

**DEPARTMENT OF GEOGRAPHY  
JAMIA MILLIA ISLAMIA  
NEW DELHI**

**MINUTES OF BOARD OF STUDIES**

An ordinary meeting of the Board of Studies (BoS) was held on **31.01.2019** at **10:30 a.m.** in the Seminar Library of the Department. The following members were present in the meeting:

- |                                |                   |
|--------------------------------|-------------------|
| 1. Prof. Masood Ahsan Siddiqui | (Chairperson)     |
| 2. Dr. Bhoop Singh             | (External Member) |
| 3. Prof. S. Khursheed Haider   | (Internal Member) |
| 4. Prof. S. Zahid Ashraf       | (Internal Member) |
| 5. Prof. M. Ishtiaque          | (Member)          |
| 6. Prof. Shahnaz Parveen       | (Member)          |
| 7. Prof. Mary Tahir            | (Member)          |
| 8. Prof. Haroon Sajjad         | (Member)          |
| 9. Prof. Atiqur Rahman         | (Member)          |
| 10. Dr. Lubna Siddiqui         | (Member)          |
| 11. Ms. Aruna Paarcha          | (Member)          |
| 12. Dr. Hasan Raja Naqvi       | (Member)          |
| 13. Dr. Adnan Shakeel          | (Member)          |

The members offered condolence to (Late) Prof. Majid Husain, former Professor of Department of Geography, JMI, who expired on 24.01.2019, and observed two minutes silence for the departed soul.

The HoD and the faculty members welcomed Prof. S. Khursheed Haider, and Prof. Zahid Ashraf as internal members of BoS.

The following agenda were discussed and resolved:

1. The minutes of the previous BoS dated **10.12.2018** were confirmed.
2. **Approval of the Ph.D. Admission recommended by the DRC (January-2019):**

The DRC in its meeting held on **22 January, 2019** recommended five candidates as per details for admission in Ph.D. in January, 2019. The BoS approved the recommendations of the DRC (Geography).

Registration No.	Roll No.	Candidate	Category	Name of the Supervisor	Recommended for
JMI00330751PH2	R6336071	Roshni	General	Prof. Haroon Sajjad	M.Phil/Ph.D.
JMI00329568PH2	R6336034	Md. Hibjur Rahaman	Muslim OBC/ST	Prof. Haroon Sajjad	M.Phil/Ph.D.
JMI00329688PH2	R6336085	Ishita Afreen Ahmed	Muslim Women	Prof. Atiqur Rahman	M.Phil/Ph.D.
JMI00329535PH2	R6336099	Mirza Razi Imam Baig	Muslim General	Prof. Atiqur Rahman	M.Phil/Ph.D.
JMI00330600PH2	R6336096	Geeta Kumari	General	Prof. Haroon Sajjad	Direct Ph.D.

Since Ms. Geeta Kumari has done M.Phil, hence she has been recommended for direct admission in Ph.D. The committee approved the topic of research as :

**Topic: Livelihood Vulnerability Assessment to Climate Variability: A Case Study of Dimapur District of Nagaland**

### 3. Revision of Syllabus of all courses (Course Structure):

The BoS has endorsed the course structure of syllabus of the courses offered by Geography Department. The detail of the course structure is as under:

	Resources	
3	RS and GIS application in Urban Environment	04
4	RS and GIS application in Climate Studies	04
5	Thematic Applications of RS and GIS in Soil, Agriculture and Forest	02
6	Thematic Applications of RS and GIS in Urban and Climate	02
7	Project	08

4. **Supplementary Agenda:**

(a) **Duration of Examination of Under Graduate Course:**

The members of the board resolved to increase the duration of Examination of all undergraduate courses from 2:00 Hours to 2:30 Hours from the current Semester.

- (b) It was also resolved that 50 per cent seats of CBCS, AECC, and SEC will be offered to the internal students. The number of intake from other departments should not exceed to 25 per cent.

The meeting came to an end at 12:00 pm with a vote of thanks to the Chairperson.

**Prof. Masood Ahsan Siddiqui**  
Head

*Planned*  
*Confirmed*  
*4/4/19.*

**Department of Geography**

**M.A./M.Sc Geography**

**Course Structure**

<b>SEMESTER -I</b>					
<b>Paper No</b>	<b>Paper Code</b>	<b>Paper Title</b>			<b>Credits</b>
I	GGM-101	Geomorphology		CC	4
II	GGM-102	Climatology And Oceanography		CC	4
III	GGM-103	Human Geography		CC	4
IV	GGM-104	Geography of India		CC	4
V	GGM-105	Cartographic Methods		Practical	2
VI	GGM-106	Quantitative Methods		Practical	2
VII	GGM-107	Disaster Management		CB	4
<b>SEMESTER -II</b>					
I	GGM-201	Geographical Thought		CC	4
II	GGM-202	Biogeography		CC	4
III	GGM-203	Geoinformatics and Applications		CC	4
IV	GGM-204	<b>GIS and Applications( revision)</b>		<b>Practical</b>	2
V	GGM-205	<b>Land Surveying and GPS( revision)</b>		<b>SEC</b>	4
VI	GGM-206	World regional Geography		CB	4
VII	GGM-207	Research Methodology		CC	2
<b>SEMESTER-III- Select any one Group</b>					
		<b>Physical Geography</b>	<b>Human Geography</b>		
I	GGM-301	Fluvial Geomorphology	Urban Geography	CC	4
II	GGM-302	Coastal Geomorphology	Population & Settlement Geography	CC	4
III	GGM-303	Tropical Geomorphology	Regional Development	CC	4
IV	GGM-304	Filed Visit	Filed Visit	CC	2
V	GGM-305	Spatial data Analysis with SPSS	Spatial data Analysis with SPSS	AECC	4
VI	GGM-306	Environmental management	Environmental management	CB	4
<b>Semester -IV</b>					
	GGM-401	Watershed management	Political Geography	CC	4
	GGM-402	Practical in Terrain Analysis	Practical on population and settlement	CC	2
	GGM-403	`Sustainable Development		CB	4
	GGM-404	<b>1.Water resources(Syllabus needed)</b> <b>2.Hydrology</b>	1.Geography of Crime 2. Gender Geography	Optional paper- Select one from your group	4
	GGM-405	DIP Training	DIP Training	Practical	2
	GGM-406	Project		CC	4

## Course Structure B.A. / B.Sc. (H) Geography

Paper No. / Code	Title	Credits	Type
<b>SEMESTER I (12)</b>			
GEB-101(H) (Paper I)	Geomorphology	4	CC
GEB-102(H) (Paper II)	Climatology and Oceanography	4	CC
GEB-103(H) Paper III	World Geography	4	CB
<b>SEMESTER II (12)</b>			
GEB-201(H) (Paper I V)	Hydrology	4	CC
GEB-202(H) (Paper V)	Principles of Ecology	4	CC
GEB-203(H) (Paper VI)	Environmental Issues and Management	4	CB
<b>SEMESTER III (16)</b>			
GEB-301 (Paper VII)	Human Geography	4	CC
GEB-302 (Paper VIII)	Economic Geography	4	CC
GEB-303 (Paper IX)	Basic Mathematics and Statistics	4	CC
GEB-304 (Practical I)	Land Surveying and GPS	2	AECC
<b>SEMESTER IV (14)</b>			
GEB-401(H) (Paper X)	Geography of India	4	CC
GEB-402 (H) (Paper XI)	Population and Settlement Geography	4	CC
GEB-403(H) (Paper XII)	Disaster Management	4	CB
GEB-404(H) (Practical II)	Cartographic Techniques	2	CC
<b>SEMESTER V (18)</b>			
GEB-501(H) (Paper XIII)	Urban Geography	4	CC
GEB-502(H) (Paper XIV)	Rural Geography	4	CC
GEB-503(H) (Paper XV)	Fundamentals of Remote Sensing	4	CC
GEB-504(H) (Paper XVI)	Sustainable Development	4	CB
GEB-505(H) (Practical III)	Visual Image Interpretation	2	CC
<b>SEMESTER VI (16)</b>			
GEB-601(H) (Paper XVII)	Regional Development and Planning	4	CC
GEB-602(H) (Paper XVIII)	Evolution of Geographical Thought	4	CC
GEB-603 (H) (Paper-XIX)	Fundamentals of GIS	4	CC
GEB-604 (H) (Paper XIX)	Acquisition and Analysis of Climatic Data	4	SEC
GEB-605 (H)	Grand Viva / Term Paper	4	CC

**Total Credits - 88**

## Syllabus

### PGDRS Sem – I

<b>Theory Paper</b>			
<b>SL No</b>	<b>Paper Title</b>	<b>Credit</b>	<b>Remarks</b>
1	Photogrammetry	04	Update Required
2	RS and Image Interpretation	04	Update Required
3	Digital Image Processing	04	Combined with sem-2 DIP, Update Required
4	Geographical Information System and GPS	04	Update Required
<b>Practical Paper</b>			
5	Photogrammetry and image interpretation	02	Update Required for System Based
6	Digital Image Processing	02	Update Required
7	GIS and GPS	02	Update Required

### PGDRS Sem – 2

<b>Theory Paper</b>			
<b>SL No</b>	<b>Paper Title</b>	<b>Credit</b>	<b>Remarks</b>
1	RS and GIS application in Soil and Agriculture	04	
2	RS and GIS application in water and Forest Resources	04	
3	RS and GIS application in Urban Environment	04	
4	RS and GIS application in Climate Studies	04	
<b>Practical Paper</b>			
5	Thematic Applications of RS and GIS - 1	02	Practical related to SI No. 1 & 2
6	Thematic Applications of RS and GIS - 2	02	Practical related to SI No. 3 & 4
7	Project	08	

**M.A. / M.Sc. Geography**  
**Semester – I; Credits: 4 (CC)**  
**Paper - I (GGM - 101)**

**GEOMORPHOLOGY**

**UNIT - I:**

Fundamental concepts in Geomorphology: Concept of time and space; Concept of dynamic equilibrium; Concept of morphogenetic regions; Models in Geomorphology, Approaches and methods of geomorphologic investigations.

**UNIT - II:**

Geomorphic processes. Dynamics of fluvial, glacial, Aeolian, marine and karst processes and resulting landforms, complexities in geomorphologic processes.

**UNIT – III:**

Drainage basin and morphometric analysis; Denudation chronology; Soil erosion and its measurement; Slope form, processes and evolution; Measurement of surface runoff; Interruption in the evolution of landforms: Tectonic, climatic and base level changes.

**UNIT - IV:**

Applied geomorphology: Principles and purpose; Geomorphology and soils; Geomorphology and land and water Resource Management Urban geomorphology, Geomorphology and watershed management; Geomorphic hazards and mitigation.

**Books Recommend:** Dayal, P. 2015. Text-Book of Geomorphology, Shukla Book Depot, Patna.

1. Dury, G.H. (Ed.) 1966. Essays in Geomorphology. Heinmann Educational Books Ltd., London.
2. Fairbridge, R.W. (Ed.) 1968. Encyclopedia of Geomorphology. Rein-hold Book Corp., New York.
3. Gabler R.E, Peterson. J.F., Trapasso, L.M., Dorothy, S. 2009. Physical Geography, Brooks/Cole, Cengage Learning, Belmont, USA.
4. Garner, H.F. 1974. The Origin of Landscape: A Synthesis of Geomorphology. Oxford Univ. Press, New York.
5. Gautam, A. 2015. Geomorphology. Sharda Pustak Bhawan. Allahabad.
6. Goudie, A. (Ed.) 2003. Encyclopedia of Geomorphology, Routledge, London.
7. Goudie, A. (Ed.) 2005. Geomorphological Techniques (2<sup>nd</sup> Edition), Routledge, London.
8. Harvey, 2012. A. Introducing Geomorphology: A Guide to Landforms and Processes.
9. Hugget, R.J. 2011. Fundamentals of Geomorphology. Routledge Pub.
10. Jhon, R. Hails. 1977. Applied Geomorphology, Elsevier.

11. Kale, V. and Gupta, A., 2004. Elements of Geomorphology. Oxford University press, Calcutta.
12. Kenneth J. Gregory, Andrew S Goudie, 2011. The SAGE Handbook of Geomorphology, SAGE Publications Ltd., London.
13. Mateo Gutierrez, 2012. Geomorphology, CRC Press, Boca Raton (FL), USA.
14. Paul R. Bierman, David R. Montgomery, 2014. Key Concepts in Geomorphology, W. H. Freeman and Company Publishers, New York.
15. Savindra, S. 2017. Geomorphology. Pravalika Publications, Allahabad.
16. Strahler, A.H. 2013. Introducing Physical Geography. Wiley Pub.
17. Thornbury, W.D., 1991. Principles of Geomorphology, Wiley Eastern Ltd., New Delhi.
18. Way,D. 1978. Terrain Analysis: A Guide to Site Selection using Aerial Photo Interpretation. Dowden, Hutchinson & Ross, Stroudsburg.
19. Worcester, P.C. 1969. Text Book of Geomorphology. East West Press, New Delhi.



**M.A. / M.Sc. Geography**  
**Semester - I Credits: 4 (CC)**  
**Paper - II (GGM - 102)**  
**CLIMATOLOGY AND OCEANOGRAPHY**

**UNIT - 1:**

Atmospheric thermodynamics; Adiabatic Process; Entropy and law of dynamics, Hydrostatic equilibrium, budget and energy balance; Classification of climate.

UNIT – 2

Genesis of Indian Monsoon and the causes of its variability, Classification, sources, origin and modifications of air masses, Micro climates and human comfort zone, Urban Microclimate with special reference to tropical cities , Global Climate Change: Climatic records; Evidences of past climatic changes; Climate models; Forecast of local weather

UNIT - 3: OCEANOGRAPHY

Currents and Thermohaline Circulation, Instability and Ocean Heat Budget Upper Ocean Structure and Processes ; Evolution of Ocean Floor Morphostructure - Actualistic Model Vorticity, Deep Ocean Circulation and Ocean Waves ; Tides - generating forces, types, theories and effects; Marine biodiversity and coral reefs.

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UNIT - 4: APPLIED OCEANOGRAPHY

Marine resources: Development and conservation; Ocean routes and trade development; Marine pollution management; Global warming and transgression of seas; Coastal area management; Remote sensing in oceanographic studies; Laws of the sea.

**Books Recommended:**

- Barry, R.G. and Chorley R.J. 2009. Atmosphere Weather and climate (9<sup>th</sup> edition), Routledge.
- Barret, E.C. 1974. Climatology from Satellites. Methuen, London.
- Critchfield, J.H. 1983. General Climatology (4<sup>th</sup>edition). Phi Learning Pub.
- Davis, R.J.A. 1986. Oceanography-An Introduction of the Marine Environment. Win C. Brown, Iowa.
- Griffiths, J.F. 1976. Applied climatology. Oxford press, New York.
- Hobbs, J.E. 1996. Applied Climatology. Oxford University Press.
- Huntington, E. and S.S. Visher. 1922. Climatic Changes. Yale University Press.
- Hussain, T. and Tahir, M. 2012. Climatology. Jawahar, New Delhi.
- Hussain, T. and Tahir, M. 2012. Oceanography. Jawahar, New Delhi.
- Kings, C.A.M. 1969. An Introduction to Oceanography. McGraw, New York.
- Lamb, H.H. 1991. Climate : Present, Past and Future. Vol.1&2. Routledge.
- Trewartha, G.T. and Horn, L.A., 1980 (5th edition). Introduction to Climate, International Studies.
- Trujillo, A.P., Thurnman, H.V. 2016. Essentials of Oceanography, Prentice Hall.
- Trujillo, A.P., Thurnman, H.V. 2010. (10th Edition). Introductory Oceanography. Prentice Hall.
- Weyl, P.K. 1970. Oceanography-An Introduction of the Marine Environment, John Wiley and Sons, London.

