. W.H. Freeman and Company, New York.
14. Verbyia D. (1995): Satellite Remote Sensing for natural resources, Lewis Publishers, Boca Rotaon, F.L.Wolf P.R. (1983): Elements of Photogrammetry, McGraw-Hill, New York.

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-303.1	Understand the modern techniques in geography under this course such as remote sensing and aerial photography.	3
GG-303.2	Understand and get the knowledge about the fundamental concept, types of aerial photography, characteristics of aerial photographs, and aerial camera.	3
GG-303.3	Understand the data product, types of data product, and its applications and uses in remote sensing.	2

GG-304: PRACTICALS IN REMOTE SENSING AND IMAGE PROCESSING

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To provide exposure to students in gaining knowledge on concepts and applications leading to the modeling of earth resources management using Remote Sensing 2. To acquire skills in storing, managing digital data for planning and development. 3. To acquire skills in advanced techniques such as hyperspectral, thermal, and LiDAR scanning for mapping, modeling, and monitoring.
Unit 1	<p>Photogrammetry Stereoscopic Vision Test, Format and stereoscopic Orientation of Aerial Photographs, Determination of scale and Stereoscopic area, Determination of Principal Point and Conjugate, Principal Point Direction of Flight line and Air Base, Calculation of traffic Speed through Aerial Photographs, Calculation of Photographic coverage for a Planning Area.</p>
Unit 2	<p>Satellite Images Interpretation; Visual interpretation of LISS, PAN, WiFS and Merged Images, A WiFS and High-Resolution Satellite, Data, Cartosat Data, IKONOS, and Quick Bird, etc.</p>
Unit 3	<p>Digital Image Processing Enhancement; Linear – Contrast Enhancement, Non-Linear – Square, Square root, Cube, Cube root, Spatial Filtering –Mean & Median, Band Ratioing, NDVI Computation.</p>
Unit 4	<p>Image Processing Introduction of image processing, farms of mages, different image processing techniques, computer image processing, digital image processing, image restoration image enhancement, edge enhancement, ratio images.</p>
Unit 5	<p>Software based Image Processing GIS; Image Registration, Enhancement, Supervised Classification Unsupervised Classification, Georeferencing of the scanned raster image, Digitization (vectorization), Rasterization, Attribute data linking, Thematic Layer Generation.</p>
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Virginia (1966): Manual of Photogrammetry (3rd ed.) American Society of Photogrammetry. 2. Virginia (1975): Manual of Remote Sensing, American Society of Photogrammetry. 3. Avery, T. E. and G. L. Berlin: Fundamentals of Remote Sensing and Airphoto Interpretation, 5th ed., New York, MacMillan Publishing Co., 1983, 1992. 4. Curran, P. J.: Principles of Remote Sensing, Longman, ELBS edition, Hong Kong, 1988. 5. Kellaway, George P.: Map Projection, Methuen & Co., London, 1956. 6. Steers, J. A.: Map Projections, University of London Press, London, 1957. 	

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-304.1	Understand the important principles of remote sensing, spectral measurements, and remote sensing systems.	2
GG-304.2	Understand the need for image pre-processing and will be able to assess the pros and cons of different methods.	5
GG-304.3	Be confident in your use of image processing software to apply routine pre-processing and image analysis steps in a rigorous and self-reflective manner.	4

GG-305: PRACTICAL'S IN GIS & GPS TECHNIQUES WITH HELP OF COMPUTER.

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Have a basic, practical understanding of GIS concepts, techniques, and real-world applications. 2. Have an understanding of the technical language of GIS. 3. Understand the basic concepts of geography necessary to efficiently and accurately use GIS technology. 4. Understand basic GIS data concepts. 5. Have an ability to perform basic GIS analysis of concepts. 6. Have demonstrated a practical application of GIS. 7. Have practical experience using basic GIS tools. 8. Have an understanding of GIS and its relationship to mapping software development. 9. Have an appreciation of GIS career options and how to pursue them.
Unit 1	<p>Introduction to GIS</p> <ol style="list-style-type: none"> 1. Introduction to GIS software ILWIS and Arc GIS and GPS etc. 2. Applications of ILWIS software; Introduction to Menu, main windows, tools, navigation bar, catalogue, operation tree, command box, domain and attribute tables. 3. Introduction of GPS, data collection and mapping by using GPS Software.
Unit 2	<p>Applications of ILWIS software –</p> <ol style="list-style-type: none"> 1. Geo-referencing; Import scanned/digital image, Coordinate system, Geo-referencing. 2. Creation of layers; Concepts: point, segment, and polygon layers, Point layers: Settlements and Wells, Segments layers: Contours, boundaries, rivers and roads, Polygon layers: village, farm, and forest. 3. Attribute data; Tabulation and attachments.
Unit 3	<p>Overview of ArcGIS Arc Map, Arc Catalog, Arc Toolbox, Help, etc.</p> <p>Geodatabase in Arc catalog Feature dataset, feature classes, import of data, spatial data formats, Shape/coverage files and layers, data frames, maps, managing TOC, displaying qualitative/ quantitative values, labeling features.</p> <p>Working with layers Building templates, classification, map creation.</p>
Unit 4	<p>Georeferenced data coordinate systems, datum conversions, Map projections, types, storing-viewing projection information.</p> <p>Editing data Selecting features, simple editing functions, creating new features, modifying, schema changes.</p> <p>Spatial and aspatial data Spatial: Linking features & attributes. geodatabase data format, ways to view data, metadata, etc. Aspatial: Understanding tables, field types, table manipulations, table relationships, join and relates to, creation of graphs and reports.</p>
Unit 5	<p>Spatial analysis Query: Identifying, measuring, query by location/attribute. Spatial Analysis: Geoprocessing wizard, spatial analysis functions.</p> <p>Network analysis Network utility, creating network model, shortest path.</p>

Suggested reading:

