

UNIVERSITY OF MADRAS



M.Sc. Degree
in
APPLIED GEOGRAPHY

Syllabus

Semester Pattern (CBCS)

UNIVERSITY OF MADRAS
DEPARTMENT OF GEOGRAPHY
CHENNAI – 600 005
DEPARTMENT OF GEOGRAPHY

**SCHOOL OF EARTH AND ATMOSPHERIC SCIENCES
UNIVERSITY OF MADRAS, CHENNAI – 600 005**

M.Sc. APPLIED GEOGRAPHY

CREDITS

All courses are standardized and the Credits (C) for each course are in accordance with the hours of teaching (L) / tutorial (T) practical (P) which includes lab or project work or internship or field visits or presentation in the form of report or / record or seminar or combination. Additionally, training with computers and in GIS / Spatial Information Systems directly or indirectly shall be the emphasis for an edge for employability.

CORE COURSES

Core courses are both basic and advanced subjects. All listed core courses are basic requirements for the award of the respective degree.

ELECTIVE COURSES

Electives are preferably taken from other departments one each for semester I,II and III as higher level courses. However, electives also can be taken from the same department. The electives offered in the department shall be learnt through lectures and tutorials. Since the fourth semester involves fieldwork and internship, no electives is offered for the Department students. However, if desires students are advised to take self-study courses which are offered at advanced level in third as well as fourth semester for extra credits.

SELF- STUDY COURSES

Self-study courses are higher level courses and shall be learnt through students' own study. Self-Study shall have 5 units for which tutorials/lectures/hand worked/lab shall be facilitated for learning.

ELECTIVE COURSES FROM OTHER DEPARTMENTS

Elective courses shall be taken from other departments. The listed elective courses are therefore for the students of other departments

PRACTICALS

Each practical is governed by One hour of instructions, One hour of tutorial and Four hours of lab (=2 credits) in every week. The assessment of practical shall be 20 marks for First sessional assessment; 20 marks for Second sessional assessment; 40 marks for End semester examination and 20 marks for the record. The first and second internal shall be the accumulation (average) of marks earned by the candidate at the end of the 5th and 10th week of lab work respectively.

TOUR-FIELD WORK AND REPORT

The students will go for a field work in the Second / Fourth semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the second and fourth semester course work containing (a) Plan and shedule of the work carried out (50 marks) and (b) Comprehensive report (50 marks).

PROJECT

Project shall be evaluated for (a) proposal presentation (20 marks) (b) final manuscript presentation (20 marks) (c) the report (40 marks) and (d) viva-voce (20 marks).

INTERNSHIP

The Internship is for M.Sc. Applied Geography course and carries 2 credits in the following manner. (a) Maximum of 25% marks for the candidate's involvement as interns in which the organisation where the candidate has undergone as intern, awards the mark. (b) 25% of marks shall be awarded for the maintenance of work dairy and proposal and (c) The Internship report carries 50% of marks.

Each candidate has to spend at least 8 / 10 weeks in an Institution / industry / Education Institution/ Business House where Surveying / Mapping or GIS or Remote Sensing or combination of the above is the main activity which may also include marketing of such products. At the end of the internship the candidate has to produce an experience certificate and a report.

SOFT SKILLS

Soft Skill courses shall be selected for each semester from the list, which has been given in the university CBCS handbook