**M.A. / M.Sc. Geography**  
**Semester – I; Credits: 4 (CC)**  
**Paper - III (GGM - 103)**

**HUMAN GEOGRAPHY**

**UNIT-I: Development and Concepts**

Development of Human Geography as a discipline; Contemporary Relevance of geography as discipline; Approaches to Human Geography, Cultural or Social Determinism; Post-Modern Human Geography.

**UNIT-II: Population and Development**

Human races: classification and distribution, Population growth, Global Demographic transition; Recent international migration: causes and consequences; Population policies, Human development: measurement and global disparity;

**UNIT-III: Cultural landscape politics**

Cultural Geographies: Religion and languages; Issues of nationalism and identity; major cultural realms; Trends and Patterns of World Urbanization; Multiculturalism, Global border and water disputes.

**UNIT-IV: Resources and economy**

Population-Resource Relationship; Rostow's Economic Growth Model; Global agricultural production and food security; World energy resources: production and consumption; Global economic development and international relations.

**Books Recommend:**

1. Rubenstein, James M. 2011. The cultural landscape : an introduction to human geography (10<sup>th</sup> Edition), Prentice Hall, Upper Saddle River, NJ, USA.
2. PETER DANIELS, MICHAEL BRADSHAW, DENIS SHA, JAMES SIDAWAY, TIM HALL, 2012. An introduction to human geography, Pearson (5<sup>th</sup> Edition), Harlow, UK.
3. Paul L. Knox, Sallie A. Marston, 2015. Human Geography: Places and Regions in Global Context, Global Edition, Pearson International,
4. Soja E, 1989 Postmodern Geographies, Verso, London.
5. Postmodern Human Geography: A Preliminary Assessment (Postmoderne Geographie des Menschen. Eine vorläufige Bilanz) Author(s): Michael Dear Source: Erdkunde, Bd. 48, H. 1 (Mar., 1994), pp. 2-13 Published by: Erdkunde.

## **M.A. / M.Sc. Geography**

**Semester – I-Credits: 4 (CC)**

**Paper - II (GGM - 104)**

### **Geography of India**

#### **UNIT-I Physical Characteristics**

Indian federalism, India unity in diversity Physiography; Drainage Systems; Climate Characteristics; Natural Vegetation; Soils.

#### **UNIT-II Population**

Human Development Index and its components ,Growth and Distribution of Population; Education Policy 2000,Population Characteristics and Composition (literacy, sex ratio, age, occupational structure etc.); Ageing Population, Unemployment and problems of demographic dividend.

#### **UNIT-III Resources and Planning**

Agro-climatic regions, Agricultural growth and Development: The Political Economy of Green Revolution in India; Food Security; Globalization and Indian Agriculture; Policies and Programs; Industrial Development: Industrial Development in India, Industrial Policy, Special Economic Zones; Energy Crisis

#### **UNIT-IV Trade and Economy**

Regional Disparities in Economic Development; India's Foreign Trade; WTO and India's Trade Policy; Globalization and Free Market Economy; Indian Diaspora and Economic Development.

Multi level planning, Community participation & governance and planning contemporary issues and Economic Reforms – Multinationals and liberalization

#### **Suggested Readings:**

1. Deshpande C.D. 1992. Indian-A Regional Interpretation. Northern Book Centre, New Delhi.
2. Govt. of India: India-Reference Annual, 2018 Pub. Div., New Delhi.
3. Govt. of India: National Atlas of India. NATMO Publication, Calcutta.
4. Govt. of India: The Gazetteer of India. Vol. I & III Publication Division.
5. Mitra, A. 1967. Levels of Regional Development of India. Census of India, Vol. I, Part I- A (i) and (ii), New Delhi.
6. Shafi, M. 2000. Geography of South Asia. McMillan & Co., Calcutta.

7. Singh, R.L. 1971 (ed). India A Regional Geography. National Geographical Society, Varanasi. Spate, O.H.K. and Learmonth A.T.A. 1967. India and Pakistan – Land, People and Economy Methuen & Co., London.
8. Hussain M (2017): Geography of India, 7<sup>th</sup> Edition, McGraw Hill Education; New Delhi.
9. Singh G (2010): A Geography of India, Atma Ram and Sons; ninth edition (2010).
10. Ministry of Finance, (GOI) Economic survey of India (various Issues), Oxford University Press, New Delhi.
11. Census of India (Various Issues): Office of the Registrar General and Census Commissioner India.

**M.A. / M.Sc. Geography**  
**Semester – I-Credits: 4 (CC)**  
**Paper - VII (GGM - 107)**  
**Disaster Management**  
**UNIT-I Disasters**

**UNIT-I: Concept of Disaster**

Hazard and Disaster - Concepts and Classifications ; Hazard Analysis; Disaster risk analysis  
Vulnerability Analysis; Risk Assessment,

**UNIT-II Natural Disasters**

Earthquakes - causes, characteristics, effects and damage potential, associated hazards, response;  
Potential Earthquake Sites in India; Case Study of the 2001 Gujarat Earthquake  
Tsunamis - mechanism, potential areas, damaging effects, associated hazards, preparedness;  
Case Study of the 2004 Indian Ocean Tsunami  
Landslides - factors, associated hazards, damage potential, Landslide Susceptibility Assessment;  
Case Study of Landslides in the GarhwalHimalays  
Floods - causes and types, geomorphology of floods, associated hazards, damage potential,  
mitigation measures;  
Cyclones: characteristics, associated hazards, damage potential , impact assessment; Case Study  
ofFoni 2019 and Hudhud 2014  
Droughts : types, mitigation measures,

**UNIT-III Manmade Disasters**

Classification of Manmade Disasters; Manmade Disasters: War and Conflict; Terrorism;  
Industrial Disasters; Hazardous Waste and Radiation.

**UNIT-IV Management**

Approaches to disaster management; Disaster management cycle: Crisis management: quick  
response and relief, recovery, development; Risk management: risk identification and risk  
assessment, risk reduction - preparedness, prevention and mitigation, risk transfer; Act and  
policy: IDNDR, UNISDR, DMA-2005. Early Warning System, India Disaster Resource Network

**Suggested Readings:**

1. G. F. White (Ed). 1974. Natural Hazards – Local, National, Global. Oxford University Press.

2. 2. V.T. Chow. 1964. Handbook of Applied Hydrology. McGraw-Hill.
3. 3. A. N. Strahler and A. H. Strahler. 1973. Environmental Geoscience - Interaction Between Natural Systems and Man . Santa Barbara, California: Hamilton Publishing.
4. 4. P. Reining. 1978. Handbook of Desertification Indicators. Washington D.C.: American Association for the Advancement of Science.
5. K. S. Valdiya. 1987. Environmental Geology. Tata McGraw-Hill.
6. Coppola DP (2011): Introduction to International Disaster Management. Elsevier.
7. 1. Alexander, D. (1993): *Natural Disasters*, ULC Press Ltd, London
8. 2. Collins, L.R. and Scheind, T.D. (2000): *Disaster Management and Preparedness*, Taylor and Francis
9. 3. Edwards, B. (2005): *Natural Hazards*, Cambridge University Press, UK
10. 4. NDMA (2009): *National Policy on Disaster Management*, NDMA, New Delhi
11. 5. Sharma, R.K. & Sharma, G. (eds.) (2005): *Natural Disaster*, APH Publishing Corporation, New Delhi
12. 6. Smith, K. (2011): *Natural Hazards*, Routledge, London

M.A. / M.Sc. Geography  
Semester - II Credits: 4 (CC)  
Paper -I (GGM - 201)

## **GEOGRAPHICAL THOUGHT**

### **UNIT-I: Development and Evolution of Geography as Discipline**

Place of geography in the classification of knowledge, Changing nature and scope of geography: Fundamentals concepts of geography; Approaches to Geography; Dualism and dichotomy in Geography; Anomalous character and contemporary relevance of geography

### **UNIT-II: Development in ancient and Medieval times**

Contribution of Greek, Roman and Arab and Indian Geographers; Broadening horizons: Impact of voyages and discoveries; Renaissance and its impact on Geographical Thought; Foundation of Scientific Geography: contributions of Varenus and Kant.

### **UNIT - III: Foundation of MODERN GEOGRAPHY**

Founders of modern Geography: Contribution of Humboldt and Ritter; Darwin's impact on Geography during the latter half of the nineteenth century; School of thoughts in Geography- German, French, British, American, India and Russia, Schaefer-Hartshorne debate, Exceptionalism

### **UNIT - IV: Modern concepts in Geographical Thought**

Empiricism, Positivism, and Quantitative revolution, Humanistic geography; Behavioralism in Geography; Radical geography; Applied Geography; Modernism and Post modernism in Geography; Modern concepts: Pragmatism, Functionalism, Idealism, Phenomenology and realism

#### **Books Recommended:**

- Dickinson. 1969. The Maker's of Modern Geography. Routledge and Kegan Paul, London.
- Hartshorne. R. 1939. The Nature of Geography. Association of American Geographers, Lancaster, Pennsylvania.
- Hartshorne. R. 1959. Perspective on the Nature of Geography. Rand McNally and Company, Chicago.
- Harvey, D. 1991. The Condition of Post Modernity: An Enquiry into the Origins of Cultural Change. Wiley-Blackwell, Oxford.
- Husain, M. 2002. Evolution of Geographic Thought (also in hindi). Rawat Publications, Jaipur.
- Singh, J. 1988. Bhaugolik Chenta ka karam vikas. Gyanodaya. Gorakhpur.
- Peet, R. 1998. Modern Geographical Thought. Blackwell, Oxford.
- Adhikari, S. 2015. Fundamentals of Geographical Thought. Orient Blackswan. Hyderabad, India
- Dikshit, R.D. Geographical Thought. 1997. PHI Learning Pvt. Ltd., New Delhi.
- Martin G.J. 2005. All Possible Worlds. OUP, USA.
- Cresswell, T. 2012. Geographical Thought: A Critical Introduction. Wiley Pub.
- Lalita Rana. 2008. Geographical Thought: A Systematic Record Of Evolution. Concept Publishing Company.
- Arild Holt-Jensen. 2009. (2nd edition). Geography: History and Concepts. Sage Pub.

**M.A. / M.Sc. Geography**  
**Semester – II; Credits: 4 (CC)**  
**Paper - II (GGM - 202)**  
**BIOGEOGRAPHY**

**UNIT-I: DEVELOPMENT AND FUNDAMENTALS OF BIOGEOGRAPHY**

Introduction and history of biogeography; Evolution and plate tectonics; The ecological niche and ecosystem; Biogeographical processes: speciation, diversification and dispersal; Distributions of species; The theory of Island Biogeography; Marine biogeography Succession and Ecological adaptation, Climax concept and ecosystem balance and spatial Dimension in Biogeography

**UNIT-II: PLANT GEOGRAPHY**

Plant geography: development and scope; Evolution of plants, Classification of plants: taxonomic, ecological and climatic. Raunkiaer's and Grime's classification; Distribution of plants: climatic and edaphic factors, Major biomes (forests, grasslands, deserts and marine); Human impact on plants.

**UNIT-III: ZOOGEOGRAPHY**

Zoogeography: scope and development; Evolution of animals; Taxonomic classification of animals; Zoo-geographical regions of the world; Dispersal of mammals, birds, reptiles, fishes; Human impact on animals and their habitats

**UNIT-IV: CONSERVATION BIOGEOGRAPHY**

Conservation Biogeography: scope and significance; Mega-extinctions and Climate Change; Ecological hotspots; Global biodiversity: distribution and extinction; Conservation of species, ecosystem and biosphere; Global efforts for the conservation of species, Agro forestry and Reforestry international and National efforts for conserving Biological Resources, Biosphere Reserves, Tropical Forest Action Plan

**Books Recommend:**

- Cox, C. B., R. Ladle, and P. D. Moore. 2016. *Biogeography: An Ecological and Evolutionary Approach*. John Wiley & Sons.
- Darlington, P. J. 1957. *Zoogeography: the Geographical Distribution of Animals*, John Wiley and Sons, New York
- Darwin, C. 1859. *The Origin of Species*. P. F. Collier & Son
- Flannery, T. 2015. *The Eternal Frontier: An Ecological History of North America and Its Peoples*. Grove/Atlantic, Inc.
- Gavin, D. G. 2012. *Biogeography* in J. P. Stoltman, editor. *21st Century Geography: A Reference Handbook*. SAGE Publications, Thousand Oaks, CA.
- Hugget, R. J. 2005. *Fundamentals of Biogeography*, 2<sup>nd</sup> Edition, Routledge, London.



- Jackson, S. T. 2004. Quaternary biogeography: Linking biotic responses to environmental variability across timescales in M. V. Lomolino and L. R. Heaney, editors. *Frontiers of Biogeography: New Directions in the Geography of Nature*. Sinauer, Sunderland, MA.
- Lomolino, M. V., B. R. Riddle, J. H. Brown, and R. J. Whittaker. 2010. *Biogeography*. Fourth Edition. Sinauer Associates, Sunderland, MA.
- MacDonald, G. M. 2003. *Biogeography: Space, Time and Life*. Wiley, New York.
- Mathur, H. S. 2003. *Essentials of Biogeography*, Pointer Publishers, Jaipur
- McCarthy, D. 2011. *Here Be Dragons: How the study of animal and plant distributions revolutionized our views of life and Earth*. OUP Oxford.
- Molles, M. C. 1999. *Ecology: Concepts and Applications*. WCB/McGraw-Hill.
- Pears, N. 1977. *Basic Biogeography*, Longman Group, London
- Perry, D. A., R. Oren, and S. C. Hart. 2013. *Forest Ecosystems*. JHU Press.
- Pielou, E. C. 1974. *Population and Community Ecology: Principles and Methods*. Gordon and Breach.
- Robinson, H. 1972. *Biogeography*, MacDonald and Evans, London
- Seddon, B. A. 1971. *Introduction to Biogeography*, Gerald Duckworth and Co., London
- Tivy, J. 1993. *Biogeography: A Study of Plants in the Ecosphere*, Longman, London

## **M.A. / M.Sc. Geography**

**Semester – II-Credits: 4 (CC)**

**Paper -III (GGM - 203)**

### **Geoinformatics & Application**

#### **UNIT I**

Fundamentals of Remote sensing;- Physics of Remote Sensing; Electro Magnetic Spectrum (EMS); EMR and its interaction with atmosphere and earth surface features.; Sensors types: active and passive Digital Image Processing-Digital data formats; Image Restoration: geometric radiometric corrections and filtering. Image Enhancement: Band combinations; Image Classifications: supervised and unsupervised. GIS; Data Models; spatial data analysis; GPS; Fundamentals of GPS; Understanding of Maps; Scale; Projection

#### **UNIT II**

Factors influencing soil reflectance properties, Spectral signatures, soil moisture assessment, Soil Erosion Assessment Models, Soil conservation. Spectral properties of crops, crop canopy, crop acreage estimation, vegetation indices, crop condition assessment, Yield Modelling.

#### **UNIT III**

Concept of Urbanization and Environment, Challenges and recent trends, Land use land cover mapping and classification system, Urban Sprawl, slums and squatter settlements, Suitability analysis for urban development.

#### **UNIT IV**

Mapping and monitoring of catchment and command areas, Watershed: delineation, morphometric analysis, watershed development planning, wetland mapping, and mapping of drought prone areas. Application of Geoinformatics in Hazards, risks and vulnerability analysis related to global warming, floods and droughts, and weather variations, ecosystems changes, and snow/glaciers melting, energy studies, health and diseases studies.

#### **Suggested Readings:**

1. Jensen John R. Introduction to Digital Image Processing: A Remote Sensing Perspective Prentice hall, New Jersey
2. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing Image Interpretation John Wiley and Sons, New York
3. [A. K. Singh](#) (2007). Geoinformatics Applications in Agriculture.
4. Gonzalez Rafael C and Woods Richard E.: Digital Image Processing Addison Wesley, New York
5. Applications of remote sensing in agriculture (1990) edited by M.D. Steven, J.A. Clark, Publisher – Butterworth, London.