1. Agarwal C.S.and Garg P.K. (2002): Text Book on Remote Sensing, Wheeler Publishing New Delhi.
2. ArcGIS 9, Building A Geodatabase by Andrew Perencsik, Simon Woo, Bob Booth, Scott Crosier, Jill Clark, Andy MacDonald, 1999-2004, USA.
3. ArcGIS 9, Geodatabase Workbook by Bob Booth, Jeff Shaner, Andy MacDonald, Phil Sanchez, Rhonda Pfaff, 2004, USA.
4. ArcGIS 9, Using ArcCatalog by Aleta Vienneau, Jonathan Bailey, Melanie Harlow, John Banning, Simon Woo, 2003-2004, USA.
5. Bernhardsen, Tor (1999): Geographic Information System, An Introduction, John Wiley & Sons.
6. Burrough, P. A. and McDonnell, R. A. (1998): Principles of Geographical Information Systems, Oxford University press Inc., New York
7. Burrough, P.A. (1986): Principles of Geographical information System for Land Resources Assessment, Oxford University Press.
8. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
9. Chang, Kang-taung (2000): Introduction to Geographic information System, Tata McGraw Hill.
10. Clarke ,Keith C. (1999): Getting Started with Geographic Information System , Prentice Hall.
11. Demers, Michael N. (2000): Fundamentals of Geographic Information System ,John Wiley.
12. Environment System Research Institute (1993): Understanding GIS , The Arc Info Method.
13. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands
14. GIS Education Solutions from ESRI, Introduction to ArcGIS- I, Course Lectures, 2003 Published by ESRI.
15. Haywood, Ian (2000): Geographical Information System, Longman.
16. Lillesand, Thomas M. & Kiefer Ralph (2000): Remote Sensing and Image interpretation, Jonh Wiley. Manual, Locate Press LLC, USA
17. Prithvish Nag and M. Kudrat (1998): Digital remote Sensing, Concept Publishing Company, New Delhi.
18. Quantum GIS User Guide, <http://docs.qgis.org/1.8/pdf/QGIS-1.8-UserGuide-en.pdf>
19. The ESRI guide to Geodatabase design by Michael Zeiler 1999.
20. Thiede, R., Sutton, T., Duster, H. and Sutton, M. (2013): The Quantum GIS Training William Jonathan (1995): Geographic information from Space: Processing and applications of Geocoded Satellite Images, John Wiley & Sons.

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-305.1	Understand the introduction of GIS software's special reference of ILWIS, to examining the types of GIS software and applications, the introduction of menu, tools, page layout and setting, scanning image, import of image in the software.	2
GG-305.2	To understand and prepare the topology of point, line, and polygon and understand non-spatial data analysis.	3
GG-305.3	To prepare the different kinds of the map using GIS software and also creates the profile of relief representation.	6

M.A./ M.Sc. Part II Semester III Applied Geography: Audit Courses

AC-301(A): Computer Skills

(Technology + Value added Audit course; Practical; 2 Credits)

(Optional: Campus + Program level)

Course Objectives (CObs):

- To inculcate different daily useful computer skills among students.

Unit 1	Elements of Information Technology 1.1 Information Types: Text, Audio, Video, and Image, storage formats 1.2 Components: Operating System, Hardware and Software, firmware 1.3 Devices: Computer, Mobile Phones, Tablet, Touch Screen, Scanner, Printer, Projector, smart boards 1.4 Processor & Memory: Processor functions, speed, Memory types: RAM /ROM /HDD /DVD-ROM/Flash drives, memory measurement metrics	2 hrs
Unit 2	Office Automation-Text Processing 2.1 Views: Normal View, Web Layout View, Print Layout View, Outline View, ReadingLayout View 2.2 Working with Files: Create New Documents, Open Existing Documents, Save Documents to different formats, Rename Documents, Close Documents 2.3 Working with Text: Type and Insert Text, Highlight Text, Formatting Text, Delete Text, Spelling and Grammar, paragraphs, indentation, margins 2.4 Lists: Bulleted and Numbered Lists, 2.5 Tables: Insert Tables, Draw Tables, Nested Tables, Insert Rows and Columns, Move and Resize Tables, Moving the order of the column and/or rows inside a table, Table Properties 2.6 Page Margins, Gutter Margins, Indentations, Columns, Graphics, Print Documents, 2.7 Paragraph Formatting, Paragraph Attributes, Non-printing characters 2.8 Types of document files: RTF, PDF, DOCX etc.	5 hrs
Unit 3	Office Automation-Worksheet Data Processing 3.1 Spreadsheet Basics: Adding and Renaming Worksheets, Modifying Worksheets, 3.2 Moving Through Cells, Adding Rows, Columns, and Cells, Resizing Rows and Columns, Selecting Cells, Moving and Copying Cells 3.3 Formulas and Functions: Formulas, Linking Worksheets, Basic Functions, AutoSum, Sorting and Filtering: Basic Sorts, Complex Sorts, Auto-fill, Deleting Rows, Columns, and Cells 3.4 Charting: Chart Types, drawing charts, Ranges, formatting charts	5 hrs
Unit 4	Office Automation- Presentation Techniques and slide shows 4.1 Create a new presentation, AutoContent Wizard, Design Template, Blank Presentation, Open an Existing Presentation, PowerPoint screen, Screen Layout 4.2 Working with slides: Insert a new slide, Notes, Slide layout, Apply a design template, Reorder Slides, Hide Slides, Hide Slide text, Add content, resize a placeholder or textbox, Move a placeholder or text box, Delete a placeholder or text box, Placeholder or Text box properties, Bulleted and numbered lists, Adding notes 4.3 Work with text: Add text and edit options, Format text, Copy text formatting, Replace fonts, Line spacing, Change case, Spelling check, Spelling options 4.4 Working with tables: Adding a table, Entering text, Deleting a table, Changing row width, Adding a row/column, Deleting a row/column, Combining cells, Splitting a cell, Adding color to cells, To align text vertically in cells, To change table borders, Graphics, Add clip art, Add an image from a file, Save & Print, slide shows, slide animation/transitions.	6 hrs
Unit 5	Internet & Applications: 5.1 Computer Network Types: LAN, PAN, MAN, CAN, WAN, Defining and describing the Internet, Brief history, Browsing the Web, Hypertext and hyperlinks, browsers, Uniform resource locator 5.2 Internet Resources: Email, Parts of email, 5.3 Protecting the computer: Password protection, Viruses, Virus protection software, Updating the software, Scanning files, Net banking precautions. 5.4 Social Networking: Features, Social impact, emerging trends, issues, Social Networking sites: Facebook, Twitter, linkedin, orkut, online booking services 5.5 Online Resources: Wikipedia, Blog, Job portals, C.V. writing	4 hrs

