

**DEPARTMENT OF GEOGRAPHY & APPLIED GEOGRAPHY
UNIVERSITY OF NORTH BENGAL**

Accredited by NAAC with Grade A

**CHOICE BASED CREDIT SYSTEM SYLLABUS
M.A./M. Sc in Geography & Applied Geography**

REVISED



ENLIGHTENMENT TO PERFECTION

DURATION: TWO YEARS

TOTAL MARKS: 1600

Total Credits: 64

- | | | | |
|-------|------|--------------------|-------|
| (i) | Core | : 36 Credits/Marks | : 900 |
| (ii) | DSE | : 12 Credits/Marks | : 300 |
| (iii) | GE | : 08 Credits/Marks | : 200 |
| (iv) | AEC | : 04 Credits/Marks | : 100 |
| (v) | SEC | : 04 Credits/Marks | : 100 |

EACH SEMESTER:

Total Marks : 400

Total Credits: 16

Instruction Hour per Week: 30

2022

REVISED CBCS SYLLABUS
M.A./ M. Sc. FIRST SEMESTER
Department of Geography & Applied Geography
University of North Bengal

Course Type	Paper Type	Course Name	Duration of Examination (Hours)	CE	Marks	Credits	Instruction hour per week
Core –1	Theory	Geomorphology and Climatology: 75	3	Tutorial: 20 # Attendance: 05	100	4	6+1
Core – 2	Theory	Economic and Settlement Geography: 75	3	Tutorial: 20 # Attendance: 05	100	4	6+1
Core – 3	Practical	General Practical: 75	4	Assignment: 20 # Attendance: 05	100	4	8
DSE –1*	Theory	Soil and Biogeography OR Social and Political Geography: 42	2	Viva Voce: 08	50	2	4
AEC**	-	-	-	-	50	2	4
Total Marks and Credits in First Semester					400	16	30

* Either A or B to be chosen by the students

** To be decided by the Committee constituted centrally.

5 Marks will be for Class Attendance.

Mark allotted for % of class attended by the student	
% of class attended by the student	Mark Allotted
75-76	1
76-78	2
78-85	3
85-95	4
95 above	5

REVISED CBCS SYLLABUS
M.A./ M. Sc. SECOND SEMESTER
Department of Geography & Applied Geography
University of North Bengal

Course Type	Paper Type	Course Name	Duration of Examination (Hours)	CE	Marks	Credits	Instruction hour per week
Core – 1	Theory	Applied Physical (Environmental Pollution and Hazard): 75	3	Dissertation/ Seminar: 20 # Attendance: 05	100	4	6+1
Core – 2	Theory	Applied Cultural (Rural Development, Tourism and Urban Planning): 75	3	Dissertation/ Seminar: 20 # Attendance: 05	100	4	6+1
Core – 3	Practical	General Practical: 75	4	Assignment: 20 # Attendance: 05	100	4	8
DSE – 1*	Theory	Techniques of Socio-Economic Survey Part-A: Urban Area OR Part-B: Rural Area: 42	2	Assignment: 08	50	2	4
SEC**	-	-	-	-	50	2	4
Total Marks and Credits in Second Semester					400	16	30

* Either A or B to be chosen by the students

** To be decided by the centrally constituted Committee.

5 Marks will be for Class Attendance.

Marks allotted for % of class attended by the students	
% of class attended by the student	Marks Allotted
75 – 76	1
76 – 78	2
78 – 85	3
85 – 95	4
Above 95	5

REVISED CBCS SYLLABUS
M.A./ M. Sc. THIRD SEMESTER
Department of Geography & Applied Geography
University of North Bengal

Course Type	Paper Type	Course Name	Duration of Examination (Hours)	CE	Marks	Credits	Instruction hour per week
Core – 1	Theory	Geography of India and Geographical Thoughts: 75	3	Tutorial: 20 # Attendance: 5	100	4	6+1
DSE – 1 DSE – 2 DSE – 3	Theory	***Any three out of ten: 42	2	Tutorial: 08	50 x 3 = 150	2 x 3 = 6	4 x 3 = 12
AEC – 1**	-	-	-	-	50	2	3
GE – 1*	Practical	Air Photo, RS & GIS and Inferential Statistics OR Instruments and Statistical Models: 75	4	Assignment: 20 # Attendance: 05	100	4	8
Total Marks and Credits in Third Semester					400	16	30

* Either A or B to be chosen by the students.

** To be decided by the centrally constituted Committee.

***The Departmental Committee will offer at least 6 out of the following 10 Courses to the students of PG 3rd Semester and the student will choose any three courses:

- | | |
|---------------------------|-------------------------|
| 1. Agricultural Geography | 6. Geography of Tourism |
| 2. Applied Hydrology | 7. Industrial Geography |
| 3. Applied Pedology | 8. Population Geography |
| 4. Cartography | 9. Transport Geography |
| 5. Fluvial Geomorphology | 10. Urban Geography |

5 Marks will be for Class Attendance

Marks allotted for % of class attended by the students	
% of class attended by the student	Marks Allotted
75 – 76	1
76 – 78	2
78 – 85	3
85 – 95	4
Above 95	5

REVISED CBCS SYLLABUS
M.A./ M. Sc. FOURTH SEMESTER
Department of Geography & Applied Geography
University of North Bengal

Course Type	Paper Type	Course Name	Duration of Examination (Hours)	CE	Marks	Credits	Instruction hour per week
Core – 1	Theory	Oceanography and Applied Geomorphology: 75	3	Dissertation: 20 # Attendance: 05	100	4	6+1
Core – 2	Theory	Population Geography and Regional Planning & Development: 75	3	Dissertation: 20 # Attendance: 05	100	4	6+1
DSE – 1*	Practical	Part-A: In relation to DSE-1, DSE-2 and DSE-3 of 3 rd Semester OR Part-B: In relation to DSE-1, DSE-2 and DSE-3 of 3 rd Semester: 42	2	Assignment: 08	50	2	4
SEC – 1**	-	-	-	-	50	2	4
GE – 1*	Practical	Digital Thematic Mapping OR Advanced Quantitative Techniques: 75	4	Assignment: 20 # Attendance: 05	100	4	8
Total Marks and Credits in Fourth Semester					400	16	30

* Either A or B to be chosen by the students

** To be decided by the centrally constituted committee.

5 Marks will be for Class Attendance.

Marks allotted for % of class attended by the students	
% of class attended by the student	Marks Allotted
75 – 76	1
76 – 78	2
78 – 85	3
85 – 95	4
Above 95	5

M.A./ M. Sc. FIRST SEMESTER

Total Marks: 400

Total Credits: 16

Course Name: GEOMORPHOLOGY AND CLIMATOLOGY

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the basic philosophy and approach to landform study, conceptual background of how landforms are developed by various processes. In climatology part, students will learn the mechanism of origin of Indian monsoon and the processes and impact of climate variability and climate change.*
- **Skill Gained:** *Gaining the skill for exploring the concerned features and processes.*
- **Competency Developed:** *Students will be able to cope up with continuous progress in geomorphology and to respond to the issue of climate variability and climate change in individual as well as societal level.*

COURSE CONTENTS:

Geomorphology

UNIT-I

Geomorphology and its branches; Concept of Threshold and Scale in Geomorphology, System approach in Geomorphology; Uniformity vs. Non-uniformity; Concept of Actualism, Non-actualism, Gradualism, Catastrophism, Steadystate and Directionalism.

UNIT-II

Geomorphic Process; Theories of Landform development: J.T. Hack, M. Morisawa and A. Schumm; Theories of slope evolution: Parallel retreat and slope replacement; Rock characteristics and its influence on the evolution of landforms: Case studies on granite, basalt and limestone.

UNIT-III

Channel network development, Open channel flow and concept of river hydraulics; Mechanisms of fluvial erosion; Profile of equilibrium, Channel pattern; Fluvial features: Floodplain morphology, Terraces, Alluvial fans and Deltas.

Climatology:

UNIT-I

Surface and upper weather phenomena, Jet Stream: Formation, types and characteristics; Acid rain: Causes and impact; Heat and cold wave; Drought, Cloudburst and Glacial Lake Outburst Flood (GLOF).

UNIT-II

Theories of origin of Indian Monsoon: Thermal concept (Sir Edmund Halley, 1986), Air mass Theory, Jet stream theory and Koteswaram's view; El Nino, La Nina, Madden –Julian Oscillation and their impact on Indian Monsoon.

UNIT-III

Concept of climate variability and climate change; evidences, possible causes and impact of climate change; Salient findings of IPCC Assessment Report; Objectives of Paris Agreement, 2015.

Suggested Readings:

Geomorphology:

1. Bradshaw, M.J., Abbott, A.J. and Gels Thorpe, A.P., 1978: The Earth's Changing surface, Hodder & Stoughton, London, UK, 1st Edition.
2. Butzer, Karl W, 1976: Geomorphology from the Earth, Harper and Row, Publishers, New York, USA, 1st Edition.
3. Chorley, Richard J., Schumm, Stanley, A. and Sugden, David E., 1985: Geomorphology, Methuen & Company, New York, USA, 1st Edition.
4. Derbyshire, E., Gregory, K. J. and Hails J. R., 1979: Geomorphological Processes: Studies in Physical Geography, Butterworths, London, UK, 1st Edition.
5. Gerrard, A. J., 1988: Rocks and Landforms, Unwin Hayman, London, UK, 1st Edition.
6. Huggett, Richard. J, 2007: Fundamentals of Geomorphology. Second Edition
7. Rice, R. J., 1977: Fundamentals of Geomorphology, Longman Group Ltd., London, UK, 1st Edition.
8. Strahler, Arthur N., 1963: The Earth Sciences, Harper's Geosciences Series, Harper & Row, Publishers, New York, USA, 1st Edition.

Climatology:

1. Barry, R. G. and Chorley, R. G., Atmosphere, Weather and Climate, Methuen & Co., London, 1968.
2. Burroughs, William James (2001): Climate Change/A Multidisciplinary Approach, Cambridge University Press.
3. Flohn, H. (Ed.), General Climatology, Elsevier, Amsterdam, 1969.
4. I.M.D., Monsoons of the World, I.M.D., New Delhi, 1960.
5. Riehl, H., Jet Streams of the Atmosphere, Colorado University, Colorado, 1969.
6. Saha, P. K., El-Nino – La Nina/ENSO and its Impact on Global Climate in 'Contemporary Dimensions in Geography', University of Burdwan, Burdwan, 2000.
7. Zbigniew W. Kundzewicz and Alice Robson (Edited, 2000): DETECTING TREND AND OTHER CHANGES IN HYDROLOGICAL DATA, WCDMP – 45, WMO/TD-No. 1013, (Geneva, May 2000)

Course Name: ECONOMIC AND SETTLEMENT GEOGRAPHY

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Participants will conceptualize how economic activities and the human settlements are organized over space depending upon the spatial variations in geographical elements.*
- **Skill Gained:** *Students will gain the expertise that will lead to proper interpretation to these aspects.*
- **Competency Developed:** *Students will be able to explore the issues related to spatial organization of economic activities and human settlements.*

COURSE CONTENTS:

Economic Geography

UNIT-I

Factors affecting spatial organization of economic activities and their changing trend; Types of economic systems and classification of world into various economies; Concept, types and processes of diffusion of innovations, Haggerstrand's Model of Diffusion.

UNIT-II

Agricultural Location Theory: Von Thunen's and Sinclair's Model; Selected agricultural concepts: Assessment of agricultural production: crop combination, crop diversification; Industrial Location Theories: Tord Paladar, E.M. Hoover, A. Pred, D.M Smith and Rawstron; Emerging industries with special reference to Information and Communication Technology (ICT) in India.

UNIT-III

Measures and indices of connectivity and accessibility, Spatial flow models: Taaffe Morrill and Gould (TMG); Ullman, Vance and M. E. Hurst Model; Gravity model (Zipf); Typology of market; Role of Market in economic development; Concept of e-Commerce.

Settlement Geography

UNIT-I

Theories of origin of towns: Gordon Childe, Henri Pirenne, Lewis Mumford, Griffith Taylor; Characteristics and processes of urbanization in developed and developing countries; Contemporary problems of rural settlements: rural urban migration, land use changes, land acquisition and transactions.

UNIT-II

Internal structure of the city: Models of Urban Land Use (Burgess, Harris and Ullman and Hoyt), Concepts of Megacities, Global Cities and Edge Cities. Urban Forms: peri-urban areas, rural-urban fringe, suburban, ring and satellite towns.