**M.A. / M.Sc. Geography**  
**Semester - II**  
**Credits: 4 (CC)**  
**Paper - VI (GGM - 206)**  
**World Regional Geography**

**Unit – 1 Eurasia**

Physiography; Drainage; Issues and Challenges: Water availability and Disputes; Human Development and Food Security; Foreign Intervention and Terrorism; Population Issues: Population Structure and Composition

**Unit – 2: Americas**

Physiography: Drainage; Issues and Challenges: Resource Development; International Trade; Antisocial Activities; Terrorism; Population Issues: Ethnicities and Cultural Conflicts;

**Unit – 3 Africa**

Physiography: Drainage; Population Issues: Population Structure and Distribution; Issues and Challenges: Food Insecurity and Malnutrition; Diseases (AIDS); Antisocial Activities: Racism; Unemployment and Youth; Land Grabbing.

**Unit – 4 Oceania**

Physiography: Drainage; Population Structure and Composition; Level of Economic Development; Impact of Climate Change.

**Suggested Readings:**

1. Majid Husain., 2004., World Geography., Rawat Publications., Jaipur., India.
2. Qazi S.A., Navaid Shabir Qazi., 2007., Geography of the World., APH Publishing Corporation., New Delhi., India.
3. Prajapathi R.V., 2008., Encyclopedia of World Geography., Cybertech Publications., New Delhi., India.
4. Joseph H. Hobbs. (2009) World Regional Geography. Brooks/Cole Cengage Learning. Canada.
5. Lydia Mihelic Pulsipher & Alex Pulsipher (2018): World Regional Geography. W H Freeman & Co; 7 edition.
6. Johnson D et. Al (2011): World Regional Geography. Prentice Hall India Learning Private Limited; 10 edition.
7. Edward Heawood (2018): Geography of Africa. Forgotten Books.
8. De Blij HJ (2013): Geography Relas Regions and Concepts, John Wiley and Sons. 16<sup>th</sup> Edition.

**M.A. / M.Sc. Geography**

**Semester - II**

**Credits: 4 (CC)**

**Paper – VII (GGM - 207)**

Research Methodology

Unit I:

Introduction and Approaches to Research, Stages of Research and Research Accuracy Considerations in selecting Research Problems:, Availability of Data, Ethical Issues, plagiarism

UNIT-II

Problem Identification and Hypothesis building and testing method ; Issues in Research - The perspective behind the research, The role of theory, Abstract writing and Title selection, Referencing, Pre-structured versus unfolding, qualitative versus quantitative ; Adaptation of Proper methodology: Research Design - Strategy, Framework, Sample design

UNIT – III

Hypothesis, meaning, characteristic importance and formulation, testing of Hypothesis – parametric (Standard) and non parametric, Review of literature, Bibliography and case study

UNIT – IV

Application of Remote Sensing and GIS in Research, Arrangements and Analysis of Data and map, Quantitative and qualitative interpretations, Writing a Research Proposal Guidelines for doing a Survey Writing of Research report/ paper and dissertation, Framing of Pilot and Research project:, Questionnaire preparation - Landuse (Rural and Urban), Traffic and Market, Socio-economic aspects: Sources of information, Integrating different data sets,

**M.A. / M.Sc. Geography**  
**Semester – III-Credits: 4 (CC)**  
**Paper - I (GGM - 301)**  
**Fluvial Geomorphology**

**Unit I: Concepts**

Concept of grade: graded profile, dynamic equilibrium , Denudation and Morpho chronology, Cyclic and non-Cyclic Concepts of Erosion , Time scale in Fluvial process , Drainage basin as geomorphic unit; Evolution of Drainage System; Properties of Drainage Basins, Fluvial Cycle.

**Unit II: Processes**

Drainage Basin morphology: drainage networks, runoff processes; Morphometric analysis of Drainage basin, Mechanics of fluvial erosion: overland flow, through flow and groundwater flow. Hydraulic geometry: at a station, downstream; stream energy, Sediment transport: suspended and bed load. Models of sediment transport

**Unit III: Channel Morphology and Landforms**

Channel pattern, channel types, concept of grade; Fluvial erosion and deposition; Landforms of fluvial Processes: Valleys: Process of evolution and types , Waterfalls, Rapids, Alluvial fans, River terraces, meanders, Ox bow lake, flood plains, Delta, Types of delta.

**Unit IV: Major Issues**

River channel management, Soil erosion and its management, Fluvial Hazards: major types, causes, consequences, viability and management, Future of fluvial systems with climate change.

1. Hart, M. G. (1986): Geomorphology, Pure and Applied, George Allen and Unwin, London.
2. Chorley, R. J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology, Methuen, London
3. Hails, J. R. (1977): Applied Geomorphology, Elsevier, Amsterdam.
4. Leopold, L. B., Wolman, M. G. and Miller, J. P. (1964): Fluvial Processes in Geomorphology, W. H. Freeman, San Francisco.
5. Schumm, S. A. (1977): Fluvial Systems, Wiley, New York
6. Kale, V. S. and Gupta, A. (2010): Introduction to Geomorphology, Universities Press, Hyderabad.
7. Fryirs, K. A. and Brierley, G. J. (2013): Geomorphologic Analysis of River Systems, Wiley-Blackwell, Chichester
8. Downs P. W. and Gregory K. J. (2004): River Channel Management, Arnold, London
9. Charlton, R. (2008): Fundamentals of Fluvial Geomorphology, Routledge, Oxon

**M.A. / M.Sc. Geography**  
**Semester - III Credits: 4 (CC)**  
**Paper - (GGM - 301)**  
**URBAN GEOGRAPHY**

**UNIT - I: BASICS OF URBAN GEOGRAPHY**

Urban geography as a sub-discipline; Approaches and recent trends in Urban Geography; Urbanism and Urban Geography; Urbanization in USA, China and India; Contemporary urban geography (1990 to the present)

**UNIT - II: MODELS AND THEORIES**

Models of Internal Structures of cities: Urban-Realms Model, White's Model of The Twenty-First-Century City; Hierarchy and Spacing of cities: Model of Christaller; Primate City and Megalopolis; Theories of Urbanisation and Development

**UNIT - III: URBAN ENVIRONMENT AND HEALTH**

Component of urban environment: Physical, Economic, Social and Cultural component; Quality of Urban Life; Air Pollution and Public Health. Environmental cost of urbanization

**UNIT - IV: URBAN PLANNING**

Origin and movements of urban planning; land-use planning; Housing and urban renewable; Urban transportation planning; Urban environmental planning; Urban planning in India with special reference to Chandigarh and Jaipur

**Books Recommended:**

- Bose, A. 1980. India's Urbanisation, Tata McGraw Hill, New Delhi
- Carter, H. 1979. The Study of Urban Geography, Arnold Heinemann, London
- Goudie, A, 2000. The Human Impact on the Natural Environment, MIT Press, Great Britain.
- Hall, T. 2006. Urban Geography, Routledge, London
- Hardoy, J. E., Mitlin. D. Satterthwaite. D. (1992). Environmental Problems in Third World Cities, Earthscan, Great Britain.
- Jensen, J.R. 2007. Remote Sensing of the Environment: An Earth Resource Perspective, Prentice-Hall, NJ, USA.
- Marcotullio, P. Mc Granahan. G. 2007. Scaling Urban Environmental Challenges: From Local to Global and Back, Earthscan, Great Britain.
- Michael.P. 2009. Urban Geography: A Global Perspective, Taylor & Francis, Great Britain.
- Pacione, M. 2009. Urban Geography, Routledge, New York
- Paul. K. Pinch. S. 2006. Urban Social Geography: An Introduction, NJ, USA. Press, New Delhi
- Ramchandran, R. 1997. Urbanization and Urban Systems in India, Oxford University
- The Urban Environment: Twenty Sixth Report, 2007. Royal Commission on Environmental Pollution, Great Britain.
- Levy, J. M. 2017. Contemporary Urban Planning, Routledge, New York.
- Robert B. Potter 1985. Urbanisation And Planning In The 3rd World: Spatial Perceptions And Public Participation, Volume 77, Routledge, London

**M.A. / M.Sc. Geography**  
**Semester – III-Credits: 4 (CC)**  
**Paper - II (GGM - 302)**  
**Coastal Geomorphology**

**Unit I: Introduction**

Definition and Classification of Coast; Evolution of Coast; Coastline; Coastal Zones: Shoreline and Hinterland. ; Models of coastal geomorphology

**Unit II: Coastal System**

Coastal rocks and sediments; Coastal systems and energy: waves, tides and currents, swells, breakers and surfs, storm surges and Tsunami; Sea-level changes, shoreline change.

**Unit III: Landforms**

Coastal processes and landforms: Processes of Weathering, Erosion and Transportation in Coastal Areas; Erosional and Depositional Landforms; Coastal wetlands: mangrove swamps and salt marshes; Beaches and spits, coastal dunes

**Unit IV: Applied**

Coastal Environment and Vulnerability; Human Impact on Coastal Environment; Coastal Hazards: Coastal Erosion, Coastal Sand Dune Encroachment and Saltwater Intrusion.; Climate change and coastal hazards; Application of remote sensing and GIS in coastal zone management  
Mechanism of Sea level Changes- Transgression, Regression, Relative and Eustatic

**Books Recommended:**

1. Hart, M. G. (1986): Geomorphology, Pure and Applied, George Allen and Unwin, London
2. Chouly, R. J., Schumm, S. A. and Sugden, D. E. (1984): Geomorphology, Methuen, London
3. Hails, J. R. (1977): Applied Geomorphology, Elsevier, Amsterdam
4. Bird, E. C. (2000): Coastal Geomorphology: An Introduction, John Wiley and Sons.
5. Bloom, A. L. (2002): Geomorphology: A Systematic Analysis of Late Cenozoic, Landforms, Prentice-Hall of India, New Delhi
6. Goudie, A. S. (Eds.) (2004): Encyclopedia of Geomorphology, Routledge, London.
7. Ivan, V. (2006): Global Coastal Change, Blackwell publishing, Oxford.
8. King, C. A. M. (1972): Beaches and Coasts, Edward Arnold, London.
9. Pethick, J. (1984): An Introduction to Coastal Geomorphology, Arnold-Heinemann, London.

**M.A. / M.Sc. Geography**  
**Semester - III Credits: 4 (CC)**  
**Paper - XI (GGM-302)**

**POPULATION AND SETTLEMENT GEOGRAPHY**

**Unit - I: Population Geography: Conceptual Frame Work and Dynamics**

Population Geography and Demography; Approaches to Population Geography; History and Changing Methodology of Indian Census Taking; Historical trends of population growth; Migration: Causes and Consequences; Population Projections and Methods; Theories of Population Growth: Thomas Maltus, Richardo, Demographic transition

**Unit - II: Population Problems and Distribution**

Population: a problem (liability) or resource (asset); Problem of Aging, Health –care and food security; Population in the context of environmental crises; World population-resource regions: Ackerman’s scheme; Prospects of habitation of Non- ecumene Regions. Critical Appraisal of Population Policy of India

**Unit III: Settlement Geography: Concepts and Processes**

Nature, Scope, significance and recent trends in Settlement Geography; Concepts related to Settlement; Nodality, Centrality, Range, Threshold and Hierachy, and Losch model. Emergence of Rural Settlements; Origin and Growth of Towns; Concepts in Settlement formation; Urbanization in the developed and developing world; urbanization in India: Trend and pattern

**Unit IV: Distribution and Structure**

Rural Settlements: Types & patterns, House Types and Environmental Conditions; Morphology of Indian Cities and Its Comparison with Western Cities; Functional Relations between Urban Settlements and their surroundings; CBD, Umland/Urban Fringe, Urban structures theories

**Books Recommended:**

- Ackerman, E.A. (1967). Population, Natural Resources and Technology. Annals of the Academy of Political and Social Science, 369: 84-97.
- Ali-Ali Sidiq, N. and Koser. K. (2002). New Approaches to migration. New York: Routledge.
- Ambrose, Peter, 1970: Concepts in Geography, Vol.-I, Settlement Pattern, Longman.
- Baskin, C., (Translator) 1996: Central Places in Southern Germany, Prentice-Hall Inc. Englewood Cliffs New Jersey.
- Bloom, D.E., D. Canning and J.Sevilla.2003. The Demographic divided: A new perspective on the consequences of population change. Santa Monica: Environmental Law Institute.
- Cassen, R. (Ed.). (1990). Population and Development: Old debates, New Conclusions, New Brunswick, Transaction Publishers. New Jersey.
- Haggett, Peter, Andrew D. Cliff and Allen Frey (Ed.) 1979: Locational Models Arnold Heinemann.
- Hudson, F. S. (1976) Geography of Settlements, Macdonald, London.



- Jones, H. (1990). Population Geography. Sage: London.
- King, Leslie, J., 1986: Central Place Theory, Saga Publications, New Delhi.
- Mayer, M. Harold and Clyde F. Kohn (Ed.) 1967 Readings in urban Geography, Central Book Depot, Allahabad.
- Mitra, Asok, Mukherjee S and Bose, R., 1980: Indian Cities Abhinav Publications, New Delhi.
- Nangia, Sudesh, 1976: Delhi Metropolitan Region, K.B. Publications, New Delhi.
- Northam Ray, M. (1979). Urban Geography, John Wiley and Sons, New York.
- Prakasa, Rao, V. L. S., 1992: Urbanisation in India: Spatial Dimensions, Concept Publishing Co., New Delhi.
- Ramachandran, R., 1992: Urbanisation and Urban Systems in India, Oxford University Press, New Delhi.
- Singh, R. L. and KashiNath Singh (Ed.) 1975: Readings in Rural Settlement Geography, National Geographical Society of India, Varanasi.
- Voss, P.R, White K.J.C.and Hammer. R.B (2004). The (re) emergence of spatial Demography, Wisconsin: Centre for Demography and Ecology.
- Weeks, J. R. (2005) Population: An introduction to concepts and issues. Belmont, C.A: Wadsworth Publications.

**M.A. / M.Sc. Geography**  
**Semester – III-Credits: 4 (CC)**  
**Paper - (GGM-303)**  
**Regional Development**

**UNIT - I: BASIC CONCEPTS**

Region: Concepts and types; Formal and functional; Delineation of region. Development and Planning: Concepts, need and scope; Types of planning.

**UNIT - II: FRAME WORK OF DEVELOPMENT AND PLANNING**

Regional devolvement: concepts, levels, and indicators; Regional Planning: concepts and scope; Levels of planning: local, regional, national and multi-level; Master Plans; Environmental issues in regional planning; Planning for sustainable development.

**UNIT - III: THEORIES AND MODELS**

Theories and models of the regional development: Hirschman's model; Growth centers and Growth pole theory of Perroux, Rostow's model; Gunnar Myrdal model.

**UNIT - IV: PLANNING AND REGION**

Five Year Plans; Command Area Development, planning for backward areas, Integrated Watershed Management Programme; Hill and Tribal Area Development; Decentralized Planning and Panchayati Raj; Regional Economic Imbalances and inequalities in India; SEZs in regional development.

**BOOKS RECOMMENDED:**

- Mishra. R. P. (1992). Regional planning: concepts, techniques, policies and case studies.  
Bhat. L. S. (1972) Regional planning in India.  
Chaudhary. J.R. (2001) Introduction to Development and Regional Planning: With Special Reference to India.  
Mishra. J. Sinha. C. (1985) Planning and regional development in India.  
Prasad B.K. (2005) India's development agenda: issues, challenges and policies.  
Nath V. Aggarwal S.K. (2009) (Edited), Regional Development and Planning in India selected Essays Concept Publishing Company.  
Compton Paul A. Peci Marton. (1976). Regional Development and planning, Akademiai Kiado Publishers.  
Chand. M. Puri V.K. (1983) Regional planning in India.  
Aziz. A. Krishna. S. Regional development: problems and policy measures.  
Mishra. S. Pal. C. (2000) Decentralized planning and Panchayati Raj institutions.