	5.6 e-learning: e-Books, e-Magazines, e-News papers, OCW(open course wares): Sakshat(NPTEL) portal, MIT courseware	
Unit 6	Cloud Computing Basics 6.1 Introduction to cloud computing 6.2 Cloud computing models: SAS, AAS, PAS 6.3 Examples of SAS, AAS, PAS (DropBox, Google Drive, Google Docs, Office 365 Prezi, etc.)	3 hrs
Suggested readings:		
<ol style="list-style-type: none"> 1. TCI, "Introduction to Computers and Application Software", Publisher: Jones & Bartlett Learning, 2010, ISBN: 1449609821, 9781449609825 2. Laura Story, Dawna Walls, "Microsoft Office 2010 Fundamentals", Publisher: Cengage Learning, 2010, ISBN: 0538472464, 9780538472463 3. June Jamrich Parsons, Dan Oja, "Computer Concepts Illustrated series", Edition 5, Publisher Course Technology, 2005, ISBN 0619273550, 9780619273552 4. Cloud computing online resources 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC301A.1	Identify their lacunas about some computer skills and try to overcome the same.	2
AC301A.2	Practice the learned computer skills in real life and do their jobs more effectively.	3

AC-301(B): Cyber Security
(Technology + Value added Audit course; Practical; 2 Credits)
(Optional: Campus + Program level)

Course Objectives (CObs):

- To make students aware of different daily useful cyber security skills/rules.

Unit 1	Networking Concepts Overview Basics of Communication Systems, Transmission Media, ISO/OSI and TCP/IP models, Network types: Local Area Networks, Wide Area Networks, Internetworking, Packet Formats, Wireless Networks: Wireless concepts, Advantages of Wireless, Wireless network architecture, Reasons to use wireless, Internet	3 hrs
Unit 2	Security Concepts Information Security Overview, Information Security Services, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, Steganography. Importance of Physical Security, Biometric security & its types, Risk associated with improper physical access, Physical Security equipments. Passwords: Define passwords, Types of passwords, Passwords Storage – Windows & Linux.	7 hrs
Unit 3	Security Threats and vulnerabilities Overview of Security threats, Hacking Techniques, Password Cracking, Types of password attacks, Insecure Network connections, Wi-Fi attacks & countermeasures, Information Warfare and Surveillance. Cyber crime: e-mail related cyber crimes, Social network related cyber crimes, Desktop related cyber crimes, Social Engineering related cyber crimes, Network related cyber crimes, Cyber terrorism, Banking crimes	7 hrs
Unit 4	Cryptography Understanding cryptography, Goals of cryptography, Types of cryptography, Applications of Cryptography, Use of Hash function in cryptography, Digital signature in cryptography, Public Key infrastructure	5 hrs
Unit 5	System & Network Security System Security: Desktop Security, email security: PGP and SMIME, Web Security: web authentication, Security certificates, SSL and SET, Network Security: Overview of IDS, Intrusion Detection Systems and Intrusion Prevention Systems, Overview of Firewalls, Types of Firewalls, VPN Security, Security in Multimedia Networks, Fax Security.	3 hrs
Unit 6	OS Security OS Security Vulnerabilities updates and patches, OS integrity checks, Anti-virus software, Design of secure OS and OS hardening, configuring the OS for security, Trusted OS.	2 hrs
Unit 7	Security Laws and Standards Security laws genesis, International Scenario, Security Audit, IT Act 2000 and its amendments.	3 hrs

Suggested readings:

- Skills Factory, Certificate in Cyber Security, Text Book Special edition, Specially published for KBC NMU, Jalgaon
- BPB Publication, “Fundamentals of Cyber Security”, Mayank Bhushan, Rajkumar Singh Rathore , Aatif Jamshed
- CreateSpace Independent Publishing Platform, “Cyber Security Basics”, Don Franke, ISBN-13: 978-1522952190 ISBN-10: 1522952195
- Online references

Course Outcomes (COts):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC301B.1	Practice learned cyber security skills/rules in real life.	3
AC301B.2	Provide guidance about cyber security skills/rules to their friends, parents and relatives.	2

AC-301(C): Rainwater Harvesting

(Technology + Value added Audit course; Optional: Program-level; Practical; 2 Credits)

Course Objectives (COs):

- To meet the increasing demands of water
- To supplement groundwater supplies during lean seasons
- To raise the water table by recharging groundwater

Reducing groundwater contamination

1. Introduction to rainwater harvesting
2. Basic principles and functions of in-field rainwater harvesting
3. Application and maintenance of in-field rainwater harvesting
4. Planting of various crops
5. All living things including, plants, animals and human beings need water to live and to carry out different cellular activities.
6. Students will learn about rainfall patterns.
7. Students will learn the relationship between catchment area and rainwater volume collected.
8. Student will learn about water use for various purposes and decide the use for their collected rainwater.

Suggested readings:

1. Theib Y. Oweis, Diter Prinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
2. Studer Rima Mekdaschi and Hanspeter Liniger. 2013 Water Harvesting – Guidelines to Good Practice Centre for Development and Environment. University of Bern. Switzerland.
3. Rainwater Harvesting for Drylands and Beyond Volume 1 by Brad Lancaster
4. “Rainwater Harvesting and Soil Water Conservation Technique” by Liliana Lizarraga
5. Rain Water Harvesting Hardcover – 1 January 2012 by D. K. Singh

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC301C.1	Describe rainwater harvesting.	1
AC301C.2	Explain the two most efficient methods used for rainwater harvesting.	2
AC301C.3	Benefits of rainwater harvesting in urban areas.	3

AC-301(D): GEO-TOURISM

(Technology + Value added Audit course; Optional: Program-level; Practical; 2 Credits)

Course Objectives (COs):

- To develop the students with professional and academic inputs to adapt to the requirements of the changing travel, tourism and hospitality industry.
- Various Physiographic regions of the world, Potential of tourism in Northern Mountains, Indo Gangetic Plains, Highlands, Coastal regions and islands. Natural and man-made tourism resources in India.
 - Explain the tourism industry, including the historical impact it has on local cultures and environments.
 - Identify potential opportunities for the development or growth of the tourism industry in each region.
 - Apply interpretive techniques to cultural and natural tourism resources to connect and influence visitors.
 - Analyze visitor behaviors and interactions to help improve tourism experiences.