M.Sc APPLIED GEOGRAPHY

Subject Code	Title of the Course	C/E/S/I	Credits			
			L	T	P	C
I SEMESTER						
EAS C001	Cartography and visualisation	C	2	1	1	4
EAS C002	Applied Geomorphology	C	3	1	0	4
EAS C003	Climate, Climate change and adaptation	C	3	1	0	4
EAS C004	Practical-I Techniques of Mapping and Map Analysis	C	1	0	3	4
Elective-1		E	2	1	0	3
Elective-2		E	2	1	0	3
UOM S001	Soft Skill *	S	2	0	0	2
II SEMESTER						
EAS C005	Geographic Information Science and Systems	C	3	1	0	4
EAS C006	Remote Sensing and Survey Techniques	C	3	1	0	4
EAS C007	Coastal and Oceanographic studies	C	3	1	0	4
EAS C008	Practical (Lab) – II : Digital Cartography and GIS Analysis	C	1	0	3	4
EAS C009	Field Survey and Mapping Techniques(Field Work)	C	0	1	1	2
Elective-3		E	2	1	0	3
Elective-4		E	2	1	0	3
UOM S002	Soft Skill *	S	2	0	0	2
III SEMESTER						
EAS C010	Theoretical Economic Geography	C	2	1	1	4
EAS C011	Urban Environment and Sustainability	C	3	1	0	4
EAS C012	Natural Resource Management and sustainable development	C	3	1	0	4
EAS C013	Practical – III : Remote Sensing : Interpretation and Data Analysis	C	1	0	3	4
Elective-5		E	2	1	0	3
Elective-6		E	2	1	0	3
UOM S003	Soft Skill *	S	2	0	0	2
IV SEMESTER						
EAS C014	Field work and spatial data analysis (Field work)	C	0	1	3	4
EAS C015	Project	C	0	1	5	6
UOM I001	Internship	I	0	0	2	2
Elective-7		E	2	1	0	3
UOM S004	Soft Skill *	S	2	0	0	2

Department of Geography
School of Earth and Atmospheric Sciences
University of Madras

ELECTIVE COURSES

Subject Code	Title of the Course	C/E/S/I	Credits			
			L	T	P	C
I SEMESTER						
EAS E 001	Geographical Thought	E	2	1	0	3
EAS E 002	Information System Management	E	2	1	0	3
EAS E 003	Watershed Management	E	2	1	0	3
EAS E 004	Geographies of Crime and Justice	E	2	1	0	3
II SEMESTER						
EAS E 005	Bio-Geography	E	2	1	0	3
EAS E 006	Environmental Impact Assessment	E	2	1	0	3
EAS E 007	Political Geography	E	2	1	0	3
EAS E 008	Research Design and Methods	E	2	1	0	3
III SEMESTER						
EAS E 009	GIS Project Planning	E	2	1	0	3
EAS E 010	Geo-informatics for Sustainable Land Resources Management	E	2	1	0	3
EAS E 011	India's Development and Regional Planning	E	2	1	0	3
EAS E 012	Physical Survey and Field Techniques	E	2	1	0	3
IV SEMESTER- (Independent Studies)						
EAS E 013	Web Cartography and Spatial Information delivery	E	2	1	0	3
EAS E 014	Microwave Remote Sensing	E	2	1	0	3
EAS E 015	Geography of Health Care					
EAS E 016	Sustainable Urban Land Management	E	2	1	0	3

I SEMESTER

EAS C001	Cartography and visualisation	C	2	1	1	4
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1. Development of Cartography- Information age and mapping, Web Cartography, Cartography as language and communication
2. Shape of the Earth - Geographical Data, Geographic Coordinates, Map projections- Scale, Reference and Plane Coordinate System- Survey methods, Remote Sensing, Global Positioning System- accuracy and reliability
3. Compilation process- Generalization- Map Design and Symbolization: Map content, design and implementation- Pattern creation; feature attributes, point, line, areas and volumes; Qualitative and Quantitative symbols
4. Thematic Mapping-Layout and Display-Map elements- typography and lettering; portraying land surface form
5. Web mapping resources and mapping – spatial Visualization- cartography and spatial information policy

Text Books

1. Robinson, A.H., J.L.Morrison, P.C., Muehrcke, A.J.Kimerling and S.C.Guptill (1995). Elements of Cartography, 6th Edition. New York., John Wiley & Sons. USA.
2. Misra, R.P. and A.Ramesh (1989). Fundamentals of Cartography, Concepts Publishing Company, New Delhi.
3. MacEachren, Alan, M., 1995, How Maps Work, Representation, Visualization and Design, Guilford Press

References

4. Kraak, M.J. and F.J.Ormeling (1996). Cartography : Visualisation of Spatial data, Longman Ltd., England.
5. Tyner, J. (1992). Introduction to Thematic Cartography, Prentice-Hall, Englewood Cliff, New Jersey.