UNIT-III

Urban Systems: Law of the Primate City, Rank Size Rule; Central Place Theories: Christaller and Losch; Urban Social Area Analysis; Manifestation of poverty in the city: slums, informal sector growth, crime and social inclusion.

Suggested Readings:

Economic Geography:

1. Bengston, N. A. & Royen M. V.: Fundamentals of Economic Geography,
2. Berry Conkling & Ray: The Geography of Economic Systems, Prentice Hall.
3. Llyod P. L. & Dicken P.: Location in Space: A theoretical approach to economic Geography.
4. Losch, A., The Economics of Location, University Press, Yale, New Haven, 1954.
5. Singh J. and Dhillion. S. S.: Agriculture Geography, McGraw Hill, India, New Delhi 1984.
6. Smith, D. E.: Industrial Location - An Economic Geographical Analysis.
7. Smith, D. M.: Industrial Location, John Wiley & Sons, N.Y., 1971.
8. Smith, J. C. and Phillip, M. O.: Industrial and Commercial Geography, Henry
9. Symons. L.: Agricultural Geography, Bell and Sons, London, 1972.
10. Wheeler, J. O., et al: Economic geography, John Wiley, New York, 1995.

Settlement Geography:

1. Hudson, F.S. 1970: Geography of Settlements, Macdonald and Evans Ltd., Plymouth Husain, Majid, 1994, Human Geography, Rawat Publications
2. Johnston. R.J (2000): The Dictionary of Human Geography, Blackwell. UK
3. Kaplan, D and Wheeler, J (2008): Urban Geography, John Wiley
4. Knox, P. 1982: Urban Social Geography, Longman Scientific and Technical, Harlow.
5. Knox, P., Pinch, S., 2000, Urban Social Geography, Pearson Education
6. Kuppuswany, B., 1975, Population and Society in India, Popular Prakashan, Bombay
7. Mandal, R.B. (2000): Urban Geography: A Textbook, Concept Pub. Co., New Delhi.
8. Mandal, R.B. 1988: Systems of Rural Settlements in Developing Counties, Concept Pub. Co., New Delhi

Course Name: GENERAL PRACTICAL

Course Type: CORE

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Students will gain basic concept of handling text based and data-based software, methods of surveying and map projection. They will also learn the application of basic statistical tools in geography.*
- **Skill Gained:** *Acquiring the expertise in the concerned fields.*
- **Competency Developed:** *Participants will be able to do the quantitative analysis of geographical elements/processes and also be able to collect spatial information and plotting the same along with their documentation and presentation through electronic display.*

COURSE CONTENTS:

UNIT-I: Computer Applications in Geography (Marks:25)

- (i) **MS Word:** Formatting paragraph, its heading and sub-heading; Citation and referencing; Inserting caption to table and figure; Writing equation; Making table of contents, List of figures and List of tables; Section break and page numbering differently for different sections.
- (ii) **MS Excel Spreadsheet:** Omitting duplicate number and blank cells; Computing conditional average; Use of VLOOKUP and application of Pivot Table; Construction and interpretation of Dot Plot; Box and Whisker Plot, Lorenz curve, Scatter plot and adding trend line.
- (iii) **MS Power Point:** Inserting new slide, deleting slide, formatting text and its heading, animation to slide and text, preparing flow chart and displaying figure and plate, print layout of pptx.

UNIT-II: Surveying and Map Projection (Marks:25)

Surveying:

- (i) Contouring of an area with the help of Dumpy Level/Auto Level.
- (ii) Measurement of height of an object with the help of Theodolite with inaccessible base.
- (iii) Theodolite survey: Principles, traversing, computation of co-ordinates, area calculation.
- (iv) Theodolite traversing: Omitted measurements, Balancing of traverse (Bowditch and Transit).

Map Projection:

- (i) Gall's Stereographic Projection
- (ii) Mercator's Projection
- (iii) Mollweide's Projection
- (iv) Interrupted Sinusoidal Projection
- (v) Simple Conical Projection with two Standard Parallels
- (vi) Conical Equal Area Projection with one Standard Parallel
- (vii) Gnomonic Projection (Cubic Development)
- (viii) UTM Projection

UNIT-III: Basic Statistics (Marks:25)

- (i) Measures of Dispersion: Mean deviation, Quartile Deviation and Standard deviation.
- (ii) Concept and application of Moments, Skewness and Kurtosis.
- (iii) Karl Pearson's Coefficient of Correlation and Spearman's Rank Correlation Coefficient.
- (iv) Bi-variate Regression, t-test and Chi Square Test.

Suggested Readings:

1. Ebdon, David, 1983: Statistics in Geography: A Practical Approach, Basil Blackwell Publisher, Oxford, England, 1983.
2. Frank, Harry & Steven C. Althoen, 1994: Statistics: Concepts and Applications, Cambridge University Press, Cambridge, UK, Cambridge low price edition, 1997.
3. Hinks, A. R.: Map Projections, Cambridge University Press, Cambridge, UK, 1st Edition, 1921.
4. Kellaway, George P.: Map Projections, Methuen & Co. Ltd., London, 2nd Edition, 1949.
5. Rabinson, Arthur H., Morison, Joel L., Muehrcke, Philip C., Kimerling, A. Jon and Guptill, Stephen C.: Elements of Cartography, John Wiley & Sons, Inc., N.Y., 6th Edition, 1995.
6. Raisz, Erwin.: General Cartography, McGraw Hill Book Co., New York, 1938.
7. Roy, P.: An Analytical Study of Map Projections, Applied and Mathematical Geographic Studies, Calcutta, 1st Edition, 1988.
8. Sarkar, Ashis: Practical Geography – A Systematic Approach, Orient Longman, Calcutta, 1st Edition, 1991.

Course Name: SOIL AND BIO-GEOGRAPHY**Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)****Paper Type: THEORY****Paper Code:****Marks: 42****Exam Duration: 2 hours****Course Outcomes:**

- **Knowledge Gained:** *Knowledge about soils in terms of their properties, erosional characteristics and nature of biogeographical studies with incorporation of plants distribution as a part of ecosystem and also essence of biodiversity.*
- **Skill Gained:** *Gaining expertise in making logical interpretation to diversified ecological environment.*
- **Competency Developed:** *Building ability to explore issue of the ecosphere with a holistic approach.*

COURSE CONTENTS:**UNIT-I**

Soil composition; Physical and chemical properties of soil: Structure, texture, color, organic matter, soil water and soil reaction; Soil profile with reference to podzol, laterite and chernozem soil.

UNIT-II

Soil erosion: factors, types and impacts; Assessment of soil erosion (USLE Model); Methods of soil conservation and management.

UNIT-III

Development of Biogeography as a discipline; Raunkiaer's classification of plants; Distribution of plants: Liebig's Law of the Minimums, Law of Limiting Factors and Law of Tolerance; Ecosystems: forest, grassland, desert and marine.

UNIT-IV

Biodiversity: concept, types, gradients, depletion, restoration and conservation in equatorial and humid tropics; Human ecology: Concept, principles, traditions and recent trends; Environmental ethics; Deep and Shallow Ecology.

Suggested Readings:

Soil Geography:

1. Brady, Nyle C., 2001: The Nature and Properties of Soils, Prentice-Hall of India Private Ltd., New Delhi, India, 10th Edition.
2. Foth, Henry D., 1984: Fundamentals of Soil Science, John Wiley & Sons, Inc., New York, USA, 7th Edition.
3. Gerrard, John, 2000: Fundamentals of Soils, Routledge Fundamentals of Physical Geography Series, Routledge, London, UK, 1st Edition.
4. Joffe, Jacob S., 1953: The ABC of Soils, Oxford Book Company, New Delhi, 2nd Edition, 1st Indian Edition, 1965.
5. Sehgal, J. 1996; Pedology: concepts & applications, Kalyani Publishers.
6. Townsend, W.N., 1973: An introduction to the scientific study of Soils, Edward Arnold (Publishers) Ltd., London, UK, 1st Edition.

Biogeography:

1. Brown, James H. and Gibson, Arthur C., 1983: Biogeography, The C.V. Mosby Co., St. Louis, USA.
2. Chapman, J. L. and Reiss, M. J. 1999: Ecology: Principles and Applications, Cambridge Low-Price Edition, Delhi, 2nd Edition.
3. Gupta, R. K., Dabral, B. G., Homji, V. M. Meher and Puri, G. S., 2000: Forest Ecology; Environment, Forests and rainfall, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, Vol. 3.
4. Rao, R. R., 1994: Biodiversity in India; Floristic aspects, Doon Photographic Printers, Dehra Dun, India.
5. Robinson, H., 1972: Biogeography, ELBS, London, 1st Edition.
6. Strain, B. R. and Billings, W. D., (Ed.) 1974: Vegetation and Environment, Dr. W. Junk. B.V. Publishers, The Hague.
7. Tivy, Joy and O'Hare, Greg, 1981: Human impact on the Ecosystem; conceptual framework in Geography, Oliver & Boyd, Edinburgh.
8. Waring, Richard H. and Running, Steven W., 1998: Forest Ecosystems; analysis at multiple scales, Academic Press, London, 2nd Edition.

Course Name: SOCIAL AND POLITICAL GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge about society, social processes and polity, their spatial variation and basic philosophy of social and political geography.*
- **Skill Gained:** *Acquiring expertise in logical interpretation of the socio-political elements and processes.*
- **Competency Developed:** *Developing competency in settling the socio-political issues.*

COURSE CONTENTS:

UNIT-I

Development of Social Geography as a discipline; Concept of social structure and patterns; Social processes and social well-being; Concept of culture, cultural complexes, cultural heritage, cultural ecology, cultural hearth and cultural realm; Cultural Take off and socio-cultural transformation

UNIT-II

Environment and human health, diseases ecology, nutritional status (etiological conditions, classification and spatial and seasonal distributional patterns with special reference to India); Health care planning and policies in India.

UNIT-III

Trends and development in Political Geography; Geopolitical Issues: Border conflict, Sharing of water with special reference to Ganga; Concept of core and periphery, frontiers and boundaries, buffer zone and buffer state; Heartland and Rimland theories, Geography of Federalism.

UNIT-IV

Electoral reforms in India; Determinants of electoral behavior; Geopolitics of climate change; Geopolitics of world resources, Geo-politics of Indian Ocean, Regional organizations of cooperation (SAARC, ASEAN, OPEC, EU). Neo politics of World Natural Resources.

Suggested Readings:

Social Geography:

1. Ahmad, A. (1999): Social Geography, Rawat Publications, Jaipur and New Delhi
2. Beteille, A. (1983): Equality and Inequality, Oxford University Press, New Delhi
3. Casino, V.J.D., Jr., (2009): Social Geography: A Critical Introduction, Wiley-Blackwell, Chichester
4. Coates, B. E. et. al. (1977): Geography and Inequality, Oxford University Press, London
5. Harmondorf (1989): Tribes of India: The Struggle for Survival, Oxford University Press, Delhi
6. Harvey, D. (1973): Social Justice and the City, Arnold, London
7. Jones, E. (ed.) (1975): Readings in Social Geography, Oxford University Press, London
8. Knoy, P. L. (1988): Social Well-being – A Spatial Perspective, Oxford University Press, London
9. Sharma, K.L. (1980): Essays on Social Stratification, Rawat Publications, Jaipur and New Delhi
10. Thapar, R (1977): Tribe, Caste and Religion in India, The Macmillan Company of Indian Limited, Meerut.

Political Geography:

1. Agnew, J., (2002): Making Political Geography, Arnold, London
2. Agnew, J., Mitchell, K. and Toal, G. (eds.) (2003): A Companion to Political Geography, Blackwell, Oxford
3. Cohen, S. (1964): Geography and Politics in a World Divided, Random House, New York
4. Cox, K.R., (2002): Political Geography: Territory, State and Society, Wiley-Blackwell, Chichester
5. Cox, K.R., Low, M. and Robinson, J. (2008): The Handbook of Political Geography, SAGE Pub. Ltd., London
6. Dikshit, R.D. (2000): Political Geography: A Contemporary Perspective, Prentice-Hall, New Delhi
7. Glassner, M., (1993): Political Geography, John Wiley & Sons, New York
8. Jones, M., (2004): An Introduction to Political Geography: Space, Place and Politics, Routledge, London

M.A./ M. Sc. SECOND SEMESTER

Total Marks: 400

Total Credits: 16

Course Name: APPLIED PHYSICAL (ENVIRONMENTAL POLLUTION AND HAZARD)

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge about different aspects of environmental pollution and the hazards.*
- **Skill Gained:** *Gaining the ability to explore different aspects of environmental pollution, flood and landslide hazards.*
- **Competency Developed:** *Developing the competency of applying the concepts for society development purpose.*

COURSE CONTENTS:

UNIT-I: Environmental Pollution

Environmental pollution: Air, water, land; Clean Ganga Mission; Environmental Management: Concepts, tools and Components; Environmental Impact Assessment (EIA); Environmental Policies in India.