Suggested readings:

- Bhatia A.K.: International Tourism
- Bhatia A.K.: Tourism Development
- Dev Manoj: India – A Tourist Paradise
- Dhar Pramnath: Development of Tourism and Travel Industry
- Gupta V.N.: Tourism in India
- Negi Jagmohan: Tourism Development and Resource Conservation 28
- Pearce Douglas: Tourism Development
- Robinson R.: Geography of Tourism
- Sharma K.C.: Tourism: Policy, Planning strategy.

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC301D.1	Demonstrate the knowledge of historical concepts of tourism.	2
AC301D.2	Describe the functionalities of tourism industry along with the various facets of travel.	1
AC301D.3	Analyze the factors which affect the growth and development of tourism.	4

SEMESTER – IV

GG-401: WATERSHED MANAGEMENT		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Improvement and restoration of soil quality and thus, raising productivity rates. 2. Supply and securing of clean and sufficient drinking water for the population. 3. Improvement of infrastructure for storage, transport and agricultural marketing. 4. To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation, etc. 5. To minimize the risks of floods, droughts, and landslides. 6. To develop rural areas in the region with clear plans for improving the economy of the regions. 	
Unit 1	<p>Introduction To Watershed</p> <p>Concept of the watershed, characteristic of watershed and classification of the watershed, Significance of watershed development, Demarcation of the watershed, Types of watershed according to area and shape.</p>	10 L
Unit 2	<p>Physical parameters of watershed –</p> <ol style="list-style-type: none"> 1. Channel geometry & basin morphology; Hydraulic geometry at channel cross-section & along the channel, Channel cross-section pattern, Channel types. 2. Basin morphology; Drainage network & watershed boundary, Drainage frequency, drainage density & constant of channel maintenance, Basin morphology. i) Horton's form factor. ii) Millar's circularity ratio. iii) Schumm's elongation ratio. iv) Strahler's ruggedness index. v) Strahler's hypsometric integral. 3. Landuse; Measurement & data sources, Use of land: i) Total geographical area. ii) Area under forest. iii) Area under agricultural. iv) Area under cultural waste. v) Area under natural waste. 4. Terrain analysis; Terrain analysis on the basis of i) Relief characteristics. ii) Slope. iii) Dissection index. iv) Drainage characteristics: Spatial distribution of drainage frequency and drainage density. v) Soil. 	15 L
Unit 3	<p>Hydrological parameters</p> <ol style="list-style-type: none"> 1. Rainfall: a) Intensity & duration, b) Measurements. 2. Aerial precipitation: a) Thiessen polygons, b) Isohytal method. 3. Evaporation & transpiration: a) Methods, b) Instruments. 4. Infiltration: a) Methods, b) Instruments. 5. Runoff: a) Measurement, b) Selection, criteria of gouging station. 6. Discharge: a) Measurements, b) Unit hydrograph. 	15 L
Unit 4	<ol style="list-style-type: none"> 1. Ground Water: Definition, Aquifer types, Water table, Porosity, Groundwater movement, Recharge & discharge. 2. Water management: Rainwater harvesting, Percolation tanks & pits, Sprinkle irrigation. 3. Development programmes: Artificial recharge of groundwater, Dams & weirs, Interlinking of rivers. 	10 L
Unit 5	<p>Sample of Watershed Management and Planning</p> <ol style="list-style-type: none"> 1. Types of Survey for watershed development; Physical survey, Hydrological, Land use, Survey of Resources. 2. Advance Techniques for watershed development; Remote sensing data analysis, Application of GIS software. 	10 L

Suggested reading:

1. **Basudeb Bhatta:** Remote Sensing and GIS, 2nd ed., Oxford university press, Printed by-Radha press, New Delhi.
2. **Brooks, K. N., Folliott, P. F. and Magner, J. A.** (2012): Hydrology and the Management of Watersheds, Wiley-Blackwell, Oxford
3. **Cech, T. V.** (2003): Principles of Water Resources: History, Development, Management, and Policy, John Wiley and Sons, New York
4. **Chanda B., Dattaa D., Mujumdar** (2001): Digital Image Processing and Analysis, Prentice-Hall of India.
5. **Heathcote, I. W.** (2009): Integrated Watershed Management: Principles and Practice, John Wiley and Sons, New York
6. **M. Anji Reddy:** Text book of Remote Sensing and GIS, 3rd Ed., BS Publications, Hydrabad.
7. **Murthy J.V.S.** (1994): Watershed Management in India, Wiley Eastern Ltd. New Delhi.
8. **Mutreja K.N.** (1990): Applied Hydrology, Tata Mc Graw Hill Pub. Co. Ltd. New Delhi.
9. **Paranjape S. and Other** (1980): Water based Development, Bharat Gyan Vigyan Samithi, New Delhi.
10. **Prithvish Nag and M. Kudrat** (1998): Digital Remote Sensing, Concept Publishing Co. New Delhi.
11. **Shing R.J.** (2000): Watershed planning and Management, Yash Publishing House, Bikaner.

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-401.1	Understand the fundamentals concepts related to the watershed, significances of watershed development, demarcation of the watershed, types of watershed according to area and shape.	2
GG-401.2	Understand the hydrological parameters, rainfall, aerial precipitation, evaporation and transpiration, infiltration, runoff, and drainage.	2
GG-401.3	Understand the watershed development planning and a sample of watershed management and planning for appropriate development of watershed management for water conservation and development.	3