Web resources

6. <http://www.fes.uwaterloo.ca/crs/geog165/cart.htm>
7. http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom_ftoc.html#3.0
8. <http://www.earthsensing.com/cart/resources/carthelp.html>

EAS C002	Applied Geomorphology	C	3	1	0	4
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1. Scope of Applied Geomorphology: Scale and landscape analysis – land systems and units for systematic analysis- terrain evaluation
2. Energy flow in geomorphic system: System concepts – availability of power – solar radiation-rotation of energy-heat, relative energy and surface processes-climatic and tectonic changes and impacts
3. Weathering, mass wasting and development of Hillslopes: Mechanical, chemical and biological weathering- structure, process and time in weathering- soil formation-mass wasting- causes and classes of mass wasting-hill slope evolution-Penk and Davisian views
4. Process geomorphology: Drainage basin, erosion, sedimentation and structural adjustments in the fluvial system; waves, evolution of shores and construction and destruction of coastal region; arid landforms and its evolution- karst and speleology; glacial process, erosion and depositional landforms
5. Methodological Issues: Mapping and statistical analysis; Morphometric, landscape and land evaluation, Hazard analysis

Text Books

1. Ruhe, R.V. (1982), Geomorphology, Boston : Houghton Mifflin Company
2. William D. Thornbury (1954); Principles of Geomorphology; John Willy & sons, Inc., London.

References

1. Arthur L. Bloom (2002); Geomorphology – A Systematic Analysis to Late Cenozoic landforms; Prentice – Hall of India Pvt., Ltd., New Delhi.
2. Arthur. N. Strahler, Alan H. Strahler (1989); Elements of Physical Geography; John Wiley & sons, Inc., London.
3. Derbyshire, E. (1980). Geomorphology and Climate, London : John Wiley & sons.

Web resources

4. <http://www.colorado.edu/geography/gcraft/notes>
5. <http://www.staff.amu.edu.pl/~sgp/gw/gwsto.htm>

EAS C003	Climate, Climate change and adaptation	C	3	1	0	4
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1. Atmosphere: Its composition (gaseous) and structure; Insolation and Radiation, heating of land and water; Temperature and pressure: variations in temperature and pressure; temperature zones, heat balance, and pressure belts
2. Global wind circulation: Tricellular meridional circulation; trade winds, easterlies and westerlies and polar winds; Air masses: Continental and maritime; fronts and their types; clouds; Precipitation: thunderstorms, cyclones (tropical and temperate) and anti-cyclones
3. Climatic classifications; Indian climates and climatic zones; micro climates, agro climates and urban climates; Global climate change; global warming and their likely impacts on human life on earth
4. Oceans: Ocean relief, temperature and salinity distribution; ocean deposits and their types; ocean currents: theories on movements; El Nino, La Nino.
5. Climate change case studies – effects of climate change – land use and land use planning-GIS for climate change –GIS based Action Plan - decision making, and application to climate science-comprehensive climate information system

References

1. R.C. Sharma and M. Vatal (1987); Oceanography for Geographers; Chaitanya Publishing House, Allahabad.
2. Tom Garrison (1996); Oceanography – An Invitation to marine science; Wadsworth Publishing co., Washington.
3. Roger G. Berry & Richard J. Chorley (1998); Atmosphere, Weather and Climate; Routledge London & New York.
4. Howard J. Critch field (1995); General Climatology; Prentice, Hall of India Pvt. Ltd., New Delhi.
5. Elizabeth Kolbert, (2006) Field Notes from A Catastrophe: Man, Nature and Climate Change, Bloomsbury Publishing Plc.
6. Lisa F. Schipper and Ian Burton (Ed.) (2008) Adaptation to climate Change, Earthscan Reader Series,