**M.A. / M.Sc. Geography**  
**Semester – III-Credits: 4 (CC)**  
**Paper - III (GGM - 303)**  
**Tropical Geomorphology**

**Unit I: Introduction**

Climatic Geomorphology and morphogenetic regions; Geological Framework of the Tropical Lands; Tropical Climate, Temperature, Winds, Tropical disturbances and water balance.

**Unit II: Processes**

Erosion and Land Cover in the Tropics; Tropical Hydrology; Process Geomorphology in the Tropics: Weathering, Slopes; Tropical Highlands, Hill slopes, pediments and gullies, Duricrusts and types.

**Unit III: Landforms**

Rivers in tropics: discharge, sediment load and landforms; Landforms in Arid tropical regions; Aeolian geomorphology in tropics; Distribution and Tropical coasts and Deltas; Karst landforms in tropics.

**Unit IV: Major Issues**

Quaternary climate changes and landforms in tropics, Anthropogenic alteration of geomorphic processes in Tropics, Anthropogenic Alteration of Geomorphic Processes in the Tropics; Urban Geomorphology in the Tropics; Future with Climate Change.

**Books Recommended:**

1. Garner, H.F. 1974. The Origin of Landscape: A Synthesis of Geomorphology. Oxford Univ. Press, New York.
2. Jhon, R. Hails. 1977. Applied Geomorphology, Elsevier.
3. Strahler, A.H., 2013(6th edition). Introducing Physical Geography. Wiley Publications.
4. Thornbury, W.D., 1991. Principles of Geomorphology, Wiley Eastern Ltd., New Delhi.
5. Worcester, P.C. 1969. Text Book of Geomorphology. East West Press, New Delhi.
6. Faniran, A. and Jeje, L. K. (1983): Humid Tropical Geomorphology, Longman, London
7. Thomas, M. F. (1994): Geomorphology in the Tropics: A study of Weathering and Denudation in Low Latitudes, John Wiley and Sons.
8. Gupta, A. (2011): Tropical Geomorphology, Cambridge University Press, London
9. Budel, J. (1982): Climatic Geomorphology, Princeton University Press, Princeton
10. Goudie, A. (1985): Duricrusts in Tropical and Sub Tropical Landscapes, Alien Unwin, Australia.

**M.A. / M.Sc. Geography**  
**Semester – III-Credits: 4 (CC)**  
**Paper - II (GGM - 306)**

**Environmental Management**

**Unit - I: Conceptual Framework**

Environmental Management: Concept and Techniques; Environment as life- support system; Human impact on land, climate, natural vegetation and non-renewable natural resources; Environmentalism.

**Unit - II: Environmental Issues**

Environmental issues: Analysis and Prediction; Environmental Degradation; Climate Change; Loss of Habitat and Biodiversity; Air Pollution; Land and Water Pollution; Human Health and Diseases.

**Unit - III: Planning and Strategies**

Methods of Environmental Planning: Survey, evaluation, preservation and conservation of resources; Environmental impact Assessment; Cost benefit Analysis, Environmental Inventorisation and Audit, Integrated management, and community participation in management.

**Unit - IV: Environmental Management**

Management of air and water resources; Management of soil and forest resources; Management of biodiversity; Management of habitats; population management; Management of disaster, and adaptation to climate change.

**Suggested Readings:**

1. Adams, W.M.1995: Green development: Environmental sustainability in the Third World, London: Rout ledge.
2. Alexander, D. 1993: Natural Disasters, New Delhi: Research Press.
3. Allaby, M. 1996: Basics of Environmental science, London: Routledge.
4. Baarshes, W.H. 1996: Eco-fiction: Understanding the Environmental Debate, London: Routledge.
5. Brayant, E.A.1991: Natural Hazards, Cambridge: Cambridge University press.
6. Canter,L. W.!996: Environmental Impact Assessment, 2nd edition, New Yprk: McGraw hill.
7. Chapman,D. 1994: Natural Hazards, Melbourne: Oxford University Press.
8. Chapman J.L. and Reiss, M.J. 1993: Ecology: Principles and applications, Cambridge: Cambridge University Press.
9. Colls, J.1997: Air Pollution: An Introduction, London: Chapman and Hall.

**M.A. / M.Sc. Geography**  
**Semester - IV Credits: 4 (CB)**  
**Theory Paper - III (GGM-401)**

**Political Geography**

**UNIT - I: Development and Approaches**

Political Geography: Nature, Scope and Significance; Recent Development in Political Geography; Approaches to Study of Political Geography: Whittlesey's Law-Landscape Approach, Hartshorne's Functional Approach, Jone's Unified Field Theory: Idea-area Chain, Political Systems Model, Wallerstein's World-Systems Approach

**UNIT - II: Concepts and Theories**

Concepts of Power, Aggression, Conflicts and Cooperation; Geopolitics and Geostrategy; Heartland Theory of Mackinder, Rimland Theory of Spyman & Sea Power Theory by Mahan

**UNIT - III: State and governance**

State, Nation, Nation-state and Nation-building; Physical, Human, and Economic Elements; Frontiers and Boundaries; Colonialism, Neo-colonialism; Neoliberalism; The Political Geography of the Sea

**UNIT - IV: Geopolitical Issues**

Geopolitical Significance of Indian Ocean; Political Geography South Asia, Environment and Politics, Politics of Resources; Globalization and World Systems; Emergence of Multipolar World.

**Books Recommended:**

- Alexander, L.M. (1963). World Political Patterns. Ran McNally, Chicago.
- Colin Flint and, Peter J. Taylor, 2018. Political Geography: World-Economy, Nation-State and Locality, 7th Edition, Routledge, London.
- Cox, K. R. 2002. Political Geography :Territory, State, and Society, Blackwell Publishers, Oxford, UK
- Cox, K. R., Low, M., Robinson, J. 2008. The SAGE Handbook of Political Geography, Sage Publications, London
- D Blij, H. J. and Glassner, M. (1968) Systematic Political Geography, John Wiley, New York.
- Deshpandey, C.D. (1992) India –a Regional Interpretation, Northern Book Centre, New Delhi.
- Dikshit R.D. (1996) Political Geography; A Contemporary Perspective, Tata McGraw Hill, New Delhi.
- East, W. G., Prescott J. R. V. 1975. Our Fragmented World: An Introduction to Political Geography, The Macmillan Press Ltd., London.
- Fisher, C. A. (1968), Essays in Political Geography, Methuen, London.
- Gallaher, C., Carl T. Dahlman, Mary Gilmartin And Alison Mountz, With Peter Shirlow, 2009. Key Concepts in Political Geography, Sage, Los Angeles
- Husain, Majid (1994); Political Geography; Anmol, New Delhi. 13) Adhikari,S (2010); Political Geography; Rawat, New Delhi

John Agnew, Virginie Mamadouh, Anna J. Secor, and Joanne Sharp, (Eds), 2015. The Wiley Blackwell Companion to Political Geography, Wiley Blackwell, West Sussex, UK

Martin Jones, Rhys Jones, Michael Woods (2004) An Introduction to Political Geography: Space, Place and Politics, Routledge

Panikkar, K.M. (1959) Geographical Factors in Indian History; II Volumes – Asia Publishing House, Bombay.

Pounds, N.J.G. (1972), Political Geography Tata McGraw Hill, New York.

Richard Muir, 1997. Political Geography: A New Introduction, Macmillan Press Ltd, London

Short, J.R. (1982), An Introduction to Political Geography, Routledge, London.

Taylor, P. (1985) Political Geography, Longman, London. 30

William B. Wood, George J. Demko (1999) Reordering the World: Geopolitical Perspectives on the Twenty-First Century : Westvi

**M.A. / M.Sc. Geography**  
**Semester – IV-Credits: 4 (CB)**  
**Theory Paper (GGM-401)**  
**Watershed Management**

**Unit - I: Introduction and Basic Concepts**

Watershed: Concept and Components; Watershed Management; Stages and Practices; Delineation and Codification of watershed; Benchmark Survey for Watershed Management; Watershed Modelling.

**Unit - II: Morphometric Analysis**

Watershed hydrology and surface runoff; Conventional methods: Smith, Wentworth and Robinson; Linear parameters of watershed; Aerial parameters of watershed; Relief parameters of watershed; Land use/ land cover Analysis.

**Unit - III: Management of Natural Resources**

Watershed prioritization: Soil Erosion Modelling: USLE, RUSLE; Sediment Yield Index; Soil information system; ground water recharge; Wetland Management; Forest Management.

**Unit - IV: Integrated Watershed Management**

Integrated watershed management: Concept and Relevance; Participation of local community and stakeholders; Role of IWM in local and regional planning.

**Suggested Books:**

1. K. N. Brooks, P. F. Folliott & J. A. Magner: Hydrology and the Management of Watersheds, Fourth Edition. John Wiley & Sons, Inc., Publication.
2. J. V. S. Murty: Watershed Management, Second Edition. New Age International (P) Limited.
3. I.W. Heathcote: Integrated Watershed Management: Principles and Practices, Second Edition. John Wiley & Sons, Inc., Publication.
4. T. O. Randhir: Watershed Management: Issues and Approaches, Latest Edition. IWA Publication
5. R. S. Kurothe, G. Kumar & A. K. Vishwakarma: Watershed Management: An Encyclopedia, Latest Edition. Biotech Books
6. S. Menon & P. A. Pillai: Watershed Management: Concepts and Experiences, Latest Edition. SBS Publishers
7. R. John: Watershed Management, Latest Edition. Alfa Publications.
8. L. Rattan: Integrated Watershed Management in The Global Ecosystem, Latest Edition. CRC PRESS
9. R. Patel: Watershed Management Planning Using Remote Sensing and GIS, Latest Edition. LAP Lambert Academic Publishing
10. IWMP: Department of Land Resources, Ministry of Rural Development, Government of India, New Delhi. ([http://dolr.nic.in/iwmp\\_main.htm](http://dolr.nic.in/iwmp_main.htm))

**M.A. / M.Sc. Geography**  
**Semester – IV-Credits: 4 (CB)**  
**Paper - II (GGM - 403)**  
**Sustainable Development**

**UNIT – I**

Sustainable Development: Concepts and Applicability; Indices and Factors of Sustainable Development, Environmental Sustainability; Economic Sustainability; Intra-generational Equity.

**UNIT – II**

Resource Issues and Sustainable Development; Approaches to Study the Sustainable Development, Natural Resources Utilization, Pattern of Industrialization and Harness Technology.

**UNIT – III**

Sustainability of Water Resources, Sustainable Management of Forests, Ecosystem Management; Coastal Environments, Sustainable agriculture and food security; Environmental education for sustainable development,

**UNIT – IV**

Environmental Sustainability and Environmental Ethics; Role of technology in Sustainable Development; Resource Conservation and Development; Awareness and Education; Government Policies and Programmes; Population Control.

**Suggested Reading:**

1. Blewett, J. (ed.) (2008): Understanding Sustainable Development, Routledge
2. Brundtland Commission (1987): Our Common Future, Oxford University Press
3. Chambers, N., Craig, S. and Wackernagel M. (2004): Sharing Nature's Interest, Earthscan Publications Ltd., London
4. Dalal-Clayton, B. and Bass, S. (2002): Sustainable Development Strategies: A Resource Book, Routledge
5. Dressner, S. (2002): The Principles of Sustainability, Earthscan Publications Ltd., London
6. Elliott, L. (2004): Global Politics of the Environment, Palgrave MacMillan, New York
7. Hulse, J.H. (2007): Sustainable Development at Risk: Ignoring the Past, Foundation Books
8. Knight, B., Chigudu, H. and Tandon R. (2002): Reviving Democracy: Citizens at the Heart of Governance, Earthscan Publications
9. Mollinga, P., Dixit, A. and Athukorala K. (ed) (2006): Integrated Water Resources Management, Sage, New Delhi
10. Rogers P. (2007): An Introduction to Sustainable Development, Earthscan Publications
11. Sachs, J. (2015): The Age of Sustainable Development, Columbia University Press



**B.A./B.Sc.(H)**  
**SEMESTER - 1**  
**Geomorphology**  
**Paper (GEB 101- H) Paper I**  
**Credits: 4**

**UNIT – I**

Nature and Scope of Geomorphology, Recent Trends in Geomorphological Studies, Geological Time Scale, Origin of the Continents and Oceans: Wegner's theory; Plate tectonics and Earth surface configuration, Interior Structure of the Earth.

**Unit II**

Major Landforms: Mountains, Plateaus, plains: their classification and distribution; Earth's Materials: Rocks- their origin, classification and characteristics.

**Unit III**

Earth Movements: Endogenetic Processes: Eperogenetic and Orogenetic - Folds and Faults; Earthquakes- Classification and world distribution; Volcanic activity: causes, types, distribution and resultant landforms;.

**Unit IV**

Geomorphic agents and processes: Exogenetic Processes- Danudational agents Weathering Process: Physical, Chemical and Biological; Mass wasting and resultant landforms; Fluvial, Aeolian, Karst, Coastal and Glacial landforms; Cycle of Erosion: Davis and Penck;

**Books Recommended:**

1. Dayal, P., 2015: Text-Book of Geomorphology, Shukla Book Depot, Patna.
2. Gabler R.E, Peterson. J.F., Trapasso, L.M. 2009. Essentials of Physical Geography Brooks/ Cole Cengage Learning.
3. Kale, V. and Gupta, A., 2004. Elements of Geomorphology. Oxford University press, Calcutta.
4. Strahaler, A.H., 2013 (6th edition). Introducing Physical Geography. Wiley Pub.
5. Thornbury, W.D., 1991. Principles of Geomorphology, Wiley Eastern Ltd., New Delhi
6. Worcester, P.C. 1969. Text Book of Geomorphology. East West Press, New Delhi.
7. Savindra Singh. Fundamental Concepts in Geomorphology. Prayag Pustak Bhavan, Allahabad.
8. Gautam, A. 2015. Geomorphology. Sharda Pustak Bhawan.
9. Hugget, R.J. 2011. Fundamentals of Geomorphology. Routledge Pub.
10. Harvey, 2012. A. Introducing Geomorphology: A Guide to Landforms and Processes. Dunedin Academic Press

## **SEMESTER - 1**

### **Climatology and Oceanography**

#### **Paper (GEB 102 H) Paper II**

**Credits: 4--**

#### **UNIT – I**

Introduction to Climatology; Climatology and Meteorology; Atmosphere: Origin, Composition and Structure; Weather and Climate: Elements and Controlling Factors; Temperature: Horizontal and vertical Distribution; Atmospheric Pressure and pressure belts; Winds: planetary, periodic and local

#### **Unit II**

Moisture in the Atmosphere: Humidity, Evaporation and Condensation, Precipitation, Thunderstorms. Atmospheric disturbances: Cyclones: Tropical and Temperate; Anti Cyclones; Climatic classification by Koppen Air Masses and Fronts: origin classification and characteristics; Climate change

#### **Unit III**

Oceanography: Definition, Nature and Scope; Reliefs of the Ocean Basins, Submarine Canyons: Origin and Significance, sub marine Relief of Pacific, Atlantic and Indian Ocean.

#### **Unit IV**

Oceanic Circulation: Tides and Currents; Origin of Tides and their types; Equilibrium theory of tides and Tsunamis; Ocean Deposits, Coral Reefs and Atolls; Salinity: Distribution and controlling factors, Marine resources: Conservation and management.