GG-402 (A): AGRICULTURAL GEOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To examine the spatial distribution of crops, livestock and other agricultural activities. To ascertain the spatial concentration of agricultural phenomena. Crop associations and crop-livestock combinations change in space and time. The performance of various crops in a country or region is not uniform. There are inter-regional, intra-regional, intra-village and intra-farm variations in the production and productivity of different crops. The agricultural geographers have to diagnose at the micro-level (household and field level) the causes of existing agricultural backwardness, and then to suggest suitable strategies to enhance productivity. 	
Unit 1	<p>Introduction to Agricultural Geography</p> <ol style="list-style-type: none"> Definition, Nature, Scope and Approaches, Origin and dispersal of agriculture, significance and development of agricultural geography. Approaches to the study of agricultural geography; Environmental, Regional, Commodity, and Behavioral approach. Significance of Agriculture - Place of agriculture in Different Economies. Significance of agriculture in world regions. Importance of agriculture in the Indian Economy. 	10 L
Unit 2	<p>Fundamental concepts in agricultural geography</p> <p>A. Meaning and explanation.</p> <ol style="list-style-type: none"> Crops; i) Cropping pattern, ii) Crop rotation, iii) Intensity of cropping, iv) Crop concentration, v) Crop diversification, vi) Crop combination. Agricultural Production and Development; i) Agricultural efficiency, ii) Agricultural productivity, iii) Agricultural labor productivity, iv) Marginal land, v) Agricultural development, vi) Sustainable Agricultural development. <p>B. Determinants of Agricultural Patterns</p> <p>Influence of Physical, Economic and Technological Factors;</p> <ol style="list-style-type: none"> Altitude, Relief, Climate, Soil. Size of Landholding, Land Tenancy, Marketing facilities, Transport, Irrigation, Mechanization and Equipment, Biochemical inputs, Government policies, Capital and Labor, Religion. 	15 L
Unit 3	<p>Agricultural Types and Characteristics</p> <p>Study of the following types of agriculture in respect of areas, salient features, and their problems; Shifting cultivation, Intensive subsistent farming, Mixed farming, Plantation agriculture, Commercial grain farming, Dairy farming.</p>	15 L
Unit 4	<p>A) Land Use Concepts</p> <p>General Land use, Agricultural Land use, Arable land, Net sown area, Gross cropped area, Land reform, and Land tenure.</p> <p>B) Agricultural Statistics & Land use Survey techniques</p> <p>Sources of agricultural statistics; i) Primary Sources of Agricultural data observation, interview, questionnaire & schedule) ii) Secondary Sources of agricultural data (Indian Agricultural Statistics, Agricultural seasons and crop reports, crop statistics, irrigation statistics, agricultural prices, World Agricultural Statistics & other statistics).</p>	10 L

Unit 5	<p>A) Agricultural regionalization Methods of Regionalization 1. Views of Baker Whittles Hann. 2. Crop combination techniques - Weaver and Thomas method. 3. Agricultural efficiency - Kendall's ranking coefficient, Bhatia's method. 4. Agricultural location models: Von Thunen and Losch Models & its modifications. 5. Agricultural regions of India.</p> <p>B) Problems & Prospects of Agriculture in India - Semi-arid & arid regions in India 1. Definition and characteristics of arid and semi-arid regions. 2. Droughts and famines 3. Role of irrigation and dry farming.</p> <p>C) Contemporary Issues In Indian Agriculture - 1. Nutrition, Malnutrition, and Hunger; 2. Rural poverty and unemployment; 3. Poverty alleviation strategies; 4. C) Food aid and nutrition programmes; 5. Food security and its components.</p>	10 L
---------------	--	-------------

Suggested reading:

1. **Singh. J. & Dhillon S.S.** (1994) – Agricultural Geography, Tata McGraw Hill, Publishing Co. Ltd.
2. **Grigg. D.G.** (1964) – An Introduction to Agricultural Geography Hutchinson & Co.Ltd.,
3. **Morgan. W.B. & S.C. Monton** (1971) – Agricultural Geography Methuen, London.
4. **Symons Leslie** (1970) – Agricultural Geography, G. Belt and Sons Ltd., London.
5. **Tarrent, J. R.** (1970) – Agricultural Geography, David and Charles, Newton Abbot.
6. **Grigg. D. G.** (1974) – The Agricultural Systems of the world An Evolutionary Approach.
7. **Illbery, B.W.** (1985) – Agricultural Geography, Social & Economic Analysis, Oxford University Press.
8. **Husain M.** (1979) : Agricultural Geography; Inter India Publishers; New Delhi.
9. **Randhawa M. S.** (1980) – An History of Agriculture in India Vols. I, II, III,IV ICAR, New Delhi.
10. **Majid Husain** (2010) – Systematic Agricultural Geography , Rawat Publications, Jaipur.
11. **Grigg, D. B.** (1974.) : The Agricultural Systems of the World. Cambridge University Press, New York.
12. **Morgan, W.B.** (1978) : Agriculture in the Third World - A Spatial Analysis. West view Press, Boulder.
13. **Tarrant, J. R.** (1974.) : Agricultural Geography. Wiley, New York

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-402(A).1	Examining the introduction to agriculture, nature, scope, significance, and development of agriculture geography approaches to study.	3
GG-402(A).2	Understand the fundamental concept, land use, crops, agricultural production, and envelopment and study the determinants of agricultural activities, physical determinants, and socio-economic determinants.	2
GG-402(A).3	Understand the agricultural regionalization and modes in agricultural geography and their classification of agricultural models and some theories.	4

GG-402 (B): OCEANOGRAPHY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To introduce students to basic concepts of Oceanography. 2. To understand the chemical, physical, geological and biological processes which act on the surface of the ocean and to recognized the submarine forms, the seawater composition, and properties. 3. Study of the marine environment and its interactions with the earth, the biosphere, and the atmosphere 4. To apply these basic physical principles to develop an understanding of specific ocean phenomena and processes. 5. To help understand why physical oceanography is important in the earth system and to learn about the interactions with other components of the system, particularly the atmosphere. 	
Unit 1	<p>Introduction Nature and Scope; Definition and Meaning of Oceanography, Foundation of Modern Oceanography, Contribution of Oceanographers in the subject, Post-war Oceanography, Modern Trends.</p>	08 L
Unit 2	<p>Origin of the Ocean Basins Global Plate Tectonics; Continental Drift, Seafloor Spreading, Plate Tectonics, World Oceans, and their formations. The Ocean Floor Relief of the Ocean Bottom; Continental Margin, Oceanic Ridges and Rises, Abyssal Plains, Oceanic Trenches, Volcanoes, Coral Reefs, and Atolls.</p>	15 L
Unit 3	<p>Properties of Sea Water</p> <ol style="list-style-type: none"> 1. Temperature; Factors affect the temperature on water and distribution. 2. Density; Factors affecting density. 3. Salinity; Origin and composition of sea salt and residence time. 4. Dissolved gases; Carbon dioxide and carbonate cycles. 5. Other physical properties; Viscosity, Surface tension. 	10 L
Unit 4	<p>Waves & Tides</p> <ol style="list-style-type: none"> 1. Waves characteristics and properties; Ideal sea waves, Wave height, length and period, Formation of the sea and swell, Capillary, gravity, shallow water and deep, Water waves, Internal and standing waves, Seismic waves (Tsunami) and storm surges, Wave reflection, refraction, and diffraction, Breaking of waves. 2. Tide generating forces, Equilibrium Theory of Tides, Dynamical Theory of Tides, Spring Tides, Neap Tides, Tidal Currents and their Channels, Tidal Bores, Tidal effects in coastal areas. 	15L
Unit 5	<p>Ocean Currents and Marine Sediments</p> <ol style="list-style-type: none"> 1. Ocean Circulation, Their causes, and effects; Types of Currents, drift currents, geostrophic Currents, thermohaline circulation, Factors responsible for ocean currents, Ocean current in Pacific, Atlantic and the Indian Ocean. 2. Sediments on the ocean floor; Lithogenous particles (Derived from Rocks), Biogenous particles (derived from organisms), Hydrogenous particles (derived from water), Distribution of sediment deposits, Oceanic ooze, Correlation and age determination. 	12 L
<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. Basu S.K. (2003) (ed): Handbook of Oceanography, Global Vision, Delhi 2. Davis Richard A. (1972): Oceanography, Addition Wesley Publishing Co. 3. Garrison Tom (1999): Oceanography, Brooks/ Cole Wadsworth, New York 		