EAS C004	Practical-I Techniques of Mapping and Map Analysis	C	1	0	3	4
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1. Map Appreciation and interpretation: Thematic, topographic and atlas maps- Mapping and Analysis : Relative relief and slope maps; height and hypsometric curves; stream Analysis
2. Climate and Hydrology: Climo and climatograph; rainfall variability intensity maps temperature and rainfall profiles; dispersion deviation graph ; aridity and water balance
3. Population and Economic Data Mapping: Dot maps, density maps-colour and grey scale patterns; index of concentration and diversification; transport network analysis
4. Quantitative Symbolisation and Location Maps: Located representation of tourism and facilities; point and line pattern analysis; cartograms and 3D maps
5. Scanning-Digitization - Map preparation -Database creation- Base map preparation- - Selection of geographical co-ordinates-Symbolization-Map Design and Layout using GIS software

References

1. Monkhouse, F.J., and Wilkinson, H.R. (1976) : Maps and Diagrams, Methuen & Co., London.
2. Worthington, B.D.R. and Robert Gent (1975): Techniques in Map Analysis, Ebenzer Baylis and Sons, USA.
3. Anson, R.W. (Ed.) (1984) Basic Cartography for Students and Technicians, Volume 2, International Cartographic Association, Elsevier Applied Science Publishers, London.
4. Dorling, D. and David Fairbairn (1997), Mapping: Map of representing the world, Addisison Wesley Longman Ltd., U.K.
5. Lawrence, G.R.P. (1971). Cartographic Methods, Methuen & Co., Canada
6. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Web resources

1. www.sevenoaks.wa.edu.au/linkpage/geog/copy.html
2. www.gisdevelopment.net/books/mapping/bmap0010.htm
3. <http://www.esri.com/>

II SEMESTER

EAS C005	Geographic Information Science and Systems	C	3	1	0	4
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1. Basic concepts of Spatial science and GIS: Geographic spaces, Spatial data and information, Reference systems and datums, GIS definition, Approaches and Components; History and Development of GIS
2. Data Models and Management: Spatial Data Models – Vector and Raster data models; Data Models – DBMS and GIS- data qualities
3. Data Capture and Geoprocessing: Sources of geographic data, capturing methods, topology, geometric Transformation, scales in GIS, precision and accuracy
4. Manipulation and Analysis: Basic spatial operations-vector and raster based point, line and area analysis; Digital Elevation Models
5. Geospatial Technology: GIS, Remote Sensing, GPS and Cartography for spatial modelling and applications

Text Books

1. Ian Heywood, Sarah Cornelius and Steve Carver(2000),An Introduction to Geographical Information Systems, Addison Wesley Longman Limited, New York.
2. Aronoff, S. (1991) Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.
3. Dr. K. Elangovan (2006)GIS - Fundamentals, Applications and Implementations, New India Publishing Agency, New Delhi

References

4. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. David J Maguire, Michael F Goodchild, and David W Rhind ed.(1991) Geographical Information Systems, Longman Scientific & Technical Co-published in the USA with John Wiley & sons, Inc. New York.

Web Resources

1. <http://www.gsd.harvard.edu/pbcote/courses/gsd6322/lectures.htm>
2. http://www soi.city.ac.uk/~dk708/part_1.htm
3. www.ncgia.ucsb.edu/education/curricula/giscc

EAS C006	Remote Sensing and Survey Techniques	C	3	1	0	4
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1. Introduction to surveying: principles of surveying – measurement technology – traditional survey methods – automated survey systems.
2. Concepts of energy and radiation - principles, components of remote sensing systems, energy interactions, atmospheric windows; Interactions of earth surface features, spectral regions and principal methods of data acquisition, active and passive methods of sensing, concepts of resolutions
3. Platforms, sensors, radiation records, format of photographic, digital imagery and non-imagery data, Data Products and Limitations; Photographic system of sensing; Satellite system of sensing
4. Sensors and sensing, optical mechanical and electronic sensor systems, microwave sensing, thermal scanning
5. Interpretation basics and methodology; *In-situ* support, collateral; Digital Image Processing; Classification and maps; Measurements and Instruments - Remote Sensing Applications in Resources

References

1. Avery, T.E. and G.L. Berlin, (1992), Fundamentals of Remote Sensing and Air Photo Interpretation, Macmillan Publishing Company, New York.
2. James B. Campbell (1996); Introduction to Remote Sensing; Taylor & Francis, London
3. Lillesand and Keifer (2000) : Introduction to Remote sensing and Image Interpretation; John Willy & sons Ltd., New York.
4. Lillesand, T.M. & R.W.Kiefer (1987), Remote Sensing and Image Interpretation, John Wiley and Sons, Canada
5. Paul. J. Gibson (2000) : Introductory Remote Sensing; Routledge; New York.