#### **Books Recommended:**

1. Barry, R.G. and Chorley R.J. 2009(9th edition). Atmosphere Weather and climate, Routledge
2. Critchfield, J.H. 1983(4th edition). General Climatology. Phi Learning Pub.
3. Das, P.K. 2011(3rd edition). The Monsoons. National Book Trust, New Delhi
4. Fein, J.S. and Stephens, P.N. 1987. Monsoon. John Wiley and Sons, New York
5. India Met. Deptt: Climatological Tables of observation in India
6. Lal, D.S. 2012. Climatology. Sharda Pustak Bhawan, Allahabad.
7. Lydolph.P.E. 1985. The Climate of the Earth. Roman & Allanheld Pub.
8. Menon,P.A. 1989. Our Weather, National Book Trust, New Delhi.
9. Thompson, R.D. and Perry, A. 1997. Applied Climatology: Principles and Practice. Routledge.
- Andrew D. Ward and Stanley Trimble .2004(2nd edition). Environmental Hydrology, Lewis Publishers.
2. Basu S.K. 2004(ed). Handbook of Oceanography. Global Vision, Delhi. 3. Garg, S.K. 2005. Hydrology and Water Resource. Khanna Publishers, New Delhi. 4. Garrison Tom. 2012. Geography: An Invitation to Marrine Science. Brooks/Cole. New York 5. Garrison Tom. 2008. Essentials of Oceanography. Brooks/Cole. New York 6. Savindra Singh. 2013. Oceanography. Prayag Pustak Bhawan, Allahabad. 7. Singh, V.P., 1992. Elementary Hydrology. Prentice Hall Inc., Upper Saddle River, N.J. 9 8. Timothy, Davie,(2003), Fundamentals of Hydrology. Routledge, Taylor and Francis Group, U.K. 9. Hussain, T and Tahir, M. 2012. Oceanography. Jawahar Pub., New Delhi 10. Siddhartha, K. . 2013. Oceanography: A Brief Introduction. Kisalaya Pub., New Delhi 11. Hussain, Majid. 2010. Fundamentals of Physical Geography. Rawat Pub. 12. Trujillo, Alan P and Thurman Harold V. 2013. Essentials of Oceanography. Pearson - Prentice Hall 13. Davis Richard A. (1972) Principles of Oce

**Semester – I Credit: 4 (CB)**  
**Paper – III GEB - 103(H)**  
**World Geography( OK)**  
**Unit - I: Geography of Asia**

Southeast Asia: Physical and Human Overview: Population, Climate and natural vegetation and mineral resources, Colonial and Modern Economics

Southwest Asia: Physical and Cultural overview: Population, Climate and natural vegetation and mineral resources, Petroleum economy

China: Physical and Human Overview: Population, Climate and natural vegetation and mineral resources, Colonial and Modern Economics

**Unit - II: Europe**

Geographical location, landforms, climate, resources, environmental modifications and crisis. History of Development; Population: Demographics, Religion, Languages, Level of Living, Distribution, Urbanization;

**Unit - III: US and Canada**

physical geography, resources for industrial growth, demographic characteristics, population mobility. Economic growth and restructuring.

**Unit - IV: Sub- Sahara Africa**

Sub-Saharan Africa: Physical and cultural Diversity, Climate, Colonial Legacy; Main Regions.

**Books Recommended:**

1. English, Paul Ward and James, A. Miller: World Regional Geography: A Question of Place, John Wiley, New York, 1989.
2. Jackson, Richard H. and Lloyd, E. Hudman: World Regional Geography: Issues for Today, John Wiley, New York, 1991.
3. Don, R. Hoy (ed.): Essentials of Geography and Development, MacMillan, New York, 1980.
4. Hussain, M. 2008, World Geography, Rawat Publications, Jaipur.
5. Khan, N. and Hoda, M. (2008) A Text Book on General Geography of Asia, Kalyani Publisher, New Delhi.
6. Goh, C.L., Morgan G.C. (1982) Human and Economic Geography, Oxford University Press.

## **SEMESTER - II**

### **Hydrology-Paper (GEB-201 H) Paper IV**

**Credits: 4**

#### **UNIT – I**

Hydrology: Definition, Nature and Scope; Hydrological Cycle and its Components, Surface Water Sources: Precipitation, Runoff, Evaporation, Transpiration, Evapo-transpiration.

#### **Unit II**

Water Bearing Properties of Rocks: Porosity, Permeability, Specific Yield and Specific Retention, Classification of Rocks According to Water Bearing Properties.

#### **Unit III**

Underground Water: Geologic and Geomorphic Controls on Ground Water, Aquifers: Evolution, Classification of Aquifers, Parameters of Confined, Semi-Confined and Unconfined Aquifers.

#### **Unit IV**

Over-exploitation of Ground Water and Ground Water Mining, Ground Water Problems in Urban Areas, Climate Change Impact on Ground Water Resources, Groundwater Management: Supply Side and Demand Side Management, Rain Water Harvesting and Aquifer Recharge.

**B.A. / B.Sc. (H) Geography**  
**Semester – II- Credits: 4 (CC)**  
**Paper - V (GEB - 202(H))**  
**Principles of Ecology**

**Unit - I: Introduction to Ecology**

Definition, Subject-matter, Scope; Typology; Evolution and Development of Ecology; Difference between Ecology and Human Ecology.

**Unit - II: Environmental Interaction and Adaptation**

Environmentalism; Man and Environment Interaction; Preservation and Conservation; Human Adaptation and Modification; Environmental Adaptation Types: Aquatic, Desert and Land Adaptations.

**Unit - III: Nutrient and Biogeochemical Cycles**

Biogeochemical Cycles: Water Cycle, Nitrogen Cycle, Carbon Cycle, Phosphorous Cycle; Human Population Size and Growth; Carrying Capacity of Earth.

**Unit - IV: Ecosystem and Energy Flows**

Ecosystem: Definition, Components and Functions; Types of Ecosystem; Food Chain, Food Webs and Energy Trophic Levels; Ecological Pyramids; Energy Flow within the Ecosystem: Linear and Y- Shaped Model.

**Books Recommended:**

1. Odum, E.P. 2004. Fundamentals of Ecology. Cengage Learning, New York.
2. Arumugam, N. 2014. Concepts of Ecology. Saras Publication, Delhi.
3. Pushpam Kumar, Reddy B. Sudhakar. 2007. Ecology and Human Well Being. Sage Publication.
4. Robert Ezra Park. 2003. Human Communities: The City and Human Ecology. Freeman Press.
5. Vladimir F. Krapivin., Costas A. Varotsos. 2005. Biogeochemical Cycles in Globalization and Sustainable Development. Springer.
6. Lovett G.M., Jones C., Turns M.G., Weather K.C. 2005. Ecosystem Function in Heterogenous Landscapes. Springer.
7. Yueh-Hsin Lo, Juan A. Blanco and Shovonlal Roy. Biodiversity in Ecosystem. InTech Publishers.
8. Herbert C. Hanson. 1962. Dictionary of Ecology. Philosophical Library Publisher .

**B.A. / B.Sc. (H) Geography**

**Semester – II-Credit: 4 (CB)**

**Paper - VI (GEB - 203 (H))**

**Environmental Issues and Management**

**Unit - I: Introduction to Environment**

Environment: Definition, meaning and components; Environment as the basis of life; Human and Environment Interaction; Humanisation of Nature and Naturisation of Human; Environmental disorders: Human impact on land, climate, natural vegetation and non-renewable natural resources.

**Unit - II: Environmental Issues**

Global Problems: Climate change, Global warming and ozone depletion; Local and Regional Problems: Extreme hydrological events; deforestation and desertification; pollution of air and water; Depletion of fresh water resources and degradation of soils.

**Unit - III: Environmental Strategies**

Uncertainty in managing environmental problems; Sustainable environmental development; Preservation and conservation; Integrated management, and community participation in management.

**Unit - IV: Environmental Management**

Management of air and water resources; Management of soil and forest resources; Management of habitats; Population management and food security; Adaptation to climate change.

**Books Recommended:**

1. Adams, W.M.1995: Green development: Environmental sustainability in the Third World, London: Rout ledge.
2. Alexander, D. 1993: Natural Disasters, New Delhi: Research Press.
3. Allaby, M. 1996: Basics of Environmental science, London: Routledge.
4. Baarshes, W.H. 1996: Eco-fiction: Understanding the Environmental Debate, London: Routledge.
5. Brayant, E.A.1991: Natural Hazards, Cambridge: Cambridge University press.
6. Canter,L. W.1996: Environmental Impact Assessment, 2nd edition, New Yprk: McGraw hill.
7. Chapman,D. 1994: Natural Hazards, Melbourne: Oxford University Press.
8. Chapman J.L. and Reiss, M.J. 1993: Ecology: Principles and applications, Cambridge: Cambridge University Press.
9. Colls, J.1997: Air Pollution: An Introduction, London: Chapman and Hall.
10. Das, R.C. and Behera, B.K. 2008: Environmental Science: Principle and Practice, Prentice Hall of India Pvt. Ltd., Delhi

**B.A. / B.Sc. (H) Geography**  
**Semester – III-Credit: 4 (CC)**  
**Paper - VII (GEB - 301)**  
**Human Geography**

**Unit - I: Introduction to Human Geography**

Definition, nature and scope of human Geography; Branches of human Geography; Dichotomy of physical and human geography; Concepts of man and environment relationship; Environmental Determinism and Possibilism.

**Unit - II: Patterns of Population**

Growth and Distribution of population in the world; Age sex structure; Theories of Population growth: Malthus, Demographic transition; Human Migration: Causes and consequences; Human Development Index.

**Unit - III: Human Settlements**

Settlement: Size, situation and classification; Origin and evolution of rural settlements; Types and patterns of rural settlement; Origin and growth of urban settlements; Process and pattern of urbanization, classification of cities on the basis of site, size and functions.

**Unit - IV: Human Adaptation to Environment**

Evolution of man; Man in eco-system; Ecological adaptation; Human adaptation in equatorial, monsoon, tundra and hot desert; Habitat, Economy and Society of bakarwals, Tharus, naga and Bhills.

**Books Recommended:**

1. Ahmad, Q.S. (1963): Major Natural Regions, S. Chand Publisher, Delhi.
2. Amit Harichandran, M.A. Chaudhry (2010): Global Vision Publication House, New Delhi-11002.
3. Kaushik, S.D. (1970): Manav Bhoogol, Rastogi & Co., Meerut.
4. Hoyt, J.B. (1973): Man and the Earth, Prentice Hall, New Jersey.
5. Husain, Majid (2010): Human Geography, Rawat Publication, Jaipur.
6. Husain, Majid (2010): Manav Bhoogol, Rawat Publication, Jaipur.
7. Leong, G. C.(1995): Certificate Physical and Human Geography, Oxford Publication.

**B.A. / B.Sc. (H) Geography**  
**Semester – III, Credit: 4 (CC)**  
**Paper - VIII (GEB - 302)**  
**Economic Geography**

**Unit - I: Introduction to Economic Geography**

Definition, Subject Matter and Scope of Economic geography; Approaches to the Study of Economic Geography; Classification of Economic Activities; Economic Resources: Concept and Classification.

**Unit - II: Primary Activities**

Geographical factors, production and world distribution of crops: rice, wheat, tea, sugarcane; Whittlesey's classification of agricultural systems; Von Thunen's model of agricultural location.

**Unit-III: Secondary Activities**

World Distribution and Production of Iron ore, coal, petroleum; Factors of Industrial location; Distribution and potential growth of Iron and Steel industry, Cotton Textiles Industry; Weber's theory of industrial location.

**Unit - IV: Tertiary Activities**

Changing forms of international trade; International trade with references to GATT and WTO; Free trade initiatives; Regional Trade Organizations: SAARC, OPEC, BRICS.

**Suggested Books:**

1. T. A. Hartshorn and J. W. Alexander: Economic Geography, Latest edition. Prentice Hall, PHI Learning New Delhi.
2. P. K. Roy: Economic Geography - A Study of Resources. Latest Edition, New Central Book Agency
3. W. P. Anderson: Economic Geography, Latest Edition. Routledge
4. R. Knowles and J. Wareing: Economic and Social Geography Made Simple, Latest Edition. Rupa Publications
5. B. J. L. Berry, E. C. Conklin and M. D. Ray: The Geography of Economic System, Latest edition. Prentice Hall
6. J. L. Guha and P.R. Chattarji: A New Approach to Economic Geography – A Study of Resources, Latest Edition. World Press, Kolkata
7. G. Alexandersson: Geography of Manufacturing, Latest Edition. Prentice Hall, New Delhi
8. Hartshorn, T.A. and Alexander, J.W. 1988: Economic Geography, Prentice Hall India, New Delhi.
9. Jones, C.F. and Darkenwald, G.G. 1954, Economic Geography, Macmillan, New York.
10. Leong. G.C. and Morgan, G.C. 1975: Human and Economic Geography, Oxford University Press, Hong Kong.



**B.A. / B.Sc. (H) Geography**  
**Semester – III-Credit: 4 (CC)**  
**Paper - IX (GEB - 303)**  
**Basic Mathematics and Statistics( OK)**

**Unit - II**

Types of Sampling; Nature of Statistical Data: Discrete, Continuous; Measures of Data: Quantitative and Qualitative Data; Quartile; Nested Mean; Bar Graph, Histogram, Line Graph, Frequency Polygon, Ogive Curve, Normal and Skewed, Pie-Chart.

**Unit I: Measures of Central Tendency and Association**

Measures of Dispersion: Mean Deviation, Quartile Deviation, Standard Deviation; Karl Pearson's Correlation; Spearman's Rank Correlation; Simple Linear Regression.

**UNIT-III Algebra, Trigonometry, Geometry and Mensuration**

Polynomials, zeros, pair of linear equation, quadratic equation, trigonometric ratios, 2D and 3D geometry, circles, ellipse, parabola, hyperbola, surface area and volume( circle, cylinder, cone and sphere etc)

**UNIT-IV Matrix and calculus**

Introduction to matrix; order, type and operation on matrix; Transpose, inverse Adjoint and rank of matrix; Determinants of matrix, Introduction to functions, limits of continuity, Differentiation, integration; Differential Equation

**Books Recommended:**

1. Alvi, Z; 1995: Statistical Geography, Rawat Publication, Jaipur.
2. Mahmood, A; 1986: Statistical Methods in Geographical Studies, Rajesh Publications, New Delhi.
3. Goon, A.M; Gupta, M.K. & Dasgupta, B. 1992: Fundamentals of Statistics, Volume I, The World Press Pvt. Ltd; Kolkata.
4. Gregory, S.1985. Statistical Methods and the Geographers, Longman, London.
5. Peter A. Rogerson; 2006: statistical methods for Geography, Sage Publication, Asia Pacific Ltd. Singapore.
6. Johnson. R.A. Bhattacharyya. G.K. (2009): Statistics: Principles and Methods, John Wiley and Sons, USA.
7. Micheal C.J. (2005): Statistics: An Introduction. R. John Wiley and Sons, USA.
8. Norcliff, G.B., (1977): Inferential Statistics for Geographers: An Introduction, Hutchinson, London.
9. David. E. (1985): Statistics in Geography, Basil Blackwell Ltd, Oxford.
10. Johnston, R.J. (1978): Multivariate Statistical Analysis in Geography, Longman Group Limited, London.
11. Burt J.E. Barber. G.E. Rigby D.L. (2009): Elementary Statistics for Geographers, Guilford Press, New York.

**B.A. / B.Sc. (H) Geography**  
**Semester – III-Credit: 4 (AECC)**  
**Practical - I (GEB - 304)**  
**Land Surveying and GPS**

**Unit - I:**

Surveying: Definition, Principles, Methods, Classification; Plane and Geodetic Surveys;  
Triangulation: Principles, base line measurement, extension of the base.

**Unit - II:**

Plane Table Survey: Radiation, Intersection and Resection Methods; Dumpy Level Survey:  
Simple and Compound Levelling.