4. Garrison Tom (2004): Essentials of Oceanography. Thompson, Australia
5. Grant Gross M. (1982): Oceanography, Prentice hall, Ince, New Jersey
6. King Cuchlain A. M (1962): Oceanography for Geographers (ED) Edward Arnold
7. Sharma & Vatal (1962): Oceanography for Geographers. Chaitanya Publishing House, Allahabad
8. Thurman Harold V. (1985): Introductory Oceanography. Bell & Howell Co. London

Weisberg J. and Howard P. (1974): Introductory Oceanography. McGraw Hill, Kogakusha, Tokyo.

Course Outcomes (COts):

After completing this course graduate should able to

CO's No.	Sr. Course Outcomes	Cognitive level
GG-402(B).1	Understand the importance of the ocean.	2
GG-402(B).2	Knowledge about the effect of ocean Currents.	2
GG-402(B).3	To understand Watershed management and water harvesting Structure.	2

GG-403: DISASTER MANAGEMENT		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To familiarize the students with the concepts, terminologies, and developments in the field of Disaster Management. 2. To help the students learn about the nature and characteristics of major natural disasters and how to mitigate the risk involved with such disasters. 3. To help the Student learn what interventions the Government is doing in the field of Disaster Management. 	
Unit 1	<p>Introduction</p> <ol style="list-style-type: none"> 1. Natural Disaster; Introduction Ancient and Modern methods of disaster planning and Preparedness, Pre-disaster, During disaster and Post disasters. Causes, Pre, During, Post-disaster Management of i. Physical, Earthquake, Volcano, Landslides, Tsunami, ii. Atmospheric, Cyclone, Flood, Drought. 2. Manmade Disaster; Cause, Management of Fire, Terrorism, Food Poisoning, Strike and Lockouts, Accident, Fair and Festivals, Domestic disaster – Food Poisoning, Fire, Gas leakages, Industrial – Fire, Explosion, Electrical, Gas Leakages, Industrial effluents (Discharge) causes and effects. 	10 L
Unit 2	<p>Pollution and War: Causes, effects remedies</p> <ol style="list-style-type: none"> 1. Air, Water, Noise, Solid waste, Biological war, Chemical war, Atomic war. 2. Biological Aspects, Waterborne, Airborne, Foodborne diseases, epidemic. 3. Medical Aspect – First Aid, Preventive Measures, Public Awareness. 	10 L
Unit 3	<p>Manifesting the Mitigation</p> <ol style="list-style-type: none"> 1. Resources planning and mobilization; Immediate survival kit, Medical Kit to provide for injuries, Rescue equipment, Permanent infrastructures, Financial resources. 2. Working out the requirement of the Medical team. 3. Establishing a control center. 4. Schematic layout of a control center. 5. The function of a control center. 6. Forming and deploying of rescue teams. 7. Security; Disposal of dead and records, Casualty evacuation, Records. 	15 L
Unit 4	<p>Evolution of Disaster Risk Management</p> <ol style="list-style-type: none"> 1. Temporary and Permanent measures in the post-disaster period. 2. Disaster Management; Action plan, Zonation Mapping, Risk Analysis, Damage Assessment, Need Analysis. 3. Factor related to disaster management. 4. Environmental Impact Assessment of disaster. Stress Management. 	10 L
Unit 5	<p>Role of Government and NGO in Disaster Management.</p> <ol style="list-style-type: none"> 1. Role of local bodies, civilians and NGO's in disaster. 2. Role of Armed forces in disaster. 3. Role of Para Military forces in disasters. 4. Role of government organization in disaster. Role of Police force in disaster. 	10 L

Suggested reading:

1. Agarwal, A. and Narain S. (Ed) (1999): State of India's Environment. The Citizens Report, Centre for Science and Environment, New Delhi
2. Bryant Edward (2000): Natural Hazards, Cambridge University Press
3. Daly, H.E. (1996): Beyond Growth, Beacon Press, Boston
4. Daly, H.E and Twonseed K.N. (Ed) (1993): Valuing the earth – Economics, Ecology and Ethics, MIT Press, London
5. Dupont, R.R. Baxter, T.E. and Theodore, L. (1998): Environmental Management: - Problems and Solutions, CRC Press
6. Hart M. G. (1986): Geomorphology, Pure and Applied, George Allen and Unwin, London
7. Morrisawa M (Ed) (1994): Geomorphology and Natural Hazards, Elsevier, Amsterdam
8. Singh Savindra (2000): Environmental Geography, ParagPustakBhavan, Allahabad
9. Smith, K. (2001): Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge
10. Turk J. (1985): Introduction to Environmental Studies, Saunders, College Publication, Japan
11. Saptarshi PG, More JC, Ugale VR, (2009): Geography and Natural Hazards, (Marathi), Diamond Publishing
12. Musmade AH, More JC (2014): Geography of Disaster Management, (Marathi), Diamond Publication, Pune

Course Outcomes (COs):

After completing this course graduate should able to

CO's Sr. No.	Course Outcomes	Cognitive level
GG-403.1	Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global level.	4
GG-403.2	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal, and organizational aspects influencing vulnerabilities and capacities to face disasters.	5
GG-403.3	Plan to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health Aspects of the disasters.	6