UNIT-II: Floods

Physical events and Natural hazards; River floods: Geophysical processes and spatial characteristics; Coastal floods: Flood producing processes in coastal and estuarine areas; Flood frequency analysis, Flood estimation; Flood defense; Flood forecasting and warning, Mitigation and management of flood losses.

UNIT-III: Landslide

Forces producing slope instability; Concept of Safety factor; Processes and types of landslides: fall, flow and slide; Occurrences of landslide in Darjeeling-Sikkim Himalayas; Landslide susceptibility zone mapping; Stabilization of landslide and Landslide management.

Suggested Readings:

Environmental Pollution:

1. Alexander, D. (1993). Natural disasters. London: ULC Press Ltd.
2. Chapman, D. (1994). Natural hazard. Melbourne: Oxford University Press.
3. Collins, L.R., and Scheind, T.D. (2000). Disaster management and preparedness. UK:Taylor
4. Garg, M. R., Bansal, V. K., & Tiwana, N. S. (1995). Environmental Pollution and Protection. Deep & Deep Publication.
5. Gilpin, A. 1997: Environmental Impact Assessment: Culling Edge for the Twenty-first Century,
6. Goel, P.K. 1997: Water Pollution: Causes, Effects and Controls, New Age International (P) Ltd. Pub. New Delhi: 169
7. Goudie, A. 1986: The Human Impact on the Natural Environment, 2nd edition, Blackwell Pub. Co., London: 337p.
8. Smith, K. (1996). Environmental hazards: assessing risk and reducing disaster. London: Routledge.

Flood and Landslide:

1. Basu, S. R. & Sarkar, S. 1985; Some considerations on recent landslides at Tindharia and their control, Indian Journal of Power and River Valley Development, 188-194.
2. Dutta, K. K. 1966; Landslips in Darjeeling and neighboring hill slopes in June, 1950: Bul. GSI, B (15), 7- 30.
3. Nautiyal, S. P. 1966; On the stability of certain hill slopes in and around Darjeeling, W. B. Bul. G.S.I. B (15), 31-48.
4. Sarkar, S. 1999; Landslides in Darjeeling Himalaya, India; Transactions, Japanese Geomorphological Union, vol. 20-3, p.299-315.
5. Selby, M. J., 1993: Hill-slope materials and processes, Oxford University Press, Oxford, 2nd Edition.
6. Sharpe, C. F. S. 1960; Landslides and related phenomena, Pageant Book Inc.
7. Sinha, B. N., Verma, R. S. & Paul, D. K. 1975; Landslides in Darjeeling district (W.B.) and adjacent areas, Bul. G.S.I. B (36)1-45.
8. Zaruba, Q, & V. Mencl, 1969; Landslides and their control, Elsevier.

Course Name: APPLIED CULTURAL (RURAL DEVELOPMENT, TOURISM AND URBAN PLANNING)

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the conceptual background of rural development, urban planning and the basic principles based on which tourism industries develop.*
- **Skill Gained:** *Gaining the expertise in giving the logical interpretation to the concerned aspects.*
- **Competency Developed:** *Developing the ability to formulate the proper management plan in this context.*

COURSE CONTENTS:

UNIT-I: Rural Development

Definition and scope of Rural Development; Indicators of Rural Development; Historical perspective of Rural Development Programmes in India; Policies and strategies of Rural Development in India; Role of Panchayati Raj Institutions (PRIs) in India; MGNREGA

UNIT-II: Tourism

Historical development of Tourism; Definition and classification of tourists; Components of tourism and its characteristics; Travel motivating factors (McIntosh, Robinson, Lundberg); Maslow Hierarchy of Need Model; Positive and negative impacts of tourism: Socio-cultural, economic and environmental.

UNIT-III: Urban Planning

History of Urban planning and policy in India; Master Plan: Definition and case studies (Chandigarh and New Delhi); Planning Thoughts: Contribution of E. Howard, P. Geddes, Le Corbusier, C.A Doxiadis; Challenges of Urban planning; JNNURM; Urban environmental problems in India.

Suggested Readings:

Rural Development:

1. Gerald, Meir (2000): *Leading Issues in Economic Development*, Oxford University Press, New Delhi
2. Reddy, Venkata, K.: *Agriculture and Rural Development (A Gandhian Perspective)* (2001): Himalaya Publishing House.
3. Singh, Katar (2009): *Rural Development – Principles, Policies and Management*, Sage Publications. New Delhi
4. Sundaram, Satya, I. (2015): *Rural Development*, Himalaya Publishing.
5. Todaro, Michael P. (2015): *Economic Development*, Pearson Education.

Tourism

1. Burkart and Medlik *Tourism, Past, Present and Future* (1981) Heinemann, ELBS
2. Cooper, Fletcher, *Tourism, Principles and practices* (1993) Pitman
3. Mill and Morrison – *The Tourism system an Introductory Text* (1992) Prentice Hall
4. P. C. Sinha; *Tourism Geography*
5. P.S. Gill, *Dynamics of Tourism* (4 Vols.) Anmol Publication.
6. Prannath Seth; *Successful Tourism Management*

Urban Planning:

1. Buch, Mahesh. – *Planning the Indian City*, Vikas Publishing House Pvt. Ltd., New Delhi 1987.
2. *Director of Town Planning – Master Plan for Jajpur Road*, Directorate of Town Planning, Orissa 1975.
3. Hall, P.: *Urban and Regional Planning*, Routledge, London, 1992.
4. Hiraskar, G. K. – *Fundamentals of Town Planning*, Dhanpat Rai & Sons, Delhi, 1989.
5. Ramchandran, R., - *Urbanization & Urban Systems in India*, Oxford University Press, Delhi, 1992.
6. Venkatarayappa, K. N. – *Slums: A Study in Urban Problem*, Sterling Publishers (P) Ltd., New Delhi 1972.

Course Name: GENERAL PRACTICAL

Course Type: CORE

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about making theme-based maps, basic principles of interpreting the topographical maps and how the meteorological data are analyzed quantitatively.*
- **Skill Gained:** *Students will gain the expertise in logical interpretation to maps and climate variability.*
- **Competency Developed:** *Developing the competency in making map, exploring the spatial temporal variability of the geographical and climate elements and processes.*

COURSE CONTENTS:

UNIT-I: Topographical Maps (Marks:25)

Morphometric Analysis of Drainage Basin: Stream Ordering (Horton, King, Schiedaegar, Strahler); Basin Circularity and Elongation; Altimetric Curve, Hypsometric Curve; Ruggedness Index; Nearest Neighbour analysis of settlements; Quantitative analysis of relation between physical and cultural features.

UNIT-II: Meteorological Data Analysis (Marks:25)

Data acquisition and interpretation of Thermohygrograph and Pluviometric chart; Extraction of IMD Gridded rainfall and temperature data; Spatial interpolation of rainfall and temperature data using Inverse Distance Weighted (IDW) method; Decomposition of meteorological time series into trend, seasonality, cyclic and irregular components; Trend analysis of annual time series by Mann-Kendall test.

UNIT-III: Thematic Mapping (Marks:25)

Delineation of Crop combination regions, Crop diversification regions, Agricultural efficiency regions; Identification of co-efficient of geographical association; Location Quotient; Residual mapping; z-Score; Connectivity and accessibility indices; Exponential growth curve and population projection; Spatial distribution of population mapping: Choropleth mapping and centographic measures; Gravity Potential Mapping.

Suggested Readings:

1. Command of the Defence Council: Textbook of Topographic Surveying, Ministry of Defence, London, 4th Edition, 1965.
2. Cromley, Robert G., 1997: Digital Cartography, Prentice Hall, Englewood Cliffs, New Jersey, 1st Edition.
3. Ebdon, David: Statistics in Geography: A Practical Approach, Basil Blackwell Publisher, Oxford, England, 1983.
4. Hipel, A. W and McLeod, A.I (1994). Time series modelling of water resources and environmental systems. Elsevier.
5. Misra, R. P.: Fundamentals of Cartography, Concept Publishing Company, New Delhi, Revised & Enlarged Edition, 1989.

Course Name: TECHNIQUES OF SOCIO-ECONOMIC SURVEY

(PART – A: URBAN AREA OR PART – B: RURAL AREA)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the basic knowledge about designing the survey and post-survey data processing.*
- **Skill Gained:** *Gaining the expertise in handling the socio-economic data in rural/urban context.*
- **Competency Developed:** *At the end of the course participants will be able to organize the survey, selecting explanatory and response variables, designing master table and all kind of data pre-processing.*

COURSE CONTENTS:**

UNIT-I

Steps of Survey and Research: Defining Research Problem, Review of Literature, Framing Hypothesis, Research design/Sampling design, Data collection, Data tabulation, Data cleaning, Data processing, Data analysis, Interpretation & suggestion, Report writing.

UNIT-II

Data: Cross section, Time series and Panel data; Variables: IDV, DV, Control Variable, Mediating Variable and Moderating Variable; Scale: Nominal (Non-metric), Ordinal (Non-metric: Rating & Ranking), Interval (Metric and Likert) and Ratio (Metric).

UNIT-III

Census Vs. Sample Survey; Population Vs. Sample; Method of sampling, Sampling unit, Sampling frame, Sampling size; Questionnaire Vs. Schedule; Questions: Fact (MCQ & Binary, Open ended) and Opinion (Rating & Ranking); Target Respondent (case)Vs. Response (variable in the form of fact and opinion); Making a questionnaire keeping well defined objective; Designing Master table.

UNIT-IV

Deriving Random Sample from Sampling frame in MS Excel; Making survey (Data collection); Coding of Categorical data; Data entry in MS Excel Spreadsheet; Data cleaning: Check for missing frequency, Check for improper coding of nominal and ordinal data (typing error), Check for category merging, Check for outlier, Check for unengaged data and Checking reliability (Cronbach's alpha) of the respondent (for Likert scale).

****N.B.** Course contents of **PART – A** and **PART – B** are same but only difference between these two is that the contents will be discussed separately for urban and rural context in concerned papers.

Suggested Readings:

1. Hair Jr. J., Babbin B., Black W. & Anderson, R. (2019). Multivariate Data Analysis (8th Edition ed.). Delhi: Cengage.
2. Kothari, C. R. (2005). Research Methodology/Methods & Techniques (2nd Edition ed.). New Delhi: New Age International (P) Ltd. Publishers.
3. Pal, S. K. (1998). Statistics for Geoscientists/Techniques and Applications. New Delhi: Concept Publishing Company.
4. UNO (2005). Designing Household Survey Samples: Practical Guideline, Studies in Methods, Series F, No. 98. New York: Department of Economic and Social Affairs, Statistics Division, UNO.

M.A./M. Sc. THIRD SEMESTER

Total Marks: 400

Total Credits: 16

Course Name: GEOGRAPHY OF INDIA AND GEOGRAPHICAL THOUGHT

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about physical environment, resource base and economic activities and their spatial distributions in India and conceptualizing the nature and scope of geography as a discipline.*
- **Skill Gained:** *Acquiring the expertise in making regional differences within the territory of India and interpreting the history of development of geographical ideas and basic philosophy of the discipline.*
- **Competency Developed:** *Developing the competency in assessing the resource base of the county and also in coping up with further development of geography as the discipline.*

COURSE CONTENTS:

Geography of India

UNIT-I

Major Physiographic regions and their characteristics; Drainage system (Himalayan and Peninsular); Climate: seasonal weather characteristics, climatic divisions, natural disasters in India (earthquake, flood, drought, cyclone and tsunami).

UNIT-II

Regional variations in agricultural productivity; factors affecting Indian agriculture; Agro Climatic Zones; Green Revolution; Food Security.

UNIT-III

Types and distribution of resources: soil, vegetation, water and mineral resources; internal and external trade; Globalization and its impact on Indian economy.

Geographical Thoughts

UNIT-I

Generic concepts and principles in Geography, Regional science tradition, Positivist Spatial Science View Point and Systems Approach; Behavioural Geography; Humanistic Geography; Liberal and Radical Geography.

UNIT-II

Structuralism, Feminism, Modernism, Post-modernism; Dualism in geographic studies (Determinism Vs. Possibilism, Physical Vs. Human, Regional Vs. Systematic, Qualitative Vs. Quantitative and Ideographic Vs. Nomothetic).