EAS C007	Coastal and Oceanographic studies	C	3	1	0	4
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1. Coastal Studies: Definitions, Meaning and Scope - Coastal zone as a Resource Base – Marine Living and Nonliving Resources - Components that concern us - Sustainable coastal zone management - Rivers to the Sea Concerns – Coastal Development Activities - Coastal Pollution
2. Coastal zone: land-water interface, international initiatives for coastal zone protection; international assessments of needs and priorities of coastal zone; UN Conventions; UNEP and national programmes for coastal zone – Fisheries and Aquaculture Management
3. Defence of the coastal areas and coastal zone management: principles, bases for decisions on coastal zone development; essential national and international linkages; Land use zoning on the land and in the coastal waters; use of land use planning principles in the coastal zone; difficulties and constraints.
4. Coastal habitats and community modifications: fisheries and other living resources; unsustainable exploitation of fisheries, coral reefs; Coastal Zone Analysis for sub-regional applications: Indian ocean scenarios and policy options – Wetland Ecosystems
5. Planning and management of coastal zone: coastal zone regulation (CZR) in India; successes and failures of coastal zone management; A resource management strategy for India's coastal region – Integrated Coastal Zone Management – Principles, Needs, Policy and Legislation – Remote Sensing Application in ICZM - Coastal Zone Information System - EIA

References

1. Global International Waters Assessment (GIWA) Reports by UNEP and other International Organisations (www.giwa.net; info@giwa.net)
2. Burton, I., R. Kates and R. Snead 1969: The Human Ecology of Coastal Flood Hazard in Megalopolis, Chicago: University of Chicago Department of Geography.
3. Proceedings of Coastal Canada 1996 and 1998.
4. World Meteorological Organisation/UNESCO 1997: The World Waters, Paris.
5. UNCED 1992: Agenda 21: Programme of Action for Sustainable Development, New York: United Nations Department of Public Information.

EAS C008	Practical (Lab) – II : Digital Cartography and GIS Analysis	C	1	0	3	4
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1. Digitization – creation of spatial data- Point, Line, Polygon features -Building topology – geo-referencing-measuring distance and area
2. Attribute data editing and integration, class interval selection, thematic mapping and output-labelling
3. Buffering, Overlay and Network analysis- 3D Analysis - TIN and DEM
4. Spatial interpolation- Thematic mapping-located bar diagrams- spatial modelling
5. Ground truth support: Use of GPS for siting and routing; GPS with field data attributes

Text books

1. Ian Heywood, Sarah Cornelius and Steve Carver (2000), An Introduction to Geographical Information Systems, Addison Wesley Longman Limited, New York.
2. Aronoff, S. (1991) Geographic Information Systems: A Management Perspective, WDL Publications, Ottawa, Canada.

References

3. Kang-tsung Chang (2002) Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing company Limited, New Delhi.
4. Chrisman, N. (1997) : Exploring Geographic Information systems, New York : John Wiley & Sons., Inc.

Web Resources

4. www.ncgia.ucsb.edu/education/curricula/giscc
5. <http://www.esri.com/>

EAS C009	Field Survey and Mapping Techniques(Field Work)	C	0	1	1	2
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The students will submit report based on fieldwork in the second semester. This course work contains - Plan and schedule of the work carried out and comprehensive report on the fieldwork. The students will go for a field work in the second semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the second semester course work containing (a) Plan and schedule of the work carried out (50 marks) and (b) Comprehensive report (50 marks).