GG-404: PRACTICAL IN SURVEYING

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To determine the relative position of any objects or points of the earth. 2. To determine the distance and angle between different objects. 3. To prepare a map or plan to represent an area on a horizontal plan. 4. To develop methods through the knowledge of modern science and technology and use them in the field. 5. To solve measurement problems in an optimal way.
Unit 1	<p>Introduction to Surveying Definitions and methods, Benchmarks, Spot heights, Reduced levels, Interpolation, and contouring.</p>
Unit 2	<p>Dumpy/Auto level</p> <ol style="list-style-type: none"> 1. Various components and common terms used in dumpy level survey. 2. Collimation method and Rise and Fall method. 3. Profile drawing and block contouring.
Unit 3	<p>Transit Theodolite</p> <ol style="list-style-type: none"> 1. Various components and common terms used in Theodolite. 2. Intersection method and Tachometric method.
Unit 4	<p>Total Station</p> <ol style="list-style-type: none"> 3. Various components and common terms used in Total Station. 4. Area and profile drawing.
Unit 5	<p>Field Visit Dumpy level/Theodolite /Total Station Survey of a Beach, River Profiles and Slope.</p>
<p>Reference books</p> <ol style="list-style-type: none"> 1. AsisSarkar (2015): Practical Geography, A Systematic Approach, Orient Black Swan 2. Duggal, S.K. (2013): Surveying Vol. 2, McGraw Hill Publication, New York. 3. Kanetkar, T.P. and Kulkarni, S.V. (2010): Surveying and Leveling Vol. II, Pune Vidyarthi Publication, Pune. 4. Maslov, AV., Gordeev, A.V. and Batrakov, Yu.G. (1984): Geodetic surveying, Mir Publishers, Moscow. 5. Rangwala, S.C. (2011): Surveying and Leveling, Charotar Publishing House Pvt. Ltd. Anand, (Gujarat), India. 6. Punmia, B.C., Jain A. and Jain A. (2011): Surveying, Vol. II. and III, Laxmi Publication - New Delhi. 	

Course Outcomes (COs):

After completing this course graduate should able to

CO's No.	Sr.	Course Outcomes	Cognitive level
GG-404.1		Understand the different surviving techniques.	2
GG-404.2		Apply the knowledge of Theodolite, Dumpy level, and Total Station in different operations.	3
GG-404.3		Manage the suggested or identified constructional problems, solve in teams, to improve future problem solving ability and able to present it.	6

GG-405: DISSERTATION

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To complete a major and worthwhile piece of research work, with some guidance, but largely self-motivated; 2. To write an academic paper that is well-organized and which clearly and concisely communicates its contents to its readers; 3. To apply knowledge of statistics and probability theory gained through coursework to a specific area of study, to demonstrate the ability to acquire further knowledge of additional statistical methodologies as required by the topic, and to show the ability to acquire a good understanding of the underlying scientific problem. 4. To identify and formulate a scientific problem and to show evidence of skills of inquiry, logical reasoning, probabilistic modeling and statistical analysis in addressing that problem.
<p>Unit 1</p>	<p>Research Techniques and Methodology Introduction to Project Report, Selection of Topic, sources of data collection and types of data, Data feeding techniques, Research techniques and methodology, Data Analysis techniques, Cartographic techniques, Guidance for report writing, checking and to prepare the students for examination, Total five Seminars (two hours per seminar) of students on selected topic and guidance to develop the communication skill of the students.</p>
<p>Unit 2</p>	<p>Research Methodology; i. Meaning and objectives of the research; research types; the significance of the research; research process. ii. Research problem: Selection and techniques. Research Design, meaning, need and features of good design. iii. Measurements in research, scales; techniques of developing measurement tools.</p>
<p>Unit 3</p>	<p>Students should prepare an individual project report on any one topic from the list of the following subjects with the help of concern guide.</p> <ol style="list-style-type: none"> 1. Physical Geography – i) Geomorphology, ii) Climatology, iii) Oceanography, iv) Soil Geography, v) Environmental Geography, vi) Plant Geography, vii) Animal Geography, viii) Biogeography or any other related to Physical Geography. 2. Human Geography – i) Economic Geography – a) Agriculture Geography, b) Resources Geography, c) Industrial Geography, d) Trade and Transport Geography, e) Travel and Tourism Geography, f) Commercial Geography, g) Marketing Geography, h) Regional Geography. ii) Social Geography – a) Population Geography, b) Settlement Geography, c) Social Geography, d) Cultural Geography, e) Rural Geography, f) Urban Geography, g) Geography of Health, h) Criminal Geography, i) Behavioral Geography. 3. Analytical Techniques in Geography - i) Cartography, ii) GIS and Computer mapping, iii) Remote Sensing Techniques, iv) Quantitative Techniques.
<p>Unit 4</p>	<p>While preparing the project students should follow the guidelines cited as below</p>

	<ol style="list-style-type: none"> 1. Research methodology should be adopted. 2. Data should be analyzed through M.S. Excel worksheet or Access, Minitab, SPSS for data calculation. 3. All maps should be prepared by using GIS Software.
Unit 5	<p>The final report should cover the following aspects.</p> <ol style="list-style-type: none"> 1. Introduction to the Problem, Aims, and objectives of the study, Methodology, Analysis, description and interpretation, Results, Conclusions, References. 2. Every table, figure, photograph should have a caption, The list of references should be given at the end and all the references should be complete in all respects (author(s) name, year, title of the article or book, name of the journal, name of the publisher of the book and place of publication, volume of journal and page numbers). 3. The total number of pages should be minimum 50, including text, figures, tables, photographs, references, and appendices. 4. At the time of viva-voce presentation may be given with the help of equipment which are available in the respective department.