**Unit - III:**

Overview of Global Positioning System; GPS: Receivers, Satellite Constellations, Segments,  
Antennas, Signal Codes and Errors; Accuracy of GPS measurements; Application of GPS.

**Unit - IV:**

GPS Surveying and Mapping: Field Exercises using Hand Held GPS.

**Books Recommended:**

1. Aylmer Johnson. 2004. Plane and Geodetic Surveying. CRC Press.
2. Singh R. L. and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers.
3. Gupta K.K. and Tyagi, V. C., 1992: Working with Map, Survey of India, DST, New Delhi.

**B.A. / B.Sc. (H) Geography**  
**Semester – IV-Credit: 4 (CC)**  
**Paper - XI GEB – 401 (H)**

**Geography of India**  
**Unit - I**

Geology and Structure, Physical Divisions of India, Drainage, Soil, Climate, Natural Vegetation, Agro-climatic Regions.

**Unit - II**

Population: Growth and Distribution, Population Composition: Sex ratio, Rural and Urban population, Literacy, Urbanization, Social structure of population: Distribution by Race, caste, religion and language.

**Unit - III**

Agriculture: Production and Distribution of Food crops- Rice and Wheat , Maize ; Production and Distribution of Cash crops- Cotton, Sugarcane and Tea, Green Revolution, Minerals: Production and Distribution of iron ore, coal and petroleum.

**Unit - IV**

Energy resources: Conventional and Non-Conventional; Industries: Mineral based and Agro-based; Industrial Regions, Industrial Policy, SEZ, Transport and Communication. Regionalisation of India: Physiographic Regional scheme of R.L. Singh.

**Books Recommended:**

1. Hussain.M. 2009, Geography of India, Tata McGraw-Hill companies Book.
2. Kalpana Raja Ram, 2007, Geography of India, Spectrum Books, New Delhi 110058.
3. Learmonth A.T.A et.al (ed) Man and land of South Asia, Concept
4. Shafi, M: Geography of South Asia, McMillan & Co; Calcutta, 2000.
5. Singh, R.L. (Ed). India: A Regional Geography, National Geographical Society, India.
6. Alexander, J.W.1965 Economic Geography.
7. Deshpande C. D., 1992: *India: A Regional Interpretation*, ICSSR, New Delhi.
8. Grigg, D. B. , 1974 *The Agricultural Systems of the World: An Evolutionary Approach*. Cambridge: The University Press.
9. Routray, J.K.: *Geography of Regional Disparity*, Asian Institute of Technology, Bangkok, 1993.
10. Sdhekhar.S.(edt.)2004, *Regional Planning in India*, Anmol Publications, New Delhi-2

**B.A. / B.Sc. (H) Geography**

**Semester – IV-Credit: 4 (CC)**

**Paper - XII GEB – 402(H)**

**Population and Settlement Geography**

**Unit - I: Introduction to Population Geography**

Subject matter and scope of Population geography, Sources of Population Data: Census, Vital Statistics and National Sample Survey, Trends of Population Growth in the World; World Pattern of population distribution.

**Unit - II: Population Dynamics**

Population Dynamics: Fertility, Mortality and Migration, Composition of population: Rural and Urban, Literacy, Sex ratio, Trend and pattern of Urbanization, Population Policy of India.

**Unit - III: Settlement Geography**

Definition and scope of settlement geography, Historical evolution of settlements, Types of Settlements, factors affecting growth of settlements.

**Unit - IV: Settlements: Types and function**

Rural and Urban Settlements: Types and Classification, Theories of City Structure: The Concentric Ring Theory, The Multiple Nuclei Theory, Settlements as Service Centres.

**Books Recommended:**

1. Ramachandran, R., Urbanization and Urban Systems in India, Oxford University Press, New Delhi, 1992.
2. Singh, R.L. and Kashi Nath Singh (editors), Readings in Rural Settlement Geography, National Geographical Society of India, Varanasi, 1975.
3. Chandana, R.C. (2008): Geography of Population: Concepts, Determinants and Patterns, 7th Edition, Kalyani Publishers, New Delhi.
4. Clarke, J.I. (Ed.) (1984): Geography and Population: Approaches, Pergamon Press Ltd; Oxford.
5. Demco, G.J; Rose, H.M. Schnell, G.A. (1970): Population Geography, McGraw Hill Book Co; New York.
6. King, Leslie, J., Central Place Theory, Sage Pub., New Delhi, 1986..
7. Mayer, M. Harold and Clyde F. Kohn (editors), Reading in Urban Geography, Central Book Depot, Allahabad, 1967.
8. Trewartha, G.T. (1969). A Geography of Population: World Patterns, John Wiley and Sons, New York.

**B.A. / B.Sc. (H) Geography**  
**Semester – IV-Credit: 4 (CB)**  
**Paper - XIII GEB - 403- (H)**

**Disaster Management**

**Unit - I: Introduction**

Disasters: Concept and Nature, Magnitude and Types; Consequences of Disaster; Social, Economic and Environmental.

**Unit - II: Vulnerability, Preparedness and Risk Assessment**

Risk and Vulnerability: Concept and Classification, Types of Risk and Vulnerability, Disaster Preparedness; Concept and Nature, Public Awareness Programs.

**Unit - II: Mitigation and Planning**

Meaning, Concept and Strategies of Disaster Mitigation, Pre-Disaster and Post-Disaster planning, Role of International Agencies in Disaster Mitigation and Planning, Significance of Information Technology, Remote Sensing and GIS in Planning and Management

**Unit - IV: National Perspective**

Disaster Prone Areas of India; Seismic Zones, Areas prone to Floods and Droughts, Landslides, Cyclones , Industrial Disaster, National Disaster Management Plan (NDMP)-2016.

**Books Recommended:**

1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
3. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
4. Kapur, A. (2010) Vulnerable India: A Geographical Study of Disasters, Sage Publication, New Delhi
5. Government of India, 1997, Vulnerability Atlas of India, New Delhi
6. Sahni, Pardeep et.al. (Eds.) 2002, Disaster Mitigation, Experiences and Reflections. Prentice Hall of India, New Delhi.

**B.A. / B.Sc. (H) Geography**  
**Semester – IV-Credits: 2 (CC)**  
**Practical - II GEB – 404 (H)**  
**Cartographic Techniques**

**Unit - I: Fundamentals of Cartography**

Definition and Scope of Cartography; Scale: Concept and Methods of Representation; Drawing of Plain, Comparative and Diagonal Scales.

**Unit - II: Cartographic Techniques**

Diagram: Bars- Simple, multiple and compound; Wheel Diagram-simple, compound and proportional circle; Thematic Mapping: Choropleth and Isopleth

Map Projections

UNIT-IV

**Books Recommended:**

1. Monkhouse. F. J. and Wilkinson. H. R. 1972: Maps and Diagrams. Methuen, London
2. Robinson A. H., 2009: Elements of Cartography, John Wiley and Sons, New York.
3. Khan Jabir, Hasan T & Shamshad, Scales, Academic Publications, 2014
4. Misra, R. P. 1969. Fundamentals of Cartography, Prasaranga. University of Mysore, Mysore.
5. Singh R. L. and Singh R. P. B., 1999: Elements of Practical Geography, Kalyani Publishers

**B.A. / B.Sc. (H) Geography**  
**Semester – V-Credit: 4 (CC)**  
**Paper - XIII GEB – 501(H)**  
**Urban Geography**

**Unit - I: Basic Concepts**

Urban Geography: Definition, Nature and Scope; Evolution of Towns: Ancient, Medieval and Modern Period; Trend of Urbanization, Urban Sprawl.

**Unit - II: Cities: Growth and Evolution**

Urban morphology and Land use patterns, models of urban growth and evolution: Burgess's Concentric Zone Theory; Hoyt's Sectoral Model; Harris and Ullman's Multiple Nuclei Model.

**UNIT - III: Cities: Functions**

Functional Classification of Towns: Harris, Nelson, Law of Primate City, Rank-Size Rule; Hierarchy of central Place: Growth Pole Theory,

**Unit - IV: Contemporary Issues**

Contemporary Urban Issues: Urban Poverty, Slums, Urban crimes; Urban pollution: Air, water and Noise; Emerging Issues: Concept of Urban Heat Island, Problems of Indian Cities.

**Books Recommended:**

1. Alam, S.M., 1964. Hyderabad-Secunderabad Twin Cities. Asia Publishing House. Bombay.
2. Berry, B.J.L. and Horton F.F; 1970 Geographic Perspectives on Urban Systems. Prentice Hall, Englewood Cliffs, New Jersey.
3. Carter, H; 1976. The Study of Urban Geography, Edward Arnold Publishers, London.
4. Hall, T; 2001. Urban Geography. Routledge, London.
5. Kundu, A; 1992. Urban Development and Urban Research in India. Khanna Publication.
6. Ramchandran. R; 1988. Urbanization and Urban System in India, New Delhi, Oxford Publication.
7. Krishan, Gopal; 1974. Nagar Bhugol, Punjab State University Text Book board, Chandigarh.
8. Hughes, Sara, Chu, Eric K., Mason, Susan G. (Eds.) (2018) Climate Change in Cities, Springer Publishers.

**B.A. / B.Sc. (H) Geography**  
**Semester – V-Credit: 4 (CC)**  
**Paper - XIV (GEB - 502(H))**  
**Rural Geography**

**Unit - I: Introduction to Rural Geography**

Concept and scope of rural geography; different approaches to the study of rural settlement geography; indicators of rural development: agricultural sector, industrial sector, social sector, and infrastructural sector.

**Unit - II: Rural Settlement**

Rural settlement: Definition and characteristics; Types and pattern of rural settlement; Rural-urban Continuum; Rural-urban Fringe: Structure, characteristics and functions.

**Unit - II: Rural Economy**

Agriculture; Non-farm Occupation; Agro-based Industry; Household Industry; Rural Economy and Social Development; Rural service centers and their hierarchy.

**Unit - IV: Rural Development**

Rural Development: elements, objectives, scope and significance; Determinants of rural development; Rural development programmes; Role of Panchayati Raj Institution; Sustainable rural development.

**Books Recommended:**

Chisholm, M., Rural Settlement and Land Use, Hutchinson, London, 1970

Clout, H. D., Rural Geography: An Introductory Survey, Pergamon Press, 1972.

Clout, R.D., Rural Geography, Pergamon Press, London, 1970

Nath, V. 2010. Rural Development and Planning in India, Concept Pub., New Delhi.

Sinha, R.N.P; Geography and Rural development; Manohar Publishers and distributors, New Delhi.

Woods, M., Rural Geography: Processes, Responses and Experiences in Rural Restructuring, Sage Publications, 2005.

Woods, M., Rural, Routledge, Oxon, 2011.



## **SEMESTER V**

### **Fundamentals of Remote Sensing**

#### **Paper (GEB-503 H) Paper XV**

**Credits: 4**

#### **UNIT – I**

Introduction, Types and Historical Development of Remote Sensing, Remote Sensing as a Tool for Geographers, Satellite Remote Sensing VS Aerial Photography, Remote Sensing Data Acquisition and Analysis, Remote Sensing Processes.

#### **Unit II**

Basic Principles of Remote Sensing: Electromagnetic Radiation, Electromagnetic Spectrum, Atmospheric Interaction with Electromagnetic Radiation, Energy Interaction with Earth's Surface Material, Spectral Signature and Curve.

#### **Unit III**

Microwave Remote Sensing: Introduction, The Radar Principle, Factors Affecting Microwave Measurements, Side Looking Airborne Radar (SLAR) System, Synthetic Aperture Radar (SAR), Interpretation of SAR Images

#### **Unit IV**

Remote Sensing Platforms and Sensors: Satellite System Parameters: Instrumental Parameters and Viewing Parameters, Sensor parameters: Spatial Resolution, Spectral Resolution, Radiometric Resolution, Imaging Sensor Systems: Multispectral Imaging Sensor System, Thermal Sensing System, Microwave Imaging System, Earth Resource Satellites: Landsat, SPOT and IRS Satellite Programme System.

#### **Books Recommended:**

## **SEMESTER V**

### **Visual Image Interpretation**

#### **Practical Paper III (GEB-505- H)**

**Credits: 2**

#### **UNIT – I**

Introduction, Nature and Scope of Photogrammetry, Fundamental Concepts of Photogrammetry, Types and Scale of Aerial Photographs.

#### **Unit II**

Determination of Photo Scale, Construction of Instrument Base, Photo Base and Stereo Modal, Determination of Height of Objects Using Single Vertical Aerial Photograph

#### **Unit III**

Detection of Defined Objectives: Interpretation of Stereo Grams: Fluvial and Industrial, Interpretation of Stereo Pair, Interpretation of Salt Affected and Ravenous Areas

#### **Unit IV**

Satellite Imageries: Types and border Information, Feature Identification from Multiband Imageries, Interpretation of FCC for Landuse/Land cover Mapping: Chandigarh/Kolkata/Delhi, Banaras.

**B.A. / B.Sc. (H) Geography**

**Semester – VI-Credit: 4 (CC)**

**Paper - XVII GEB – 601(H)**

**Regional Development and Planning**

**Unit - I: Region and Development**

Region: Concept, Definitions and Types; Development: Concept and Definition, Types of Development: economic development, sustainable development and human development

**Unit - II: Regional Development and Regional Planning**

Regional development: Concepts and indicators; Regional Planning: Concepts and purpose; Delineation of Planning Region, Types of Regional Planning: short and long term, single and multilevel, centralized and decentralized.

**Unit - III: Development Theories and Models**

Rostow's model, Core-periphery model of Friedman, Hirschman theory of unbalanced growth, Myrdal Cumulative Causation Theory

**Unit - IV: National Perspective**

Regional Planning in India: Five year plans - goals and achievements; Regional imbalances and inequalities in India; Area Development plans: Concept, Types, Indian examples of area development plans; Metropolitan Plans: Case Study of a Metropolitan Indian City.

**Books Recommended:**

1. Glasson, 1980, Regional Planning, Hutchinson, London.
2. Friedmann J. and Alonso W., 1975 Regional Policy-Readings in Theory and Applications, MIT Press, Massachusetts.
3. Haynes J. 2008 Development Studies, Polity Short Introduction Series
4. World Bank 2018, World Development Report, Oxford University Press
5. Ray Chaudhary, J., 2001, An Introduction to Development and Regional Planning, Orient Longman, Hyderabad.
6. L. S. Bhat, 1972 Regional planning in India.
7. Jayasri Ray Chaudhuri, 2001 Introduction to Development and Regional Planning: With Special Reference to India.
8. Peet R., 1999: Theories of Development, The Guilford Press, New York.
9. India Human Development Report, 2011 Towards Social Inclusion, Institute of Applied Manpower Research, Oxford University Press, New Delhi, India.

## **SEMESTER VI**

### **Evolution of Geographical Thought**

#### **Paper (GEB-602 H) Paper XVIII**

**Credits: 4**

#### **UNIT – I**

Early Origin of Geographical Thinking with Reference to Thales, Hecataeus, Herodotus, Eratosthenes, Ptolemy.

#### **Unit II**

Dark Age in Europe and its Impact on Geography, Development of Geography in Arab World During Medieval Time, Contribution of Al-Masudi, Al-Biruni, Ibn-e-Batuta, Ibn-e-Khaldun.

#### **Unit III**

Evolution of Geographical Thinking and Disciplinary Trends in Germany, France, Britain and United States of America.

#### **Unit IV**

Trends in Geography: Quantitative Revolution and Its Impact, Behaviouralism, Radicalism, System Approach, Changing Concept of Space in Geography, Future of Geography.

**B.A. / B.Sc. (H) Geography**  
**Semester – VI-Credit: 4 (SEC)**  
**Paper - XIX GEB – 604 (H)**

**Acquisition and Analysis of Climatic Data**

**Unit -I: Climatic Data: Introduction**

Climatic Data: Concept and Utility; Types of Climatic Data: Temperature, Pressure, Humidity, Rainfall, Surface wind, Insolation, Clouds; types and their role in weather, Role of climatic data in Weather forecasting.