III SEMESTER

EAS C010	Theoretical Economic Geography	C	2	1	1	4
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1. The principles of location, distance and resource utilisation are dealt with along side economic principles of demand, supply price and transaction
2. Basic concepts: location, distance, space, spatial analysis and spatial organisation; economic activity, interaction and economic landscape
3. Principles of demand, supply, market, economies of scale; Scale agglomeration, cost and price; The principles of heterogeneous landscape and resource variation
4. Economic activities: primary - location and interaction mechanism –Von-Thunen location theory – application in time-space environment; Manufacturing activity- Smith, Weber and Isard; Tertiary activity- Christaller, Losch and Perrou.
5. Pole of transport in spectral development; regional planning- concepts of growth centres, area and sectoral plans.
6. Data, mapping and GIS implementation in economic geography; Recent trends and scope of economic geography

Text Books

1. Lloyd, P.E., and P.Dicken (1992). “Location in Space: A Theoretical Approach to Economic Geography”, Harper International Edition.
2. Boyce, R.R. (1974). “The Basis of Economic Geography”, Holf Rinehart and Winston Inc. New York.

References

3. Smith, D.E. (1971) Industrial Location: An Economic Geographical Analysis, John Wiley and Sons., New York.
4. Abler, Adam and P.Gould (1972). Spatial Organisation : A Geographer’s View of the World. Englewood Cliff. New Jersey.

EAS C011	Urban Environment and Sustainability	C	3	1	0	4
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1. Urban system and Indian Urbanisation - objectives of urban development, national and international policies in urban planning-historical trends, patterns of growth of urban population and urban centres, Concept of Sustainability –Sustainability measurement – Indicators of Sustainability - Sustainability Application to cities and urban areas.
2. Environmental justice, social equity and social dimensions of sustainability: Urban sprawl and smart growth - Urban sprawl and smart growth – Definitions - Trends and Projections - Factors affecting and driving urban sprawl - Case studies of cities - - Discussion about the social dimension of sustainability in cities. Environmental health risks and vulnerable populations, environmental justice, income, Inequality, crime rates and trends
3. Green buildings and sustainable housing: Green building and housing-Green Building Rating System - Potential of green building in developing countries. Sustainable transportation: sustainable transportation systems and vehicles - Trends in transportation use and modes of transportation- developing countries learn from developed country experiences - The role of Intelligent Transportation Systems - innovative case studies in developing countries -The bus rapid transits system of India cities and public health-Past, current and projected trends in energy production and consumption.
4. Sustainable use of materials and waste management: Trends of material use and waste production - Factors affecting waste production - re-use and recycling - Introduction to eco-efficiency Sustainable water use: Differences in access to water in urban areas in developed and developing countries - Access to clean water and sanitation, water pollution and public health in urban areas
5. Urban areas, parks, public spaces and biological diversity - Rates of urbanization India and the world - sub - urban areas growth and replace natural areas - urban areas: biodiversity hotspots. Urban areas and global climate change: Global climate change and its impact on cities and urban areas - Sea level rise, extreme weather events and changes in temperature

References

1. Bharadwaj, R.H. (1974) . Urban Development in India. N.N. Publishing House, New Delhi.
2. Singh, K. and F.Steinberg (eds.) (1996). Urban India in Crisis, New Age International Limited Publishers, New Delhi.
3. Harold Carter (1995); The study of Urban Geography; Arnold, London.
4. Rakesh Mohan (1994); Understanding the Developing Metropolis; Oxford University Press, New York.
5. The Sustainable Urban Development Reader, “The Next American Metropolis,” pages 73-80. Taking Sustainable Cities Seriously, Chapters 4 and 7, pages 101-123 and 177-219. Web, “Who Sprawls Most? How Growth Patterns Differ Across the U.S.
6. BRE: Climate and site development. Part 2: Influence of microclimate. Building Research Establishment 1990. ISBN: 0-85125-429-2
7. BRE: Climate and site development. Part 3: Improving microclimate through design. Building Research Establishment 1990.
8. Gehl, J(2001) Life Between Buildings Using Public Space. The Danish Architectural Press
9. Givoni, B(2008): Climate Considerations in Building and Urban Design. Van Nostrand Reinhold

EAS C012	Natural Resource Management and sustainable development	C	3	1	0	4
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1. Introduction to Resources: Concepts, classification and appraisal- Natural resources – natural resource economics - management of natural resources-Sustainability and resources
2. Resource Assessment-I : Land evaluation methods- land classification methods-soil and water conservation- land use and Land cover mapping- land use planning and sustainable development
3. Resource Assessment-II: sustainable water resource assessment- watershed analysis and management-coastal and ocean resources and management- fisheries management
4. Risk assessment: Wildlife, forest, recreational, agricultural and rangeland assessment - Ecological Risk Assessments - Natural Resource Damage Assessments- damage of natural resources
5. Natural resource surveys and monitoring– strategies for sustainable natural resource management-millennium eco-system assessment project-resources utilization and conservation in India.