Course Outcomes (COs):

After completing this course graduate should able to

CO's No.	Sr.	Course Outcomes	Cognitive level
GG.405.1		Recognize the importance of planning and preparation required to undertake a research project.	6
GG.405.2		Develop a thorough understanding of the chosen subject area.	3
GG.405.3		Demonstrate and understanding appropriate referencing and develop skills in other aspects of dissertation writing.	6

M.A./ M.Sc. Part II Semester IV (Applied Geography): Audit Courses

AC-401(A): Human Rights (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)		
	Course Objectives (CObs): <ul style="list-style-type: none"> • To make students aware about human rights and human values. 	
Unit 1	Introduction to Human Rights 1.1 Concept of Human Rights 1.2 Nature and Scope of Human Rights 1.3 Fundamental Rights and Fundamental Duties 1.4 Interrelation of Rights and Duties	6 hrs.
Unit 2	Human Rights in India 2.1 Meaning and Significance of : 1) Right to Equality 2) Right to Freedom, 3) Right against Exploitation, 4) Right to Freedom of Religion, 5) Cultural and Educational Rights, and 6) Right to Constitutional Remedies. 2.2 Constitutional Provisions for Human Rights 2.3 Declaration of Human Rights 2.4: National Human Rights Commission	8 hrs.
Unit 3	Human Values 3.1: Meaning and Definitions of Values 3.2: Importance of values in the life of Individual 3.3: Types of Values 3.4: Programmes for conservation of Values	8 hrs.
Unit 4	Status of Social and Economically Disadvantaged people and their rights 4.1: Rights of women and children in the context of social status 4.2: The Minorities and Human Rights 4.3: Status of SC/ST and other Indigenous People in the Indian Scenario 4.4: Human rights of economically disadvantaged Society	8 hrs.
Suggested readings: <ol style="list-style-type: none"> 1. Human rights education – YCMOU, Nasik 2. Value education – SCERT, Pune 3. Human rights reference handbook – Lucille whare 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC401A.1	Practice the learned issues under human rights and human values in real life.	3
AC401A.2	Provide social justices to people around them and provide guidance about human rights to their friends, parents and relatives.	5

AC-401(B): Current Affairs (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)			
<i>Course Objectives (COs):</i>			
<ul style="list-style-type: none"> To make students updated about current affairs of India and world. 			
	Title	Content	Hours
Unit 1	Politics & Economy	<ul style="list-style-type: none"> National & International Political Activity, Organization. Economy & Business, Corporate world 	08
Unit 2	Awards and recognitions	<ul style="list-style-type: none"> National & International Awards and recognitions Books and authors 	07
Unit 3	Science & Technology	<ul style="list-style-type: none"> Software, Automobile, Space Research New inventions and discoveries 	07
Unit 4	Environment & Sports	<ul style="list-style-type: none"> Summit & conference, Ecology & Climate, Organization. National & International Games, Olympics, commonwealth etc. 	08
Suggested readings (Use recent years' data and current literature):			
<ol style="list-style-type: none"> India 2019, by Publications Division Government of India Manorama Year Book by Philip Mathew, India 2019, Rajiv Maharshi Quick General Knowledge 2018 with Current Affairs Update, Disha Experts General Knowledge 2018: Latest Who's Who & Current Affairs by RPH Editorial Board. 			

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC401B.1	Identify important issues currently/ recently happening in India or world.	5
AC401B.2	Summarize current affairs regularly.	6

AC-401(C): Surveying and Instrumentation

(Technology + Value added Audit course; Optional: Program-level; Practical; 2 Credits)

Course Objectives (CObs):

- To learn the basics of plane surveying and different types of instruments used for plane surveying.
 - To learn different methods of surveying
1. Classifications and basic principles of surveying – Equipment and accessories for ranging and chaining – Methods of ranging – Compass – Types of compass – Basic Principles Bearing – Types – True Bearing – Magnetic Bearing.
 2. Plane Table Surveying- Parts and accessories. Methods of surveying.
 3. Surveying instruments: chains, tapes, steel bands, their types & uses.
 4. Chain Surveying- Ranging & Chaining of Survey lines. Field work & plotting of Chain survey
Compass Surveying- Prismatic Compass & Surveyor compass Uses, Bearings, Local attraction, Fieldwork & Plotting.

Suggested readings:

- AsisSarkar (2015): Practical Geography, A Systematic Approach, Orient Black Swan
- Duggal, S.K. (2013): Surveying Vol. 2, McGraw Hill Publication, New York.
- Kanetkar, T.P. and Kulkarni, S.V. (2010): Surveying and Leveling Vol. II, Pune Vidyarthi Publication, Pune.
- Maslov, AV., Gordeev, A.V. and Batrakov, Yu.G. (1984): Geodetic surveying, Mir Publishers, Moscow.
- Rangwala, S.C. (2011): Surveying and Leveling, Charotar Publishing House Pvt. Ltd. Anand, (Gujarat), India.
- Punmia, B.C., Jain A. and Jain A. (2011): Surveying, Vol. II. and III, Laxmi Publication - New Delhi.

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC401C.1	Operate and use surveying equipment.	3
AC401C.2	Draw plan or map of the existing permanent features on the ground.	4
AC401C.3	Classify the ground features from the map or plan	4

	AC-401(D): Watershed Management (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Program-level)	
--	---	--

	<p>Course Objectives (CObs):</p> <ul style="list-style-type: none"> • To understand different watershed behaviour • Improvement and restoration of soil quality and thus, raising productivity rates. • Supply and securing of clean and sufficient drinking water for the population. • Improvement of infrastructure for storage, transport and agricultural marketing. 	
--	--	--

	<ol style="list-style-type: none"> 1. Concept of the watershed, characteristic of watershed and classification of the watershed, Significance of watershed development, Demarcation of the watershed, Types of watershed according to area and shape. 2. Introduction, watershed behaviour, effects of land use and its change on hydrological cycle components, Land capability and suitability classification. 3. Factors affecting watershed management. 4. Watershed management practices 5. Various measures taken up for management like Socio-economic Aspects, Water harvesting, Afforestation and agro-forestry, Mechanical measures for reducing soil erosion and runoff losses, Scientific mining and quarrying, Public participation. 	
--	--	--

Suggested readings:

1. Basudeb Bhatta: Remote Sensing and GIS, 2nd ed., Oxford university press, Printed by- Radha press, New Delhi.
2. Brooks, K. N., Folliott, P. F. and Magner, J. A. (2012): Hydrology and the Management of Watersheds, Wiley-Blackwell, Oxford
3. Cech, T. V. (2003): Principles of Water Resources: History, Development, Management, and Policy, John Wiley and Sons, New York
4. Chanda B., Dattaa D., Mujumdar (2001): Digital Image Processing and Analysis, Prentice- Hall of India.
5. Heathcote, I. W. (2009): Integrated Watershed Management: Principles and Practice, John Wiley and Sons, New York.

Course Outcomes (COs):

On completion of this course, the student will be able to:

CO No.	CO	Cognitive level
AC401D.1	Suggest technical measures for soil erosion control both due to water and wind	2
AC401D.2	Assess the current status of the watershed at field, by taking up accurate investigation measures and conduct survey	2
AC401D.3	Suggest drought control measures, water conservation structures, including design	5