**Unit II Climatic Data: Acquisition**

Weather Instruments: Thermometer; Barometer; Wind vane; Rain gauge, Data sources: Weather Stations, Indian Meteorological Department, National Remote Sensing Centre (NRSC), Weather monitoring Satellites.

**Unit III Analysis of Data**

Interpretation of weather data: Temperature- Mean, Monthly, Diurnal range and trend analysis; Humidity; relative and absolute; Rainfall- trend and pattern; Wind speed and direction.

**Unit IV Representation of Data**

Climatic data representation: Iso-lines, Isobars, Line graphs; Wind roses; Climograph; Rainfall dispersion diagram; Ergograph, Synoptic charts; Weather maps

## **PG Diploma in Remote Sensing and GIS Applications**

### **Paper - I (PGDRS-101)**

#### **Photogrammetry**

**Credits: 4 (OK)**

#### **Unit I: Introduction to Photogrammetry**

Historical developments; Principles and Types of **Photogrammetry**; Role of photogrammetry in surveying and mapping; Recent trend in Photogrammetry; Aerial and Close-range Photogrammetry: orientation of the bundle of rays, orientation of images, geometric accuracy

#### **Unit II: Aerial Photography**

Fundamentals of aerial Photography: Flight planning and Resolution; Types and Geometry of Aerial Photograph; Projection of Aerial Photograph; Scale and ground coverage; Relief displacement

#### **Unit III: Stereophotogrammetry**

Stereoscopy and stereoscopic parallax: Parallax bar, Floating mark and Parallax Bar formula  
Use of Parallax bar in height measurement; Stereophotogrammetry: Degrees of freedom in single photograph, Principle of reprojection, stereo restitution; Photogrammetric stereo plotters and mapping instruments; Control extension and aerial triangulation.

#### **Unit IV: Analytical and Digital Photogrammetry**

Basics of Analytical Photogrammetry: Collinearity and Coplanarity conditions, Concept of Rotation Matrix; Concepts in Digital Photogrammetry: Digital data input; satellite based digital photogrammetry; Concept of DEM, DSM and DTM and Orthoimage; Geometric accuracy; Principles of digital photogrammetry, Image measurement, Orientation procedure, Epipolar geometry, Aerotriangulation, Block adjustment, Mosaics of DTM & ortho images

#### **Suggested Readings:**

1. Cliff Greve and ASPRS Digital Photogrammetry: An Addendum to Manual of Photogrammetry

2. EGELS, Y. -- KASSER, M. Digital Photogrammetry London Taylor & Francis 2002 0-748-40945-9
3. GÁL, P. Fotogrametria Bratislava SNTL 1965
4. Kasser Michel and Egles Yves Digital Photogrammetry. Taylor & Francis. London & New York.
5. Mikhail Edward, Bethel James and McGlone J Chris Introduction to Modern Photogrammetry, John Wiley & Sons Inc.
6. Paul Wolf, Elements of Photogrammetry, McGraw Hill.
7. Sanjib K. Ghosh, 1979: Analytical Photogrammetry, New York: Pergamon Press
8. Sanjib K. Ghosh. 2005. Fundamentals of computation Photogrammetry. Concept publishing, New Delhi.
9. Toni Schenk: Digital Photogrammetry, Volume I., TerraScience.
10. WOLF, P R. Elements of photogrammetry: with applications in GIS. Boston McGraw-Hill 0-07-292454-3
11. ŽÁRA, J. et al. Moderní počítačová grafika Brno Computer Press 2004 80-251-0454-0

**PG Diploma in Remote Sensing and GIS Applications**  
**Paper - II (PGDRS-102)**  
**Remote Sensing & Image Interpretation**  
**Credits: 4 (OK)**

**Unit I: Fundamentals of Remote Sensing**

Definition, types scope and principles of remote sensing; Stages in remote sensing data acquisition; Electromagnetic radiation and electromagnetic spectrum; Black body radiation and radiation laws; Interaction of EMR with atmosphere and Earth's surface features, spectroscopy of water, soil and vegetation.

**Unit II: Platforms, Orbits, Sensors and Data Products**

Remote sensing platforms and orbits; Types & characteristics of sensors: IRS, LANDSAT, SPOT, IKONOS, Quick Bird; Remote sensing data products.

**Unit III: Thermal & Microwave Remote Sensing**

Thermal Remote Sensing; Thermal properties of materials: emissivity of materials; thermal inertia of Earth surface features; Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltzmann law), Interaction of EMR with the Earth Surface ( Wien's displacement law; Thermal data sets: LANDSAT and ASTER; Principles of microwave remote sensing; Microwave data sets SLAR, LIDAR and SAR; Application of Thermal and Microwave data.

**Unit IV: Image Interpretation**

Factors affecting image interpretation; Image characteristics, Elements of Image interpretation; Methods and techniques of image interpretation; land use/land cover classification system; Multi concepts in image interpretation.

**Suggested Readings:**

- 1) Jensen John R. Introduction to Digital Image Processing: A Remote Sensing Perspective Prentice hall, New Jersey
- 2) Richards John A& Xiuping Xia, 2006. Remote Sensing Digital Image Analysis: An Introduction. Birkhäuser.
- 3) Lillesand Thomas M. & Kiefer Ralph: Remote Sensing Image Interpretation John Wiley and Sons, New York
- 4) Campbell John B. Introduction to Remote Sensing, Taylor & Francis, London
- 5) Sabins Floyd. F: Remote Sensing and Principles of Image Interpretation, W H Freeman, New York



## **PG Diploma in Remote Sensing and GIS Applications**

### **Paper – III (PGDRS-103) Digital Image Processing Credits: 4 (OK)**

#### **UNIT I: Introduction to DIP and Digital Data**

Overview of DIP and its advantage and disadvantages, key stages; Resolutions: spatial, radiometric, spectral and temporal; Digital images and its types; Digital data formats: band interleaved by pixel, band interleaved by line, band sequential.

#### **UNIT II: Image Rectification & Manipulation**

Introduction-Sensor model, Pre-processing and Post processing Geometric distortion, sources and causes for distortion, rectification, GCP, Re-sampling, Image registration, transformation, Radiometric distortion, sources and causes, Computation of radiance, Computation of reflectance, cosmetic operations, Noise removal, atmospheric correction.

Multi Image Manipulation: Band rationing; Vegetation Indices: Normalized Differential Vegetation Index, Transformed Vegetation Index, and Normalized Differential Water Index , Soil Moisture index and SAVI

#### **Unit III: Image Enhancement**

Contrast Stretching; Linear contrast stretching, Non-linear contrast stretching, histogram equalization, Gaussian stretch, density slicing and pseudo colouring; filtering: spatial domain and frequency domain filtering; High pass and low pass filters; Linear edge enhancement filter: Laplacian filter; Non linear edge enhancement filter: Roberts filter, Sobel's filter.

#### **.UNIT IV: Image Classification and Accuracy**

Image classification: Spatial pattern recognition, Image classification types: Supervised, unsupervised; Training site selection and analysis; Supervised image classifiers : Minimum distance to mean classifier, Parallelepiped classifier, Gaussian maximum likelihood classifier, Unsupervised image classifiers: Histogram based classification, Sequential clustering, Isodata clustering; Fuzzy classification; Classification Accuracies: Producer accuracy, User accuracy, overall accuracy and K statistics.

#### **Suggested Readings:**

- 1) Gonzalez Rafael C and Woods Richard E.: Digital Image Processing Addison Wesley, New York
- 2) Pratt William K.: Digital Image Processing, John Wiley and Sons, New York

- 3) Jain Anil K. Fundamentals of Digital Image Processing, Prentice Hall, New Jersey:
- 4) Jensen John R. Introduction to Digital Image Processing: A Remote Sensing Perspective  
Prentice hall, New Jersey.
- 5) Richards John A& Xiuping Xia, 2006. Remote Sensing Digital Image Analysis: An  
Introduction. Birkhäuser.

**Paper – IV (PGDRS-104)**  
**Geographical Information Systems and Global Positioning System**  
**Credits: 4 (OK)**

**Unit I: Introduction to GIS**

History and development of GIS; Cartography –GIS interface; Recent trends and applications of GIS; Open source GIS; GIS Mobility; Real-Time GIS, Programming Language: Python and Java

**Unit II: GIS Data base**

Geographic data: Spatial and non-spatial; Data models: Raster and vector; Database Management System (DBMS); Data Structures: Relational, hierarchical and network; spatial data types insertion and retrieval; Attribute data generation; Coordinate transformation; Big Data Analytics and Data Mining; spatial queries using extended SQL, Query optimization & index creation; Spatial database design using Unified Modelling Language, spatial database schema creation.

**Unit III: Spatial analysis**

Spatial overlay operations, network analysis and proximity analysis; 3D models; TIN, DEM, DTM Query in GIS; Interpolation of non-spatial data; multi-criteria decision modelling; hydrological analysis; Generalization; Map Algebra and Geostatistical Analysis

**Unit IV: Global Positioning System**

Global Positioning System: Introduction, Satellite constellation, GPS signals and data, Geopositioning-Basic Concepts. NAVSTAR, GLONASS, Indian Regional Navigational Satellite System (IRNSS), GAGAN Control Segment, Space Segments, User Segment, GPS Positioning Types- Absolute Positioning, Differential positioning , GPS Surveying Methods and Accuracy: Methods-Static & Rapid Static, Kinematic-Real Time Kinematic Survey- DGPS-GPS Data Processing and Accuracy, Factors Affecting GPS Accuracy , GPS receiver, GPS antenna. Radio and its types, Radio Antenna

**Suggested Readings:**

1. Burrough, P.A., 1986, Geographical Information System for land Resources System, Oxford Univ. Press, UK.

2. Fotheringham, S.; Rogerson, P. (ed.), 1994. Spatial analysis and GIS. Taylor and Francis, London, UK.
3. Laurini, Robert and Dierk Thompson, 1992, Fundamentals of Spatial Information Systems, Academic Press, ISBN 0-12-438380-7.
4. Maguire, D.J.; Goodchild, M.F.; Rhind, D.W. 1991. Geographical Information System, Longman, London, UK
5. Siddiqui, M.A.; 2006, Introduction to Geographical Information System, Sharda Pustak Bhavan, Allahabad.
6. Siddiqui, M.A.; 2011, Concepts and Techniques of Geoinformatics, Sharda Pustak Bhavan, Allahabad.
7. Devillers, R. and Jeansoulin (2006). Fundamentals of Spatial Data Quality. ISTE Ltd, United States.
8. Draper, N. and Smith, H. (1981). Applied Regression Analysis. Wiley, New York.
9. Hengl, H. (2007). A Practical Guide to Geostatistical Mapping of Environmental Variables. European Commission, Italy.
10. Sen, Z. (2009). Spatial Modeling Principles in Earth Sciences. Springer.

**Practical – I (PGDRS-105)**  
**Photogrammetry and Image Interpretation**  
**Credits: 2**

**Unit I: Aerial Photography**

Introduction to aerial photographs; Numerical problems on the aerial photographs: Determination of photo scale; determination of number of Strips and total number of aerial photographs; Preparation of photo index.

**Unit II: Photogrammetry: Instruments and Data Collection**

Stereo test; Orientation of stereopair under mirror stereoscope; Determination of heights and slopes; Preparation of base map. Familiarization with DPWS, Project creation, data input, orientation. Data integration from different sources of GPS and High-resolution satellites for large scale mapping.

**Unit III: Digital Photogrammetry**

DEM and ortho-image generation and accuracy assessment. Feature extraction from 2D and 3D model. Use of Google Earth and Bhuvan Earth Models.

**Unit IV: Interpretation of Satellite Imageries**

Referencing and lay out of satellite images; Identification of objects/features from satellite imageries based on reflectance; Interpretation of physical and cultural features from IRS imagery; Preparation of image interpretation keys. Image Metadata and their use in image interpretation

**Suggested Readings:**

1. American Society of Photogrammetry, 1993, Manual of Remote Sensing, Falls Church, Virginia
2. Cliff Greve and ASPRS Digital Photogrammetry: An Addendum to Manual of Photogrammetry
3. Curran, Paul J., 1995, Principles of Remote Sensing, Longman, London
4. Joseph George (2003) Fundamentals of Remote Sensing, University Press, Hyderabad.
5. Kasser Michel and Egles Yves Digital Photogrammetry. Taylor & Francis. London & New York.

6. Li,Zhilin, Chen,Jun and Baltsav,Emmanual, 2008. Advances in photogrammetry, Remote Sensing and Spatial Infomation Science: 2008 ISPRS Congress Book. / London: Taylor and Francis Group, xviii,527p ISBN : 978041547805.
7. Lillesand T.M and Keifer R.W. (2000) Remote Sensing and Image Interpretation, IVth Eds. John Wiley and Sons, New York.
8. Lo C.P. & Yeung A.K.W., (2004). Concepts and Techniques of GIS, Prentice-Hall of India, New Delhi.
9. Mikhail Edward, bethel James and Mcglone J Chris Introduction to Modern Photogrammetry, John Wiley & sons Inc.
10. Schmidt Milton O and Rayner William Horace Fundamentals of Surveying, Van Nostrand Reinhold Company

## **PG Diploma in Remote Sensing and GIS Applications**

### **Paper – VI (PGDRS-106)**

**Credits:2**

### **Digital Image Processing (Practical)**

#### **UNIT 1: Image Restoration and Enhancement**

Digital images; Layer stacking, Subsetting and Band Compositions; Image enhancement techniques: Histogram equalization; Image filtering.

#### **UNIT 2: Image Error Rectification**

Radiometric and atmospheric error rectification, Geometric Error Rectification Exercises.

#### **UNIT 3: Indices Modeling**

Normalized Differential Vegetation Index, and Soil Adjusted Vegetation Index models

#### **UNIT 4: Image Classification**

Image classification: Unsupervised classification; Training sets and supervised classification using Maximum likelihood methods; Introduction to Earth Engine

#### **Suggested Readings:**

- 1) Ekstrom, M.P., 1994, Digital Image Processing Techniques, Academic Press, New York.
- 2) Hord, R.M., 1992, Digital Image Processing of Remotely Sensed Data, Academic Press, New York
- 3) Jensen, J.R., 1996, Introductory Digital Image Processing: A Remote Sensing Perspective, Printice Hall, Englewood Cliffs, New York.
- 4) Lillesand T.M and Keifer R.W. (2000) Remote Sensing and Image Interpretation, IVth Eds. John Wiley and Sons, New York.
- 5) Muller, P.J., 1996, Digital Image Processing in Remote Sensing, Taylor & Francis, London.
- 6) Nag, P. & Kudrat, M., 1996, Digital Remote Sensing, Concept Publishing Company, New Delhi.
- 7) NRSA, 1995. IRS - IC, Data User Handbook, Hyderabad.
- 8) Sabins, F.F. (2002), Remote Sensing: Principles and Interpretation, Freeman, New York

## **Practical – III (PGDRS-107)**

### **Geographical Information Systems and Global Positioning System**

**Credits: 2**

#### **Unit -I: Introduction to Computers & GIS**

Graphical user interface of Arc GIS; QGIS; Google Earth Engine; Open Source Geo-network metadata cataloguing system

#### **Unit - II: Data Base Creation**

Spatial data input and Geo-referencing; Spatial data base creation; Creation of non-spatial data sets into DBF format; Linking of Spatial data with non-Spatial data sets; Map generation at varied spatial resolutions, Spatial resolution vs. attribute uncertainty; Modifiable Areal Unit Problem (MAUP)

#### **Unit-III: Spatial Analysis**

GIS analysis: Proximity, Thematic mapping and Over lay; 3D modelling: DEM, Slope and Aspect; Geo-visualization of 3D geospatial data; Overlay and proximity analysis; Output and report generation; Modelling spatial structure from point samples, Assessing the quality of spatial predictions, Auto-correlation, Variogram and Semi-variogram analysis

#### **Unit IV: Global Positioning System**

Demonstration on GPS and DGPS; Selection of datum, units and scale; GPS measurement: Collection of GCPs; Mobile mapping; Transfer of GPS data in to GIS software. Land Surveying through DGPS.