UNIT-III

Philosophy, methodology and scientific explanation in Geography; Role of Laws, Theories and Models in Geography; Contemporary trends in Indian Geography (cartographic, thematic and methodological contributions)

Suggested Readings:

Geography of India

1. Deshpande, C. D., 1992: India: a Regional Interpretation ICSSR & Northern Book Centre.
2. Dreze, Jean & Amartya Sen (ed.) 1996: India Economic development and social opportunity: Oxford University Press, New Delhi.
3. Husain, M., 2009; Geography of India, Tata McGraw Hill Publishing Co. Ltd., New Delhi – 110008
4. Kundu, A. and Raza, Moonis, 1982: Indian Economy: The Regional Dimension. Spectrum Publishers, New Delhi.
5. Singh, R. L. (Ed.) 1971: India: A Regional Geography, National Geographical Society, India, Varanasi.
6. Spate, OHK & ATA Learmonth, 1967: India & Pakistan Methuen, London.

Geographical Thought

1. Abler, Ronald; Adams, John S. Gould, Peter, 1971: Spatial Organization: The Geographer's View of the World, Prentice Hall, N.J.
2. Amedeo, Douglas, 1971: An Introduction to Scientific Reasoning in Geography, John Wiley, U.S.A.
3. Hartshorne, R, 1959: Perspectives on Nature of Geography, Rand McNally & Co.
4. Harvey, David, 1969: Explanation in Geography, Reprint, 2007, Rawat Pub.
5. Husain, Majid; 1984: Evolution of Geographical Thought, Rawat Publications, Jaipur.
6. Johnston, R. J., 1983: Philosophy and Human Geography, Edward Arnold, London.
7. Johnston, R. J., 1988: The Future of Geography, Methuen, London.
8. Johnston, R. J.; 1945: Geography and geographers: Anglo American Human Geography.
9. Minshull, Roger, 1970: The Changing Nature of Geography, Hutchinson University Library, London.

Course Name: AGRICULTURAL GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge about agricultural system and related issues.*
- **Skill Gained:** *Gaining the skill of identifying the spatial variation in agriculture and related issues.*
- **Competency Developed:** *Developing the competency in exploring various aspects of agriculture in spatial frame.*

COURSE CONTENTS:

UNIT-I

Land capability & Land suitability classification (FAO & USDA Method); Land use and decision-making
Land Use planning.

UNIT-II

Concepts in Agricultural Geography; Agricultural typology; Agricultural systems of the world
(Whittlesey's classification)

UNIT-III

Contemporary issues in Indian agriculture: Agricultural storage, marketing, risk management, Problems, management and planning of Indian agriculture.

UNIT-IV

Measurement and determinants of agriculture; Regional perspective of Indian Agriculture; Regional variations in agricultural productivity.

Suggested Readings:

1. Brown, L.R.: The Changing World Food Prospects: The Nineties and Beyond, World Institute, Washington DC, 1990
2. Dyson, T.: Population and Food – Global Trends and Future Prospects, Routledge, London, 1997
3. Gigg, D.B.: The Agricultural System of the World, Cambridge University Press, New York, 1974
4. Grigg, D.: An introduction to Agricultural Geography, Hutchinson Publication, London
5. Mannion, A.M.: Agriculture and Environment Change, John Wile, London, 1995
6. Morgan, W.B.: Agriculture in the Third World – A Spatial Analysis, West Press, 1978
7. Sauer, Carl: Agricultural Origin and Dispersals American Geographical Society, New York, 1952
8. Symons, L.: Agricultural Geography, G. Bells, London, 1967

Course Name: APPLIED HYDROLOGY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about functioning of hydrological system and how it could be applied for solving various issues related to occurrence and circulation of water.*
- **Skill Gained:** *Gaining the skill of evaluating various components of hydrological system.*
- **Competency Developed:** *Developing competency of exploring how the understanding of hydrologic system could be applied for society development purpose.*

COURSE CONTENTS:

UNIT-I

Concept and Component of Hydrological Cycle; Measurement of rainfall and error of measurement of rainfall; IMD defined criteria for identifying the Year of Normal Rainfall, Deficit Rainfall (Dry Year) and Surplus Rainfall (Wet Year); Construction and Interpretation of Rainfall Mass Curve and Hyetograph; Rainfall Intensity and Duration Analysis; Dependable rainfall and Probable Max Rainfall.

UNIT-II

Initial Abstraction loss; Infiltration, Percolation and Seepage; Infiltration Capacity and Infiltration rate; Factor affecting infiltration capacity; Infiltration indices; Estimation of Evaporation by Penman-Monteith Equation; Factor affecting evaporation; Occurrence of Groundwater; Aquifer parameters: Porosity, Specific Yield, Specific retention, storage co-efficient, permeability and transmissivity; Darcy's law and Groundwater movement; Human interference in Groundwater and its impact on streamflow.

UNIT-III

Concept and Component of Runoff; Factor affecting runoff; Runoff generation processes; Partitioning the Total Rainfall into Abstraction Loss and Rainfall Excess (Graphical Method); Measurement of Streamflow and Rating Curve; Hydrograph and depicting Basin Lag, Time to Peak, Recession Time, Time of Concentration and Time Base; Method of Baseflow separation: Straight line method, fixed base method, variable slope method and Recursive Digital Filter (after Nathan and McMahon, 1990).

UNIT-IV

Unit Hydrograph Theory: Concept, assumption and limitation; Derivation of UH: from Single storm and complex Storm; Construction of SCS UH, Conversion of D Hour UH into 2D and 3D Hour UH; Concept and use of S-Curve; Application of UH for Computation of Direct Runoff Hydrograph; Flood routing: Reservoir routing (Puls Method) and Channel routing (Muskingum Method).

Suggested Readings:

1. Chow, V. T., Maidment, D. R., & Mays, L. W. (1998). Applied Hydrology. New Delhi, Sa Juan, Singapore, Sydney, Tokyo, Toronto: McGraw Hill, Inc.
2. Das, Ghanshyam (2009). Hydrology and Soil Conservation Engineering/including Watershed Management. PHI Learning Pvt. Ltd., Second Edition.
3. Hydrologic Engineering Centre. (March 2000). Hydrologic Modeling System/HEC-HMS, Technical Reference Manual. Davis, California: US Army Corps of Engineers.
4. Reddy, P. Jaya Rami (2011). A Text Book of Hydrology. University Science Press, Third Edition.
5. Wurbs, Ralph A. and James, Wesley P (2012). Water Resources Engineering. PHI Learning Pvt. Ltd., Second Edition.

Course Name: APPLIED PEDOLOGY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge of how various aspects of soils could be used for development of agriculture.*
- **Skill Gained:** *Gaining the expertise to detect the soil related problem which affect human society and agriculture.*
- **Competency Developed:** *Developing the competency to trace various issues of soils in connection human society.*

COURSE CONTENTS:

UNIT-I

Soil chemical and colloidal properties: Soil clays, Organic colloid (Humus), Cation and anion exchange, Soil buffering capacity; General classification of soil organism and soil microbial activities; Composition of soil organic matter and their beneficial & detrimental effects; Soil Taxonomy.

UNIT-II

Plant-soil-nutrient relationship; Mechanisms of nutrient uptake, Balanced nutrition through fertilizer (NPK); Detrimental effect of excess chemical fertilizer and irrigation on top soils; Crop suitability of soil; Soil and agricultural land use.

UNIT-III

Soil degradation and assessment methods; Impact of uses of modern heavy machineries on soil microbes; Reclamation of acidic, sodic, saline and alkaline soils; Importance of organic farming in maintaining the soil properties; Concept of soil health.

UNIT-IV

Soil and Hill slope: Concept and formation of catena, Catena in different climates, Catena and time, Catenary differentiation, soil changes within catena; Importance of catena, catena and process of erosion, Control of soil erosion in hill slope.

Suggested Readings:

1. Brady, Nyle C., 2001: The Nature and Properties of Soils, Prentice-Hall of India Private Ltd., New Delhi, India, 10th Edition.
2. Bresler, E., McNeal, B. L. and Carter, D. L., 1982: Saline and Sodic Soils: Principles & Dynamics – Modelling, Advanced Series in Agricultural Sciences 10, Springer-Verlag, Berlin, Germany, 1st Edition.
3. Duchaufour, Philippe, 1982: Pedology: Pedogenesis and Classification, George Allen & Unwin, Bouton, UK, 1st English Edition.
4. Joffe, Jacob S., 1953: The ABC of Soils, Oxford Book Company, New Delhi, 2nd Edition, 1st Indian Edition, 1965.
5. Morgan, R. P. C., 1995: Soil Erosion and Conservation, Longman Group Limited, Malaysia, 2nd Edition.
6. Thompson, Louis M. and Troeh, Frederick R., 1973: Soils and Soil Fertility, McGraw-Hill Book Company, New York, 3rd Edition.
7. USDA, 1968: Diagnosis and improvement of Saline and Alkaline Soils US Salinity Laboratory Staff, Ag. Hand book No. 60, USDA, Oxford & IBH Pub. Co., New Delhi, 1st Indian Edition.
8. USDA, 1975: Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys Soil Survey Staff, Soil Conservation Service, USDA, Agri. Handbook No. 436, US Govt. Printing Office, Washington D.C., USA, 1st Edition.

Course Name: CARTOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge of map projection and surveying using traditional cartographic methods and computer aided RS & GIS methods as well.*
- **Skill Gained:** *Building expertise for using such projection and survey techniques for academic purpose.*
- **Competency Developed:** *Developing competency of applying the cartographic techniques in academic investigation and research.*

COURSE CONTENTS:

UNIT-I: Spherical Trigonometry

Fundamental Principles of Spherical Triangle, Spherical Excess; Napier's Rule of circular parts; Application for determination of distance, azimuth and area on the earth's surface; Application of spherical trigonometry in polar zenithal cases of map projections – Gnomonic, Stereographic and Orthographic and calculation of distance, azimuth and scale variations.

UNIT-II: Map Projection

Conical Orthomorphic with two standard parallels; Conical Equal Area with two standard parallels; Cylindrical Equal Area Projection with two standard parallels; Cassini's Projection; Mercator's Projection; Mollweide's Projection (Normal case); Modified International Projection; Calculation of distance, azimuth and scale variations.

UNIT-III: Surveying with Theodolite and Levels

Determination of heights, distance and reduced levels by Tachometric surveying; Principles and methods of triangulation; Base line measurements and correction; satellite stations and reduction to center; Principles, corrections for curvature and refraction of Reciprocal levelling and determination of reduced level of a place.

UNIT-IV: Remote Sensing and GIS

Basic concept of visible, infrared, hyperspectral, microwave, LIDAR remote sensing; Digital Image Processing; Image Correction; Image Enhancement Techniques; Image classification; accuracy assessment; Basic concepts of GIS and its applications; Web GIS and its applications; Navigation system; DRONE and GEE.

Suggested Readings:

1. Bhatta, B. (2021). Remote sensing and GIS. Oxford University Press, USA.
2. Deetz, C. H. Adams O. S. (1934): Elements of Map projection with applications to map and chart construction, Special publication no. 68, US Govt. Printing Office, Washington DC.
3. Hanks, A. R. (1942): Map Projection, 2nd Edition 1942.
4. Higgings, A. L. (1944): Higher surveying, MacMillan and Co., 1944
5. Kellaway, G. P. (1974): Map Projections 1st Indian Edition, 1974.
6. Roy, P. (1988): An analytical Study of Map Projection, 1988.
7. Steer, J. A. – An introduction to the Study of Map Projection.
8. Tobler, W. R. –A classification of Map Projection.

Course Name: FLUVIAL GEOMORPHOLOGY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about hydraulics and fluvial processes.*
- **Skill Gained:** *Gaining the expertise in exploring the fluvial processes.*
- **Competency Developed:** *Developing the competency of using such knowledge for further academic research.*

COURSE CONTENTS:

UNIT-I

Fundamentals of river hydraulics; Forces acting within the channel; Stream flow measurement; Factors controlling flow velocity; Flow types; Fluid mechanics.

UNIT-II

Types of fluid; Stokes' Law of Settling Velocity; Newtonian laws and theorem of Bernoulli; Concept of Equilibrium; hydraulic geometry at a station; The continuum concept of channel pattern.

UNIT-III

The steady state and river regime; Dynamic equilibrium; Misfit streams; Laws of drainage composition and constant of channel maintenance; transport and deposition of sediment; Major changes of river courses and evolution of drainage pattern: Cases of Ganga-Bhagirathi-Hooghly, Damodar, Tista and Narmada.