#### **Suggested Readings:**

1. Bernhardsen (2003) *Geographic Information Systems: An Introduction*, 3ed, Wiley India Pvt. Ltd., New Delhi.
2. Demers (2004) *Fundamentals of Geographic Information Systems*, 3ed, Wiley India Pvt. Ltd., New Delhi.
3. Joseph George (2003) *Fundamentals of Remote Sensing*, University Press. Hyderabad
4. Lillesand T.M and Keifer R.W. (2000) *Remote Sensing and Image Interpretation*, IVth Eds. John Wiley and Sons, New York.
5. Lo C.P. & Yeung A.K.W., (2004). *Concepts and Techniques of GIS*, Prentice-Hall of India, New Delhi
6. LO & YEUNG (2009) *Concepts and Techniques of Geographic Information Systems*, 2nd ed., PHI Learning Pvt. Ltd, New Delhi.



7. Downey, A. B. (2009). Python for Software Design: How to Think Like a Computer Scientist. Cambridge University Press.
8. Sherman, G. (2012). The Geospatial Desktop: Open Source GIS and Mapping. Locate Press.
9. Swaroop C. H. (2008). A Byte of Python. <http://www.swaroopch.org/notes/Python>.

### **Online Sources**

1. <http://www.python.org/>
2. <http://pypi.python.org/pypi>
3. <http://www.pythonware.com/products/pil/>
4. <http://www.opengeospatial.org/standards/kml/>
5. <http://www.gdal.org/>
6. NumPy User Guide Release 1.5.1 (<http://docs.scipy.org/doc/numpy-1.5.x/numpy-user.pdf>)
7. Python Imaging Library Overview 1.1.3 (<http://www.pythonware.com/media/data/pil-handbook.pdf>)
8. Matplotlib Release 1.0.0 (<http://matplotlib.sourceforge.net/trunk-docs/Matplotlib.pdf>)

# **Post graduate Diploma in RS and GIS Application**

## **PGDRS-201**

### **RS & GIS Application in Soil and Agriculture**

#### **Credit-4**

##### **UNIT I**

Soil classifications, Soil survey, Types and methods: Hydrological Soil grouping - Factors influencing soil reflectance properties, Factors affecting Soil erosion, Major soil types of India and Spectral signatures, characteristics of saline & alkaline Soils.

##### **UNIT II**

Soil mapping, degradation and fertility, Application of remote sensing in soil type mapping, soil moisture assessment, erosion assessment and degradation, Soil Erosion Assessment Models, watershed management, Soil conservation.

##### **UNIT III**

Spectral properties of crops, crop canopy, crops identification, crop inventory, crop acreage estimation, vegetation indices and biophysical model, crop condition assessment, crop water management, command area monitoring and management,.

##### **UNIT IV**

Agro-ecological zonation, site suitability for agricultural and horticulture crops, damage assessment due to cyclone, drought, flood and forewarning, precision agriculture, crop loss assessment, RS for crop insurance claim.

##### **Suggested Readings:**

1. Remote sensing applications (2009), Published by NRSC, ISRO, Hyderabad, Chapters – 1 & 13
2. Manfred Owe; Guido D'Urso (2005). Remote Sensing for Agriculture, Ecosystems, and Hydrology VII : Proceedings of SPIE Volume: 5976
3. Quantitative Remote Sensing of Land Surfaces (2005) By Shunlin Liang ), Willey Publishers
4. Applications of remote sensing in agriculture (1990) edited by M.D. Steven, J.A. Clark, Publisher – Butterworth, London
5. Ustin, S. (2001). Manual of Remote Sensing, Volume 4, Remote Sensing for Natural Resource Management and Environmental Monitoring, 3rd Edition, Willey Publishing
6. Precision Agriculture in the 21st Century - Geospatial and Information Technologies in Crop Management (1997) National Academy Press, Washington D. C.

7. Holmes M.G., 1990, Application radar in Agriculture, Remote sensing applications to agriculture, ed. M.D. Steven and J.A. Clark, Butterworths, p. 307.
8. Encyclopedia of Soil Science - Second edition (2010) Edited by Rattan Lal, Publisher – Taylor & Francis
9. Huete Alfredo (2004). Remote Sensing of Soils and Soil Processes. In: Susan Ustin (ed.) Remote Sensing for Natural Resource Management and Environmental Monitoring: Manual of Remote Sensing, Vol. 4, John Wiley & Sons, Inc.

# **Post graduate Diploma in RS and GIS Application**

**PGDRS – 202**

**RS and GIS Application in Water and Forest Resources**

**Credits: 4**

## **Unit I: Assessment of Water Resources**

Hydrological cycle and its components; concept of the watershed; water resources of India: Classification of wetlands; Spectral reflectance of water, surface water mapping through water index; water quality parameters and mapping, Spectral reflectance of snow, snow cover mapping through snow index

## **Unit II: Spatial Modelling of Water Resources**

Rainfall-runoff modelling: Hydrograph analysis, unit hydrograph, base flow separation, river flow measurement and flow routing; snowmelt runoff modelling; watershed prioritization; monitoring and management of waterlogged areas; Groundwater system, groundwater targeting, groundwater flow equations groundwater potential zones

## **Unit III: Forest Mapping and Monitoring**

Geographical distribution, vegetation types, extent and status in the World and India. Forest cover classification scheme (FAO, NRSC and FSI); Environmental policy and strategy, Environmental impact assessment and monitoring; Spectral reflectance properties of vegetation; Forest information extract from Aerial Photograph and imagery; Forest mapping through on-screen digitization and vegetation indices; Hyperspectral remote sensing for vegetation species determination; LiDAR data for tree height and Forest Canopy Density mapping

## **Unit IV: Inventory and Spatial modelling**

Forest ecosystems principles and concepts; Sampling theory and design for data collection, forest Growing stock, carbon and biomass estimation, Statistical data analysis. Interpretation of statistical results; Geostatistical analysis and modelling; Landscape Characterization and habitat suitability in forest.

### **Suggested Readings:**

1. alponete, M., Bruzzone, L., Vescovo, L. and Gianelle, D. 2009. The role of spectral resolution and classifier complexity in the analysis of hyperspectral images of forest areas. *Remote Sensing of Environment*, 113(11): 2345-2355

2. Bala Krishnan P. "Issues in Water Resources Development and Management & the role of Remote Sensing", Technical Report ISRO-NNRMS-TR-67-86, NNRMS, ISRS, India.
3. Beven, K.J. (2001). "Rainfall-runoff modelling: the primer". John Wiley and Sons, UK.
4. Chow V.T., Maidment D.R. and Mays L.W. (1988). "Applied Hydrology", McGraw-Hill, New York.
5. Cochran, W.G. 1977. Sampling Techniques. John Wiley & Sons, New York.
6. Congalton, R.G. 1991. A review of assessing the accuracy of classifications of remotely sensed data. Remote Sensing of the Environment, 37: 35- 46
7. Constantin, Z. and Pardolos, P.M. 1998. Managing in Uncertainty: Theory and Practice. Kluwer Academic Publisher, Boston.
8. Engman E.T. and Gurney R.J (1991). "Remote sensing in Hydrology", Chapman & Hall, London.
9. Gregory K.J., Walling D.E. (1973). "Drainage Basin Form and Process: A Geomorphological approach", Edward Arnold Ltd., U.K.
10. Hunt, E.R., Gillham, J.H., Daughtry, C.S.T. 2010. Improving potential geographic distribution models for invasive plants by remote sensing. Rangeland Ecology and Management, 63(5): 505-513.
11. Isobel W. H. (2009). "Integrated watershed management: principles and practice" John Wiley and Sons, U.K.
12. Jones T.G., Coops N.C. and Sharma, T. 2010. Assessing the utility of airborne hyperspectral and LiDAR data for species distribution mapping in the coastal Pacific Northwest, Canada. Remote Sensing of Environment, 114(12): 2841-2852.
13. Levizzani V., Bauer P. and Joseph Turk F. (eds.) (2007). "Measuring Precipitation from space EURAINSAT and the Future", Published by Springer, P.O. Box 17,3300, AA Dordrecht, The Netherlands.
14. Maidment D.R. (ed.) (1993). "Handbook of Hydrology", McGraw-Hill.
15. Maidment D.R., (2002). "Arc Hydro: GIS for Water Resources", ESRI Press, Redlands CA, USA.
16. Michaelides S. (ed.) (2008). "Precipitation: Advances in Measurement, Estimation and Prediction". Published by Springer-Verlag, Berlin, Heidelberg.

## Online Sources

1. <http://trmm.gsfc.nasa.gov/>
2. <http://www.india-wris.nrsc.gov.in/>
3. <http://www.chikyu.ac.jp/precip/>
4. <http://www.imd.gov.in/>
5. <http://clic.npolar.no/>
6. <http://www.cwc.nic.in/>
7. <http://ladsweb.nascom.nasa.gov/data/>
8. <http://www.itc.nl/WRS>
9. <http://www.iirs-nrsc.gov.in/index.php>
10. [http://www.ats.ucla.edu/stat/examples/msm\\_goldstein/default.htm](http://www.ats.ucla.edu/stat/examples/msm_goldstein/default.htm)
11. <http://www.autonlab.org/tutorials/>

# **Post graduate Diploma in RS and GIS Application**

## **PGDRS-203**

### **RS & GIS Application in Urban Environment**

#### **UNIT I**

Concept of Urbanization and Environment, Challenges and recent trends, Land use land cover mapping and classification system, Urban Sprawl, slums and squatter settlements, Suitability analysis for urban development.

#### **UNIT II**

Role of Geoinformatics in population estimation and updating, Land information system: revenue and tax mapping, Hot spots and Cluster Analysis for Crime mapping, Traffic and parking studies, Accident analysis.

#### **UNIT III**

Role of Geoinformatics to monitor the changes in local weather conditions, Air and Noise pollution, Urban Green spaces, urban heat island due to urbanization.

#### **Unit IV**

Urban Issues and Hazards: Monitoring of urban environment; urban facility/utilities mapping, Disease Mapping: Spatio-temporal visualization of disease pattern and trends, Solid waste management, urban floods.

#### **Suggested Readings:**

1. Ellen M. van Bueren, Hein van Bohemen, Laure Itard, Henk Visscher. Sustainable Urban Environments: An Ecosystem Approach.
2. George Z. Xian. Remote Sensing Applications for the Urban Environment.
3. Xiaojun Yang. Urban Remote Sensing: Monitoring, Synthesis and Modeling in the Urban Environment.
4. Ian Douglas. The Urban Environment.
5. Jean-Paul Donnay, Michael John Barnsley. Remote sensing and urban analysis.
6. Qihao Weng, Dale A. Quattrochi. Urban Remote Sensing.

# **Post graduate Diploma in RS and GIS Application**

**PGDRS- 204**

**RS and GIS Application in Climate Studies**

**Credits: 4**

## **Unit I: Introduction to Atmosphere and Climate**

Energy balance; atmospheric circulation and climate. radiation and heat budget, Basic concepts of tropical climates: Tropical Circulations, Scale Analysis of Large-Scale Tropical Motions, Equatorial Wave Theory etc. El Nino Southern Oscillation and Indian Monsoon

## **Unit II: Principles of Atmospheric Remote Sensing**

Interaction of electromagnetic radiation (EMR) with atmosphere: absorption by atmospheric gases and emission; scattering: Mie and Rayleigh scatterings; EMR interaction with cloud; reflection from the Earth's surface

## **Unit III: Meteorological satellite and Data Collection**

Characteristics instrumentation of Polar orbiting meteorological satellite: advanced very high-resolution radiometer, high resolution infrared radiation sounder, microwave sounding unit, stratospheric sounding units, solar backscatter ultraviolet radiometer, earth radiation budget instrument etc. Characteristics instrumentation of Geostationary meteorological satellite: GMS, Meteosat, Insat, GOES; other satellite; Meteorological measurement using interferometer, limb scanner, microwave imager etc.

## **Unit IV: Application and Modelling**

Trace gases retrieval methods: Retrieval of ozone and other gases; Cloud and water vapour retrieval through remote sensing data; Retrieval of aerosol optical depth, remote sensing and rainfall estimation and prediction; Solar constant and top of the atmosphere radiation estimation; Land surface temperature and sea surface temperature estimation; micro-climate study

## **Suggested Readings:**

1. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley
2. Campbell John B.: Introduction to Remote Sensing Taylor & Francis
3. Floyd F. Sabins : Remote Sensing and Principles and Image Interpretation
4. Stanley Q. Kidder and Thomas H: Satellite Meteorology an Introduction, 1995. VonderHaar, Academic Press.

5. Geoffrey K .Vallis : Atmospheric and ocean fluid dynamics, 2006, Cambridge university Press.
6. James R. Holton : An introduction to dynamic meteorology,2004, Elsevier Academic Press.
7. C.N. Hewitt and Andrea V. Jackson: Handbook of atmospheric science, 2003. Blackwell publishing.



## **205- RS & GIS Application in Soil, Agriculture, Water and Forest (Practical)**

### **UNIT I: Soil Resources Analysis**

Soil Moisture Assessment using Remote Sensing; Soil Erosion modeling: Sediment Yield Model

### **UNIT II: Agriculture land and crop mapping and Analysis**

Site suitability analysis for agricultural land and crop acreage estimation.

### **UNIT III: Water Resources Analysis**

Watershed delineation from DEM; Surface water body mapping through NDWI model.

### **UNIT IV: Forest Resource Analysis**

Digital image interpretation of Vegetation & Spectral vegetation indices; Leaf Area Index; Forest Biomass estimation.

### **Suggested Readings:**

1. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley
2. Campbell John B.: Introduction to Remote Sensing Taylor & Francis
3. Bala Krishnan P. "Issues in Water Resources Development and Management & the role of Remote Sensing", Technical Report ISRO-NNRMS-TR-67-86, NNRMS, ISRS, India.
4. Beven, K.J. (2001). "Rainfall-runoff modelling: the primer". John Wiley and Sons, UK.
5. Chow V.T., Maidment D.R. and Mays L.W. (1988). "Applied Hydrology", McGraw-Hill, New York.

## **206-RS & GIS Application in Urban Environment and Climate (Practical)**

### **UNIT I: Geospatial data for Urban and Climate Studies**

Data Products Weather map; thematic maps of weather elements; IMD data products; Satellite data products: Landsat; MODIS; NOAA, INSAT series; Rainfall data analysis

## **UNIT II: Suitability Analysis**

Site selection suitability for urban development.

## **UNIT III: Urban Area Mapping**

Urban sprawl mapping and Normalized Differentiate Built up Index Model using Remote Sensing

## **UNIT IV: Geospatial models and Applications**

Temperature models: Land surface temperature, Model validation through in situ data, Urban heat island

## **References**

1. Jean-Paul Donnay, Michael John Barnsley. Remote sensing and urban analysis.
2. Qihao Weng, Dale A. Quattrochi. Urban Remote Sensing.
3. Basudeb Bhatta. Analysis of Urban Growth and Sprawl from Remote Sensing Data.
4. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition John Wiley.
5. Campbell John B.: Introduction to Remote Sensing Taylor & Francis.
6. [Jiansheng Yang](#) (2009). Estimating Land Surface Temperature From Space: A Remote Sensing Perspective.
7. [Ayse Pamuk](#) (2006) Mapping Global Cities: GIS Methods in Urban Analysis.