UNIT-IV

River regime: Types and controlling factors; National Policy of Water Resource Development; National Water Grid and Inter basin water transfer.

Suggested Readings:

1. Basu, S. R., 1981: Some consideration on the process of sedimentation in Hooghly tidal channel, North Bengal University Review (Science & Technology), Vol.2.
2. Chorley, Richard J., (Ed.), 1969: Water, Earth and Man: A synthesis of Hydrology, Geomorphology and Socio-economic Geography, Methuen and Company Ltd., New York, USA.
3. Chow, Ven Te, (Editor-in-Chief), 1964: Handbook of Applied Hydrology: A Compendium of Water- resources Technology, McGraw-Hill Book Company, New York, USA.
4. Dury, G. H., (Ed.), 1970: Rivers and River Terraces, Macmillan, Edinburgh, UK.
5. Leopold, Luna B., Wolman, M. Gordon and Miller, John P., 1964: Fluvial Processes in Geomorphology, S. Chand and Company Ltd., New Delhi, 1st Indian Reprint.
6. Morisawa, Marie, 1968: Streams: their dynamics and morphology, Earth and Planetary Science Series, McGraw-Hill Book Company, New York, 1st Edition.
7. Morisawa, Marie, 1985: Rivers: Form and Process, Geomorphology Texts, Longman Group Ltd., New York, 1st Edition.
8. Rao, K. L., 1979: India's Water Wealth: Its Assessment, Uses and Projections, Orient Longman Limited, New Delhi, Revised Edition.

Course Name: GEOGRAPHY OF TOURISM

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining specific knowledge about basics of tourism industries from geographical perspective.*
- **Skill Gained:** *Gaining the expertise in tracing various aspects of such industries and evaluating its importance in economy as well as in recreation and leisure in social life.*
- **Competency Developed:** *Developing the competency to conduct exploration and research in this field.*

COURSE CONTENTS:

UNIT-I

Importance of leisure and recreation in social life; Geography and Tourism: Relationship between Tourism and Geography; Geographical Elements of Tourism: Rural Tourism, Village Tourism, Homestay Tourism; Socio-Economic significance of Tourism

UNIT-II

Tourism Infrastructure; Concept of Tourism infrastructure- travel and accommodation; Travel Agency and Tour Operators: Concept, Classification and Functions; Tourism and Hotel Industry; classification of hotels and its significance.

UNIT-III

Sustainable Tourism: Programmes and principles of Sustainability (Brundtland Convention, Kyoto Protocol, Agenda 21, guiding principles of Sustainable Tourism SDG); Dimensions of Sustainable Tourism; Environment, Economic and Social

UNIT-IV

An overview of geographical features of North Bengal; Situation, location, area and extent, History and favorable conditions for tourism growth; Major tourism destination in West Bengal: Kulik Bird Sanctuary in Raiganj, Darjeeling Himalayan Railway, Buxa Fort in Alipurduar, White water rafting in Teesta River, Cooch Behar Palace; Importance of Tourism on Socio-Economic Environment in North Bengal.

Suggested Readings:

1. Crouch, D. (ed.) (1999). *Leisure / tourism geographies: practices and geographical knowledge*, London, New York: Routledge.
2. De Kadt, E. (1979). *Tourism: Passport to Development. Perspectives on the social and cultural effects of tourism in developing countries.*
3. Hall, C. M. (2019). *The Geography of Tourism and Recreation* (Issue January 1999). <https://doi.org/10.4324/9780203796092>
4. Hall, C.M. and Page, S.J. (2002). *The Geography of Tourism and Recreation: Environment, Place and Space*, 2nd ed., London, New York: Routledge.
5. Hoogendoorn, G., & Rogerson, C. M. (2015). *Tourism geography in the global South: new South African perspectives.*
6. Mitchell, L. S., & Murphy, P. E. (1991). *Geography and tourism. Annals of Tourism Research*, 18(1), 57-70.
7. Williams, S., & Lew, A. A. (2014). *Tourism geography: Critical understandings of place, space and experience.* Rout ledge.

Course Name: INDUSTRIAL GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Understanding how geographical environment controls the locational pattern of industries over space.*
- **Skill Gained:** *Gaining the expertise in explore such spatial aspect of industries.*
- **Competency Developed:** *Developing the competency of assessing the problems and prospects of industrial activities and suggesting for sustained industrial growth.*

COURSE CONTENTS:

UNIT-I

Factors of industrial location, changing nature of urban industrial economy, Globalization and its impact on world industrial geography.

UNIT-II

Classification of Indian Industries, Industrial growth in pre-independence and post-independence period, Industrial policies of India during post-independence period.

UNIT-III

Industrial regions and Industrial complexes of India, their problems and prospects; Special Economic Zone and Export Processing Zone.

UNIT-IV

Distribution, recent trends, problems and prospects of Automobile industry, Petrochemical industry, Pharmaceutical and Nuclear Industry.

Suggested Readings:

1. Alexanderson, G. (1967): *Geography of Manufacturing*, Prentice Hall, New Jersey
2. Alexander, J.W. (1973): *Economic Geography*, Prentice Hall, New Jersey
3. Estall and Buchana (1969): *Industrial Activity and Economic Geography*
4. Losch, A. (1954): *The Economics of Location*, University Press, Yale, New Haven, 1954.
5. Meyer-Arendt, Klaus J., and Alan A. Lew. "Recreation, Tourism and Sport." In *Geography in America at the Dawn of the 21st Century*. Edited by Gary L. Gaile and Cort J. Willmott, 526–542. Oxford: Oxford University Press, 2003.
6. Miller, E.C. (1977): *Manufacturing- A study of industrial location*, Penn State, University Park, USA
7. Riley, R.C. (1973): *Industrial Geography*, Progress Publication, Moscow
8. Shaw, E.B. (1979): *An Anglo-America- A Regional Geography*
9. Smith, David, M, (1971): *Industrial location- An Economic Geographical Analysis*, John Wiley and Son, New York.
10. Watts, H.D. (1989): *Industrial Geography*, Longman Group Ltd. Hong Kong
11. Yusuf, S. and Nabeshima, K. (2010): *Changing the industrial geography in Asia*, World Bank, Washington, DC 204433

Course Name: POPULATION GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge of population distribution, growth and related aspects.*
- **Skill Gained:** *Gaining expertise to explore such aspects.*
- **Competency Developed:** *Building capacity to resolve population related academic problems.*

COURSE CONTENTS:

UNIT-I

Distribution, measures and patterns of world population; Trend and growth of world population (prehistoric to modern period); variation of trend of population growth in India, China, Japan and the USA, Laws and models of migration.

UNIT-II

Theories of Fertility: Social Capillarity Theory by Arsne Dumont, Theory of Multiphasic Demographic Response by Kingsley Davis, Theory of Relative Income by Richard Easterlin; Fertility transition in the developed and developing countries with special reference to India; Differentials of fertility by residence; education, religion and income in India.

UNIT-III

Infant mortality: Causes of decline in infant mortality in the developing countries with special reference to India; Life Tables; Differentials of mortality by residence; education and income in India.

UNIT-IV

Concept of population ageing; Economic composition: Measurement of working population; Determinants of work force; Population dividend; Occupational structure of population with special reference to India; Work participation rate in India

Suggested Readings:

1. Ararwala and Sinha, 1977, India's Population Problems, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
2. Cassen, R.H., 1978, India: Population, Economy and Society, English language Book society and Macmillan
3. Chandna R.C. 2005: Population Geography, Kalyani publishers
4. Clout, Hugh D., 1972, Rural Geography-An Introductory survey, Pergamon Press
5. Dickinson, R.E. 1968: City and Region: A Geographical Interpretation, Routledge and Kegam Paul Ltd. London.
6. Diddee, J., 1997: Indian Medium Towns, Rawat Publications, Jaipur. Earthscan Pub. Ltd. London.
7. Garnier, J. Beaujeu, 1966, Geography of Population, Commonwealth Printing Press Ltd.
8. Ghosh, S. 1998: Introduction to Settlement Geography, Orient Longman Ltd., Calcutta
9. Hardoy, J. E., Mittin, D. & Satterthwaite, D. 1992: Environmental Problems in the World Cities,
10. Hassan, M. Izhar, 2005, Population Geography, Rawat Publications
11. Rogers, Alisdair; Castree, Noel; Kitchin, Rob (19 September 2013). "Population geography". A Dictionary of Human Geography. Oxford University Press. ISBN 9780199599868.

Course Name: TRANSPORT GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge of transport network and its functioning and related policy issues.*
- **Skill Gained:** *Gaining expertise to determine the role of modern urban transport network in regional economy.*
- **Competency Developed:** *Developing the competency to resolve many such related problems of modern cities.*

COURSE CONTENTS:

UNIT-I

Concept and dimensions of transport geography; Structural analysis of transport network; Transport models: Allocation model, Energy and Emission model and Rimmer model.

UNIT-II

Transport economics; Concept of mass transport, BRTS, MRTS, intermodal and multimodal transportation, Modal split, Public and private transport system; Freight characteristics.

UNIT-III

Typology of highway and its role in regional (urban development) mobility with special emphasis to West Bengal; Energy consumption in transport; Issues associated with urban transport: accidents and environmental degradation.

UNIT-IV

National and international transport policy; Transport planning in India; East West and North South Corridor, Golden Quadrilateral, Freight corridor, Traffic generation; Zonal interchange of traffic; Mode and route assignments.

Suggested Readings:

1. Ashton, W.D., 1966. The Theory of Traffic Flow, Methuen, London
2. Berry, B.J.L et al., 1966. Essays on Commodity Flow and Spatial Structure of Indian Economy, Department of Geography, Chicago.
3. Haggett, P. and Chorley, R.J. 1969. Networks Analysis in Geography, London.
4. Hensher, D.A., Button, K.J., Haynes, K.E., Stopher, P.R. 2004, Handbook of Transport Geography and Spatial Systems, Emerald Group Publishing Limited
5. Hoyle, B.S and Knowles, R.D. 1992. Modern Transport Geography, Belhaven press
6. Kansky, K.J., 1963. Structure of Transportation Networks: Relationships between Network Geometry and Regional Characteristics, University of Chicago, Department of Geography, Research Paper, Chicago, 84.
7. Nagar, V.D. and Gautam S. 1964. Principles and Problems of Indian Transport, Kailash Pustak Sadan, Gwalior.
8. Raza, M. and Aggarwal, Y. 1986. Transport Geography of India, Concept Publishing Company, New Delhi.
9. Rodrigue, J., Comtois, C. and Slack, B. 2006. The Geography of Transport Systems, Routledge.
10. Saxena, H.M. 2005. Transport Geography, Rawat publications
11. Singh, Mohan. 2011. Transport Geography, ABD Publishers, New Delhi.
12. Taaffe, E. J., & Gauthier, H. L. (1973). Geography of Transportation. Prentice Hall, New York.
13. White, H. P. and Senior, M.L. 1983. Transportation Geography, Longman Inc. New York.

Course Name: URBAN GEOGRAPHY

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: THEORY

Paper Code:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining basic knowledge about structure, functioning, growth and related environmental and socio-economic problems of urban centers and also the issues of migration.*
- **Skill Gained:** *Gaining expertise in this field to explore such issues.*
- **Competency Developed:** *Developing competency to resolve many academic issues urban geography.*

COURSE CONTENTS:

UNIT-I

Physical structure and functions of the C.B.D; Contemporary urban morphological theories, Concept of sub-urbanization, Counter-urbanization and Re-urbanization,

UNIT-II

Slums and urban renewal; neighborhood unit planning and residential mobility, Concept of New town, JNNURM, Smart cities, Expansion of new township, Sprawl vs Compact city, Social space and polarization: Meaning, differentiation, congregation and segregation.

UNIT-III

Theories of rural-urban migration: Lewis's Model of Rural Urban migration, Harris-Todaro Model of Rural-Urban Migration; Urban restructuring, redevelopment and renewal; Urbanization process in India, Urbanization and environmental problems; Sustainable development and cities: its needs and implications; city as an ecological unit; Solid Waste Management.

UNIT-IV

Factors determining urban land values; Spatial structure of urban land values; Urban land value theory; Urban governance; Urban gentrification.

Suggested Readings:

1. Bhattacharya, B. (2006). Urban Development in India. New Delhi: Concept Publishing Company
2. Carter, H. 1981: Urban Geography, 3rd edition Arnold-Heinemann, New Delhi.
3. Das, A. K. (2007). Urban Planning in India. Jaipur: Rawat Publications.
4. Dickinson, R.E. 1968: City and Region: A Geographical Interpretation. Routledge and Kegam Paul Ltd. London.
5. Diddee, Jaymala 1997: Indian Medium Towns. Rawat Publications, Jaipur. Earthscan Pub. Ltd. London.
6. Hall, Peter. Cities of tomorrow. Oxford: Blackwell Publishers, 1988.
7. Mandal, R.B. (2000): Urban Geography: A Textbook. Concept Pub. Co., New Delhi.
8. Pacione, Micheal, 2001: Urban Geography, Routledge, London
9. Ramachandran R. 1989: Urbanisation arid Urban Systems in India. Oxford University Press, New Delhi.
10. Short, John, 1984: An introduction to Urban Geography, Routledge, London
11. Singh, R. Sandhu (ed) 2003: Urbanisation in India, Sage Publications, New Delhi.
12. Verma, L.N., 2006, Urban Geography, Rawat Publications

Course Name: AIR PHOTO, RS & GIS AND INFERENTIAL STATISTICS

Course Type: GENERIC ELECTIVE (GE)

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about acquisition of data through interpretation of air photos and satellite images and also handling this database in GIS environment. In statistic part students will learn application of statistical tools for cause-effect analysis.*
- **Skill Gained:** *Through hand-in-exercise students will build expertise in this field of data acquisition and analysis.*
- **Competency Developed:** *Gaining competency in exploring the geographical phenomena and drawing inference.*

COURSE CONTENTS:

UNIT-I: Aerial Photo interpretation (Marks: 25)

Application of air photo techniques in Geography, type of air photograph and their application to situations; orthophotos, stereoscopic measurement of terrain elevation by using parallax bar, elements of object identification, photo-mosaics; Simple geometry of air photograph, measurement and corrections of relief and tilt displacement, measurement of object height; Determination of scale; Stereo-photography and its planning, applications, sequence and objectives; Identification of elements/features of natural and cultural landscape and mapping.

UNIT-II: Remote Sensing and GIS (Marks: 25)

Definition and Stages of Remote Sensing; Satellite and Sensor; Resolution: Spatial, Spectral, Radiometric and Temporal; Band combination and FCC Image; Conversion of DN to TOA and importance of TOA; Digital Image Classification and Preparation of land use land cover map; Computation of NDVI and NDWI and water body extraction; Concept of Geographical Information Systems (GIS) and its components; Applications of GIS; Data Structure in GIS; Geo-referencing, mosaicing, digitization and database creation using GIS Software.

UNIT-III: Inferential Statistics (Marks: 25)

Relative Frequency Function Vs. Probability Function (PMF, PDF and CDF); Computation of probability by using CDF of Normal Distribution, Binomial Distribution and Poisson Distribution in MS Excel Spreadsheet; Concept of sampling distribution & hypothesis testing; Application of t-Test: one sample, two independent samples and two related samples; Design and application of ANOVA: One-way CRD, Two Way RBD, factorial ANOVA and One-way repeated measures ANOVA; Part and Partial correlation; Spatial Auto Correlation (Moran's I); Multiple Regression: Objective, Assumption, Deriving the model and Reporting; Regression for Categorical data (Dummy Variable Regression); Crosstab: Chi-square Test, Computation of Phi, Cramer's V, Somers' d, Kendall's tau (b and c), Eta, Interpretation and reporting of Crosstab Result.

Suggested Readings:

Air Photo, RS & GIS

1. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001.
2. Janza. F.J., Blue, H.M., and Johnston, J.E., Manual of Remote Sensing Vol. I, American Society of Photogrammetry, Virginia, U.S.A, 1975.
3. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York.
4. M.G. Srinivas, Remote Sensing Applications, Narosa Publishing House, 2001.
5. Mather, P. M., 1987, Computer Processing of Remotely Sensed Images: An Introduction, John Wiley & Son.

Inferential Statistics

1. Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2012). Basic Econometrics (5th Edition ed.). Chennai and New Delhi: McGraw Hill Education (India) Pvt. Ltd.
2. Hair Jr. J., Babbitt B., Black W. & Anderson, R. (2019). Multivariate Data Analysis (8th Edition ed.). Delhi: Cengage.
3. Ho, R. (2006). Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS. Boca Raton, London and New York: Chapman and Hall/CRC.
4. Kothari, C. R. (2005). Research Methodology/Methods & Techniques (2nd Edition ed.). New Delhi: New Age International (P) Ltd. Publishers.
5. Pal, S. K. (1998). Statistics for Geoscientists/Techniques and Applications. New Delhi: Concept Publishing Company.

Course Name: INSTRUMENTS AND STATISTICAL MODELS

Course Type: GENERIC ELECTIVE (GE)

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge in handling the instruments and data acquisition and also the knowledge about application of statistical model for analysis of geographical phenomena.*
- **Skill Gained:** *Gaining the skill for handling the instrument and data analysis.*
- **Competency Developed:** *Developing competency in data collection, analysis and future prediction.*

COURSE CONTENTS:

UNIT-I: Instruments (Marks: 15)

Specific Gravity Meter; Soil Kit Box (NPK, pH, organic matter); Box Sextant, Abney's Level, Clinometer; Brunton Compass, Munsell Colour Chart, Hygroscopic Moisture, Air Quality Pollutants Meter, Noise Meter and Current Meter.

UNIT-II: Linear Statistical Model (Marks: 30)

Matrix algebra and its application for model fitting: Definition & types of matrices, matrix addition, subtraction, multiplication, division of matrix, determinant of a matrix, adjoint of a matrix and application of matrix for fitting Linear Multiple Regression Model; Application of ANOVA and t-Test for the validation of fitted model.

UNIT-III: Model Application (Marks: 30)

Spatial interpolation of point data using Kernel Smoothing & validating the data using cross validation method in MS Excel; Interpolation of Population Census data by fitting Polynomial Model in MS Excel; ARIMA Model: Model building and application for future prediction of time series data; Cox Proportional Hazards Model to assess simultaneous effect of several risk factors on survival time.

Suggested Readings:

1. Brockwell, Peter J. and Davis, Richard A. (2002): Introduction to Time Series and Forecasting, Second Edition, Springer.
2. Cox, D. R. & D. Oakes (1984): Analysis of Survival Data. London: Chapman and Hall.
3. Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2012). Basic Econometrics (5th Edition ed.). Chennai and New Delhi: McGraw Hill Education (India) Pvt. Ltd.
4. Hammond, Rober and McCullagh, Patrick (1974): Quantitative Techniques in Geography: An Introduction, Clarendon Press, Oxford.
5. Mahmood, Aslam and Raza, Moonis (1998): Statistical Methods in Geographical Studies, Rajesh Publication, New Delhi.
6. Mills, Melinda (2011): Introducing Survival and Event History Analysis, Sage Publications.
7. Pal, S. K. (1998). Statistics for Geoscientists/Techniques and Applications. New Delhi: Concept Publishing Company.

M.A./ M. Sc. FOURTH SEMESTER

Total Marks: 400

Total Credits: 16

Course Name: OCEANOGRAPHY AND APPLIED GEOMORPHOLOGY

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge about various physical and chemical aspects of ocean and ocean water. Students will learn how geomorphological knowledge could be applied for society development purpose.*
- **Skill Gained:** *Gaining expertise in making logical interpretation to the phenomena in concerned disciplines.*
- **Competency Developed:** *Competency of characterizing those aspects of ocean and resolving the conflicts regarding consuming marine resource and resolving the geomorphological issues in connection to human society.*

COURSE CONTENTS:

Oceanography

UNIT-I

Oceanic Surface configuration in relation to Plate Tectonics, Bottom topography of Indian, Pacific and Atlantic oceans; Ocean deposits, Coral reefs and canyons.

UNIT-II

Physical and chemical properties of soil water: Density, temperature & salinity; Ocean currents; Waves & tides; Sea level changes.

UNIT-III

Salient features of UNCLOS; Exclusive Economic Zone (EEZ) & Coastal Regulation Zone (CRZ, Govt. of India); Food & mineral resources of the sea.

Applied Geomorphology

UNIT-I

Scope and contents of applied geomorphology; Assessing River bank erosion potential (Rosgen's BEHI); Problem and remedies of river bank erosion: Case study of River Ganga in Malda district of West Bengal; Flood hazards vulnerability and risk: Concept, types and assessment; Flood hazard zone mapping using RS & GIS.

UNIT-II

Impact of dam, embankment and urban development on runoff; Causes, consequences and remedies of accelerated siltation in alluvial channel; Concept and method of river restoration; Wetland and its importance in river restoration.

UNIT-III

Groundwater recharge estimation by GEC97; Method of groundwater potential zone mapping using RS & GIS; Causes, consequence and remedies of water logging in urban areas; Urban storm water management system using Storm Water Management Model (SWMM).

Suggested Readings:

Oceanography:

1. Garrison, T.S. (2015). Oceanography: an invitation to marine science. Massachusetts: Cengage
2. International (P) Limited Publishers.
3. Learning.
4. Pethick, J.S. (1984). An introduction to coastal geomorphology. London: Department of Geography, University of Hull.
5. Petts, G.E., and Amoros, C. (1996). Fluvial hydrosystems. London: Chapman and Hall.
6. Raghunath, H.M. (2006). Hydrology: Principles, Analysis and Design. New Delhi: New Age
7. Sharma, R.C., and Vatal, M. (1962). Oceanography for geographers. Allahabad: Chaitanya Publishing.
8. Talley, L.D. (2011). Descriptive physical oceanography: an introduction. Massachusetts: Academic Press.
9. Todd, D.K. (1959). Ground water hydrology. New York: John Wiley and Sons.
10. Viessman, W., Lewis, G.L., and Knapp, J.W. (1989). Introduction to hydrology. New York: Harper & Row Publishers.

Applied Geomorphology:

1. Allison, Robert. 2002. Applied Geomorphology: Theory and Practice. Chichester, UK: John Wiley & Sons.
2. Downs, Peter, and Derek B. Booth. 2011. "Geomorphology in Environmental Management." In The SAGE Handbook of Geomorphology, edited by K.J. Gregory and A.S. Goudie, 78–105. London: SAGE.
3. Graf, William L. 1996. "Geomorphology and Policy for Restoration of Impounded American Rivers: What Is 'Natural'?" In The Scientific Nature of Geomorphology, edited by B.L. Roads and C.E. Thorn, 443–473. Chichester, UK: John Wiley & Sons.
4. McGregor, Duncan M., and Donald A. Thompson. 1995. Geomorphology and Land Management in a Changing Environment. Chichester, UK: John Wiley & Sons.
5. Saha, S. K. and Barrow, Christopher, J., (Ed.), 1981: River basin planning: Theory and Practice, John Wiley & Sons, Chichester, USA.
6. Thorne, Colin R., Richard D. Hey, and Malcolm D. Newson. 1997. Applied Fluvial Geomorphology for River Engineering and Management. Chichester, UK: John Wiley & Sons.

Course Name: POPULATION GEOGRAPHY AND REGIONAL PLANNING AND DEVELOPMENT

Course Type: CORE

Paper Type: THEORY

Paper Code:

Marks: 75

Exam Duration: 3 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge about geographical aspects of population and conceptual background of formulating development plan.*
- **Skill Gained:** *Gaining expertise in the concerned subject.*
- **Competency Developed:** *Competency of resolving the problems related to human resources and related development issues.*

COURSE CONTENTS:

Population Geography

UNIT-I

Theories of Population: Malthus Vs Boserup, Demographic Transition Theory (First and Second); Michael Thomas Sadler's Destiny Theory; Ricardo's Theory of Population.

UNIT-II

Population policies in the developed (Japan & Sweden) and developing (India & China) countries; Measurement of HDI.

UNIT-III

Theories and Models of Migration: Ravenstein's Law of Migration; Everett Lee's Theory of migration, Zelinsky's Migration Transition Model, Duncan's Model of Migration.

Regional Planning and Development

UNIT-I

Region, Regionalization and Regional Planning: Concept of region, Classification of region, Methods of delineation of Region, Schemes of Regionalization of India, Concept of Planning and Regional Planning.

UNIT-II

Regional Development Theory: Growth Pole Theory by Perroux, Export Base Theory by North, Stages of Economic Growth Theory by Rostow, Core-periphery model by Friedmann, Cumulative causation theory by Myrdal, Unbalanced growth theory by Hirschman.

UNIT-III

Regional disparity and planning practices in India: Centralized and decentralized planning, District level planning and Block level planning. Community participation, Marginalized planning, Metropolitan planning; NITI Ayog.

Suggested Readings:

Population Geography:

1. Bhende, A., and Kanitkar, T. (1982). Principles of population studies. Bombay: Himalaya Publishing.
2. Blunden, J., Haggett, P., Harnnett, C., and Sarre, P. (1985). The fundamentals of human geography. New York: Harper and Row.
3. Chandna, R.C. (2010). A geography of population: concepts, determinants and patterns. Kalyani Publishers.
4. De Blij, H.J. (1996). Human geography: culture, society and space. New York: John Wiley and Sons.
5. Newman, J. and Matzke, G. (1984). Population, pattern, dynamics and prospects. Prentice Hall

Regional Planning and Development

1. Bhat, L S. – Regional Planning in India, Statistical Publishing Society, Calcutta, 1973.
2. Chand, M. & Puri, V. K. – Regional Planning in India, Allied Publishers Pvt. Ltd., N. Delhi, 1983.
3. Friedman J. & Alonso W. – Regional Development and Planning – A Reader, M.I.T. Press, Cambridge, 1967.
4. Kundu, A. & Raza M. – Indian Economy: The Regional dimension – Spectrum Publishers, N. Delhi, 1982.
5. Misra R. P. – Regional Planning: Concepts, Techniques and Policies, University of Mysore, Mysore, 1969.
6. Misra, R. P., et. al – Multi-level planning & Integrated Rural Development in India - Heritage Publishers, Delhi, 1980.

Course Name: AGRICULTURAL GEOGRAPHY (PART – A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation and interpretations of selected agricultural attributes.*
- **Skill Gained:** *Gaining skill to prepare the database of such attributes.*
- **Competency Developed:** *Developing competency to exploration different academic aspects of agriculture.*

COURSE CONTENTS OF PART – A:

Crop combination by Weaver and Thomas; Crop concentration and Crop Diversification by Bhatia's method; Measurement of Agriculture efficiency Jasbir Singh; Preparation of Maps and Charts based on Agricultural Data

COURSE CONTENTS OF PART – B:

Crop Intensity Index (CII) and Crop Diversity Index (DI); Crop-combination by Doi and Weaver method; Determination of Agricultural Efficiency by Kendall; Cropping-intensity (Rafiullah's Method) and Crop-diversification (Jasbir Singh's Method).

Suggested Readings:

1. Brown, L.R.: The Changing World Food Prospects: The Nineties and Beyond, World Institute, Washington DC, 1990
2. Dyson, T.: Population and Food – Global Trends and Future Prospects, Routledge, London, 1997
3. Gigg, D.B.: The Agricultural System of the World, Cambridge University Press, New York, 1974
4. Grigg, D.: An introduction to Agricultural Geography, Hutchinson Publication, London
5. Mannion, A.M.: Agriculture and Environment Change, John Wile, London, 1995
6. Morgan, W.B.: Agriculture in the Third World – A Spatial Analysis, West Press, 1978
7. Sauer, Carl: Agricultural Origin and Dispersals American Geographical Society, New York, 1952
8. Symons, L.: Agricultural Geography, G. Bells, London, 1967

Course Name: APPLIED HYDROLOGY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge of hydrologic models and probabilistic treatment of hydrological variables.*
- **Skill Gained:** *Gaining the skill of determining the proper model selection and application for explaining the hydrologic system as a whole.*
- **Competency Developed:** *Developing the competency to explore the hydrologic processes.*

COURSE CONTENTS OF PART – A:

Concept and classification of Hydrologic Model; Concept of Model calibration and Model validation; Application, calibration and validation of NRCS-CN model, SWAT and HEC-HMS for runoff simulation; Change detection in hydrological time series: Step change (Buishand U test, SNH Test and Pettit test) and trend detection (Mann-Kendal test and Seasonal Mann-Kendal test).

COURSE CONTENTS OF PART – B:

Types of hydrological time series: Complete duration series, Partial duration series, Annual exceedance series (Partial duration series with # of values = # years), Extreme value series; Analysis of probability by using Normal Distribution, Log Normal Distribution, Gamma Distribution, Exponential Distribution, Gumbel's Extreme Value Distribution (Type – I), Log Pearson's Type-III Distribution; Weibull's Distribution (Type-III) and Binomial Distribution; Flood frequency analysis by Weibull's formula; Seasonality analysis of water quality by Hierarchical Clustering and Spearman's Rank Correlation; Identification of source of water contaminant by PCA.

Suggested Readings:

1. Abbaspour, K.C (2015). SWAT CUP: Swat Calibration and Uncertainty Programs-A User's manual. Eawag: Swiss Federal Institute of Aquatic Science and Technology.
2. Helsel, D. R., & Hirsch, R. M. (2002). Statistical Method in Water Resources. Science for a changing world. Retrieved from <http://water.usgs.gov/pubs/twri/twri4a3/>
3. Hipel, A. W and McLeod, A.I (1994). Time series modelling of water resources and environmental systems. Elsevier.
4. Hydrological Engineering Centre. (Sep 2018). Hydrological Modeling System/HEC-HMS/User's Manual/Version 4.3. Davis, California, USA: US Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Centre.
5. Reddy, D. P. (1997). Stochastic Hydrology (2nd Edition ed.). New Delhi: Laxmi Publications (P) Ltd.
6. Winchell M., Srinivasan R., Di Luzio M. and Arnold J (March 2013). ArcSWAT Interface for SWAT 2012 User's Guide. Blackland Research and Extension Centre Texas Agri Life Research, Texas and Grassland, Soil and Water Research Laboratory USDA Agricultural Research Service, Texas.

Course Name: APPLIED PEDOLOGY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning the soil sample analysis and data generation.*
- **Skill Gained:** *Gaining the expertise to prepare the data databases for their use in academic investigation.*
- **Competency Developed:** *Competency to explore many academic issues of pedology.*

COURSE CONTENTS OF PART – A:

Methods of Collection of Soil Samples; Soil Mechanical analysis; Soil pH (Kuhn's Colourimetric; Method); Munsell Chart Method and Soil Colour Determination; Measurement of Soil Physical and Chemical Characteristics by digital and hand-held Instruments.

COURSE CONTENTS OF PART – B:

Soil Kit Box Analysis; Measurement of soil Moisture and Density; Keen Raczkowski's (Keen box Analysis) Measurements; Soil Specific Gravity, (b)Soil Porosity, (c)Water Holding Capacity (d)Soil Density; Soil pH (Kuhn's Colourimetric Method); Determination of proportion of sand, silt and clay; Soil Organic Matter (Wet Combustion method).

Suggested Readings:

1. Head, K.H., 1986: Manual of Soil Laboratory Testing, Pentech Press, London, UK, 1st Edition, Vol. I-III.
2. Jackson, M.L., 1967: Soil Chemical Analysis, Prentice-Hall of India, Pvt. Ltd., New Delhi, 1st Edition.
3. Marshall, C. Edmund, 1964: The physics, Chemistry & mineralogy of Soils, John Wiley & Sons Inc., New York, Vol. I & II, 1st Edition.
4. Wright, C. Harold, 1934: A Handbook of Soil Analysis: Physical and Chemical Methods, Logos Press, New Delhi, India, 1st Edition.
5. Jenny, Hans, 1941: Factors of Soil Formation: A system of Quantitative Pedology, McGraw-Hill Book Co., Inc., New York, USA, 1st Edition.

Course Name: CARTOGRAPHY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the knowledge of field survey and that of drawing graticules on selected projection.*
- **Skill Gained:** *Gaining expertise to handle such techniques of survey and map projection.*
- **Competency Developed:** *Competency to extend help for academic researchers in any spatial science.*

COURSE CONTENTS OF PART – A:

Determination of reduced level of a place by Reciprocal survey by Dumpy level; Determination of difference in heights by Tacheometric surveying with Theodolite.

COURSE CONTENTS OF PART – B:

Gnomonic Projection (Cubic Development); Conical Orthomorphic Projection with two Standard Parallels; Modified International Projection; Cylindrical Equal Area Projection with two Standard Parallels; Parabolic Projection (Normal Case).

Suggested Readings:

1. Deetz, C. H. Adams O. S. (1934): Elements of Map projection with applications to map and chart construction, Special publication no. 68, US Govt. Printing Office, Washington DC.
2. Hanks, A. R. (1942): Map Projection, 2nd Edition 1942.
3. Higgings, A. L. (1944): Higher surveying, MacMillan and Co., 1944
4. Kellaway, G. P. (1974): Map Projections 1st Indian Edition, 1974.
5. Roy, P. (1988): An analytical Study of Map Projection, 1988.

Course Name: FLUVIAL GEOMORPHOLOGY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation and graphical construction of selected quantities.*
- **Skill Gained:** *Gaining expertise to prepare data base on hydrologic and hydraulic parameters.*
- **Competency Developed:** *Developing competency to help research activities.*

COURSE CONTENTS OF PART – A:

Hydrographs and its types; Geomorphological mapping; Methods of sampling channel bed-surface sediments; Sediment and sediment load description: Field approaches; Types of Loads: Dissolved, wash and bed material load

COURSE CONTENTS OF PART – B:

Measurement for the case of fluvial process; Velocity: Manning's and Chezy's method; Discharge: Slope-Area method; Flow types: Reynold's and Froude's number; Estimation of runoff: NRCS-CN Method, Rational method; Pair-wise interrelationship study of morphometric variables: Regression and correlation methods.

Suggested Readings:

1. Chow, V. T., Maidment, D. R., & Mays, L. W. (1998). Applied Hydrology. New Delhi, Sa Juan, Singapore, Sydney, Tokyo, Toronto: McGraw Hill, Inc.
2. Doornkamp, John C. and King, Cuchlaine A. M., 1971: Numerical analysis in Geomorphology: An introduction, St. Martin's Press, New York, USA, 1st Edition.
3. Gardiner, V. and Dackombe, R., 1983: Geomorphological field Manual, George Allen & Unwin, London.
4. Hydrologic Engineering Centre. (March 2000). Hydrologic Modeling System/HEC-HMS, Technical Reference Manual. Davis, California: US Army Corps of Engineers.
5. King, Cuchlaine A. M., 1966: Techniques in Geomorphology, Edward Arnold (Publishers) Ltd., London.

Course Name: GEOGRAPHY OF TOURISM (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation of selected variables of tourism industries.*
- **Skill Gained:** *Gaining expertise to prepare database on such variables.*
- **Competency Developed:** *Developing competency to analyze functional relationship of such variables to settle many academic problems related to tourism industries.*

COURSE CONTENTS OF PART – A:

Tourist Flow analysis, Trend of tourist flow growth and projection of tourist; Tourism Potentiality Index

COURSE CONTENTS OF PART – B:

Isochronic Map showing tourist resource and travel time; Environmental Impact Assessment of Tourism development

Suggested Readings:

1. Crouch, D. (ed.) (1999). Leisure / tourism geographies: practices and geographical knowledge, London, New York: Routledge.
2. De Kadt, E. (1979). Tourism: Passport to Development. Perspectives on the social and cultural effects of tourism in developing countries.
3. Hall, C.M. (2000). Tourism Planning: Policies, Processes and Relationships, Harlow: Prentice Hall.
4. Hall, C.M. and Lew, A.A. (ed.) (1998). Sustainable Tourism Development: Geographical Perspectives, Harlow: Addison Wesley Longman.
5. Mowforth, M. and Munt, I. (1998) Tourism and Sustainability: New Tourism in the Third World, London, New York: Routledge.
6. Shaw, G. and Williams, A.M. (2002). Critical Issues in Tourism: A Geographical Perspectives, 2nd ed., Blackwell: Oxford.

Course Name: INDUSTRIAL GEOGRAPHY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation of selected variables of firms and industrial activity.*
- **Skill Gained:** *Gaining expertise to prepare and handle such database.*
- **Competency Developed:** *Gaining competency to resolve many academic problems in this field.*

COURSE CONTENTS OF PART – A:

Input–output Analysis, Flow Analysis, Time Series Analysis; Gini, Theil, Sopher’s Index.

COURSE CONTENTS OF PART – B:

Measuring interdependent between different economic sectors of industries, Map showing movement of goods and services, Trend analysis, Measures of Inequality.

Suggested Readings:

1. Miller, R.E. and Blair, P.D. (2009): Input-output Analysis: Foundation and Extensions, Cambridge University Press.
2. Patra, A. K (2010): Regional Dimension of Input-output Analysis, Discovery Publishing Pvt. Ltd.
3. Raa, T.T (Edt., 2017): Handbook of Input-output Analysis, Edited book, Edward Elgar Publishing Ltd.
4. Sen, A (1998): On Economic Inequality, Oxford University Press.

Course Name: POPULATION GEOGRAPHY (PART- A OR PART – B)**Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)****Paper Type: PRACTICAL****Paper Code for PART – A:****Paper Code for PART – B:****Marks: 42****Exam Duration: 2 hours****Course Outcomes:**

- **Knowledge Gained:** *Learning computation of variables on various aspects of population.*
- **Skill Gained:** *Gaining expertise to prepare and handle such data base.*
- **Competency Developed:** *Developing competency to resolve many academic problems in this field.*

COURSE CONTENTS OF PART – A:

Measures of population growth and decline: Arithmetic growth, geometric growth and exponential growth; Population projection, Development Indices (HDI, PQLI, Theil’s Index); Life Table.

COURSE CONTENTS OF PART – B:

Measures of reproduction: Gross Reproduction Rate and Net Reproduction Rate; Measures of Mortality: Infant Mortality Rate, Perinatal Mortality Rate, Early Neo-natal Mortality Rate, Late Neo-natal Mortality Rate and Standardized Death Rate; Measures of Work Participation Rate (Crude Labour Force Participation Rate, Age Specific Labour Force Participation Rate).

Suggested Readings:

1. Barclay, George, W. (1958) Techniques of Population Analysis; John Wiley & Sons, New York
2. Chattopadhyay, A. K. & Saha, A. K., (2012); Demography Techniques & Analysis, Viva Books, New Delhi
3. Pressat, Roland, (1992); Demographic analysis: Methods, Results, Applications, Chicago
4. Srinivasan, K. (1995); Basic Demographic Techniques and Applications, Sage Publications, New Delhi
5. Weinstein, Jay & Pillai, Vijayan K., (2015); Demography: The Science of Population, Rawat Publications, Jaipur
6. Johnston R; Gregory D, Pratt G. et al. (2008) The Dictionary of Human Geography, Blackwell Publication.

Course Name: TRANSPORT GEOGRAPHY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation of selected variables of transport network.*
- **Skill Gained:** *Gaining the expertise to analyze such data.*
- **Competency Developed:** *Developing competency to resolve many academic problems of transport geography.*

COURSE CONTENTS OF PART – A:

Network Hierarchy: Hierarchical Node, connectivity ratio, Weighted Hierarchical Node Connectivity ratio, Clustering Co-efficient, Average Shortest Path length, Assortative Co-efficient, Average nearest neighbor degree; Concentration Indices (specialization index, location co-efficient), Wiener Index, Measurement of Inequality and Dissimilarity of Network.

COURSE CONTENTS OF PART – B:

Gravitational Analysis (Reilly's, Haff's Law of Gravitational analysis), Traffic counts and traffic surveys, Measurement of emission and noise, Geospatial application in transport modelling (Buffering, tracing, routing, Proximity mapping, multi-parametric network efficiency analysis).

Suggested Readings:

1. Berry, B.J.L et al., 1966. Essays on Commodity Flow and Spatial Structure of Indian Economy, Department of Geography, Chicago.
2. Berry, B.L.J. and Marble, D.F. (eds.) 1967. Spatial Analysis: A Reader in Statistical Geography, Prentice Hall.
3. Cliff, A.D. and J.K. Ord (1981) Spatial processes: models and applications, London: Pion.
4. Darmofal, D. (2015) Spatial analysis for the social sciences. Cambridge: Cambridge University Press.
5. Haggett, P. 1965. Locational Analysis in Human Geography, London.
6. Haggett, P. and Chorley, R.J. 1969. Networks Analysis in Geography, London.
7. Kansky, K.J., 1963. Structure of Transportation Networks: Relationships between Network Geometry and Regional Characteristics, University of Chicago, Department of Geography, Research Paper, Chicago, 84.
8. Sarkar, A. 2013. Quantitative Techniques: Techniques and Presentations, Orient Black Swan, New Delhi
9. Wilson, A. G (1974) Urban and Regional Models in Geography and Planning. London: Wiley.

Course Name: URBAN GEOGRAPHY (PART- A OR PART – B)

Course Type: DISCIPLINE SPECIFIC ELECTIVE (DSE)

Paper Type: PRACTICAL

Paper Code for PART – A:

Paper Code for PART – B:

Marks: 42

Exam Duration: 2 hours

Course Outcomes:

- **Knowledge Gained:** *Learning computation and interpretation of selected geographical attributes of urban settlement.*
- **Skill Gained:** *Gaining expertise to prepare and handle such data base.*
- **Competency Developed:** *Developing competency to resolve many academic problems in this field.*

COURSE CONTENTS OF PART – A:

Network Topology: connectivity and centrality; Analysis of spatial and regional patterns (tests of clustering and regularity, standard score); Measures of Inequality; Empirical study on city size distribution.

COURSE CONTENTS OF PART – B:

Measure of Accessibility; Concentration Indices (specialization index, location co-efficient), Gini Coefficient, Sopher Index, Theil's Index; Testing Urban Rank Size Rule & its applications.

Suggested Readings:

1. Carter, H. (1995). The Study of Urban Geography. 4th ed, Arnold.
2. Giuliano, G., Hanson, S. (Eds) (2017). The Geography of Urban Transportation. 4th ed, Guilford Press.
3. Hanson, S., & Giuliano, G. (2004). The geography of urban transportation. New York: Guilford Press.
4. Kaplan, D., Holloway, S. (2014). Urban Geography. 3rd ed, Wiley.
5. Kneeshaw, R. (1972). Practical urban geography. London.
6. Knox, P.L., McCarthy, L.M. (2011). Urbanization: An Introduction to Urban Geography. 3rd ed, Pearson.
7. Latham, A., McCormack, D., McNamara, K. McNeill, D. (2009). Key Concepts in Urban Geography. Sage.
8. Mandal, R.B. (2008). Urban Geography: A Text Book. Concept Publishing Company.
9. Pacione, M. (2009). Urban Geography: A Global Perspective. Routledge.
10. Ramachandran, R. (1989). Urbanisation and Urban Systems in India. Oxford University Press.
11. Taylor, G. (2013). Urban Geography. Hoboken: Taylor and Francis.

Course Name: DIGITAL THEMATIC MAPPING

Course Type: GENERIC ELECTIVE (GE)

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining knowledge about data acquisition and making theme-based maps in computer aided digital environment.*
- **Skill Gained:** *Gaining expertise in map making methods in digital platform.*
- **Competency Developed:** *Developing the ability to data base generation, processing and mapping.*

COURSE CONTENTS:

UNIT-I (Marks: 15)

Choosing right sensors and spatial resolution of satellite image for mapping river basin; Raster data corrections (Radiometric and Atmospheric corrections); Image rectification and registration; Coordinate transformation and Reprojection.

UNIT-II (Marks: 15)

Digital Image Interpretation and Multi Band concept of Image Interpretation; Vector layers creations i.e., point, line and area features and computing their attributes; Interpolation of point data and creation of isopleth; Making layout and map annotation.

UNIT-III (Marks: 15)

Land use and Land cover (LULC) classification and thematic mapping; Creation of confusion table and computation of overall percentage of correct classification; Computation of Kappa Statistics; Analysis of various Indices i.e., NDVI, NDWI and TWI.

UNIT-IV (Marks: 15)

Basin delineation by DEM Hydro processing; Forest fire mapping; Flood hazards zone mapping; Groundwater potential mapping; Site suitability mapping for institutions providing public service (health center, bus stop, school etc.).

UNIT-V (Marks: 15)

Morphometric analysis (Basin approach): Drainage network, Stream ordering, Drainage density, Stream frequency, Contouring, Relative relief, Dissection index, Slope, Slope aspect, Ruggedness index, Longitudinal and Cross profiles.

Suggested Readings:

1. Bhatta, B. (2021). Remote sensing and GIS. Oxford University Press, USA.
2. Burrough, P.A. and McDonnell, R.A. 1998. Principles of Geographic Information Systems, Oxford University Press.
3. Grigoriev A.N. (2015). "Method of radiometric distortion correction of multispectral data for the earth remote sensing". Scientific and Technical Journal of Information Technologies, Mechanics and Optics. 15 (4): 595–602. doi:10.17586/2226-1494-2015-15-4-595-602
4. Heywood, I., Cornelius, S., Carver, S. 2011. An Introduction to Geographic Information Systems, 4 th Edition, Pearson Education.
5. Jensen, J.R. 2006. Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Edition, Pearson Education.
6. Law, M. & Collins, A. (2015). Getting to know ArcGIS Desktop. ESRI press, Redlands, California.
7. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). Remote sensing and image interpretation. John Wiley & Sons.
8. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation, 3rd Edition, Waveland Press.
9. Schowengerdt, Robert A. (2007). Remote sensing: models and methods for image processing (3rd ed.). Academic Press. p. 2. ISBN 978-0-12-369407-2.

Course Name: ADVANCED QUANTITATIVE TECHNIQUES

Course Type: GENERIC ELECTIVE

Paper Type: PRACTICAL

Paper Code:

Marks: 75

Exam Duration: 4 hours

Course Outcomes:

- **Knowledge Gained:** *Gaining the concept of advanced statistical tools and techniques and their applications in geographical research.*
- **Skill Gained:** *Gaining the expertise in selecting the proper statistical tools in view to solving academic problem.*
- **Competency Developed:** *Competency of data analysis and interpretations.*

COURSE CONTENTS:

UNIT-I (Marks: 15)

One Sample Test: Kolmogorov-Smirnov test; Two Independent Sample Test: Mann-Whitney U test; Two Related Sample test: Wilcoxon test and McNamar test; K-Independent Sample test: Kruskal Wallis test, K-Related Sample test: Friedman test and Cochran's Q test.

UNIT-II (Marks: 15)

Statistical design theory: Social Affinity index; Importance performance analysis (IPA), Canonical correlation; Correspondence analysis; ANCOVA, MANOVA AND MANCOVA; Analytic Hierarchy Process (AHP).

UNIT-III (Marks: 15)

Concept, Types and Objective of Cluster Analysis; K-Means and Hierarchical Cluster: Input data structure, Computation, Validation and Interpretation and reporting; Computation of Euclidian Distance; Dendrogram Plot; Method of Hierarchical Clustering (Nearest Neighbor and Farthest Neighbor); Objective, Computation, Interpretation and Reporting of Linear Discriminant Analysis (LDA), Multiple Discriminant Analysis (MDA), Binary and Multinomial Logistic Regression.

UNIT-IV (Marks: 15)

Specific variance, shared/common variance and error variance; Introducing Principal Component Analysis (PCA), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Confirmatory Composite Analysis (CCA), Path Analysis and SEM and the differences among them; Variable Vs. Construct, Exogenous Vs. Endogenous Construct; Measurement Model Vs. Structural Model, Structural Model: Inner model Vs. Outer Model; Scale of Measurement model: Formative Vs. Reflective Scale.

UNIT-V (Marks: 15)

Objective, Design, Assumption, Deriving the model and Model fit, Interpretation and validating the result of PCA, Categorical PCA and SEM (EFA & CFA); Application of Factor Analysis in Social Indexing and Mapping.

Suggested Readings:

1. Doumpos, M. and Zopounidis, C. (2004): Multicriteria Decision Aid Classification Methods, Kluwer Academic Publishers, New York

2. Fotheringham, A.S., Brunson, C. and Charlton, M. (2007): Quantitative Geography: Perspectives on Spatial Data Analysis, SAGE Publications India Pvt. Ltd., New Delhi
3. Griffith, D.A. and Amrhein, C.G. (1997): Multivariate Statistical Analysis for Geographers, Prentice Hall, Upper Saddle River, New Jersey
4. Hair Jr., J., Babin, B., Black, W., & Anderson, R. (2019). Multivariate Data Analysis (8th Edition ed.). Delhi: Cengage.
5. Ho, R. (2006). Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS. Boca Raton, London and New York: Chapman and Hall/CRC.
6. Johnston, R.J. (1978): Multivariate Statistical Analysis in Geography: A Primer on the General Linear Model, Longman, Harlow
7. Khan, N. (1998): Quantitative Methods in Geographical Research, Concept Publishing Company, New Delhi
8. Kothari, C. R. (2005). Research Methodology/Methods & Techniques (2nd Edition ed.). New Delhi: New Age International (P) Ltd. Publishers.
9. Pal, S. K. (1998). Statistics for Geoscientists/Techniques and Applications. New Delhi: Concept Publishing Company.
10. Ripley, B.D. (2004): Spatial Statistics, John Wiley & Sons, N.J Swan, A.R.H., Sandilands, M. and McCabe, P. (1995): Introduction to Geological Data Analysis, Blackwell Science Ltd., Oxford

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