References

1. Holechek, J. L., R. A. Cole, J. T. Fisher, and R. Valdez (2003) Natural Resources: Ecology, Economics and Policy (2nd Edition). Prentice Hall Education.
2. Knight, Richard L., and Sarah F. Bates (1995). A New Century for Natural Resource Management. Island Press Publishing.
3. Lilesand and Keifer (2000) : Introduction to Remote sensing and Image Interpretation; John Willy & sons Ltd., New York
4. Colin W.Mitchell (1991) Land Evaluation, Longman scientific& Technical, copublished with John Wiley & sons Inc, New York.
5. Burrough, P.A. (1986). Principles of Geographical Information Systems for Land Resource Assessment, Clarendon Press, Oxford, New York.

EAS C013	Practical – III : Remote Sensing : Interpretation and Data Analysis	C	1	0	3	4
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1. Spectral reflectance Profiles, features and wavelength regions; Interpretation of Photomorphographic / image products: use of black/white, color, FCC, thermal, radar images.
2. Geometrical characteristics: scale and projection; Use of Instruments and equipment: stereoscopes, planimeter, stereometer and interpretation equipment.
3. Digital Image Manipulation: Raster data: display' enhancement and filters; Raster map: overlay analysis and multi-image manipulation; Bit map studies and training sites; Supervised and unsupervised classification
4. Statistical Mapping: Graphs z scores, index construction, correlation, regression and residuals.
5. Geospatial analysis- Spatio-temporal analysis - Map modeling and Applications

References

1. Dury, G.H. (1952). Map Interpretation. Sir Issac Pitman & Sons., Ltd., UK
2. Jensen, J.R. (1996). "Introductory Digital Image Processing, Prentice Hall. New Jersey.
3. MapInfo Professional Users Guide (1995). MapInfo Corporation, New York.

IV SEMESTER

EAS C014	Field work and spatial data analysis (Field work)
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The students will submit report based on fieldwork in the Fourth semester. This course work contains - Plan and schedule of the work carried out and comprehensive report on the fieldwork. The students will go for a field work in the second semester, which is compulsory and on the basis of that, each student has to submit a field work report as part of the fourth semester course work containing (a) Plan and schedule of the work carried out (50 marks) and (b) Comprehensive report (50 marks).

EAS C015	Project	C	0	1	5	6
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The project can be taken highlighting any issue relating to geographic knowledge and analysis. The project is for addressing problems relating to spatial data gathering, mining, warehousing and or raster / vector analysis and modelling. Programming or script writing can also be theme for the project, If it involves spatial data handling or analysis or modelling or in combinations of all. All data analysis and survey related projects shall necessarily present in a series of thematic maps. The data analysis mapping and documentation shall be conducted in the Remote Sensing and Computer Applications Laboratory of the Department

UOM I 001	Internship	I	0	0	2	2
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Each candidate has to spend at least 8 weeks in an institution / industry /educational Institution/ business house where mapping or GIS or remote sensing or a combination of these above is the main activity which may also include marketing of such products. At the end of the internship the candidate has to produce an experience certificate and a report.

ELECTIVES

EAS E 001	Geographical Thought	E	2	1	0	3
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1. Intellectual Challenge and Philosophy of Geography: The urgency of teaching history and philosophy of geography; The Four Traditions in Geography; Dualism: geography as a science: ideographic and homothetic; against geography.
2. The Importance of Geographic Viewpoint: Why place and geography matter; paradigms and revolutions in geography; Approaches in geography: Determinism, Voluntarism, Possibilism, Probablism, Existentialism, Phenomenology, and Humanism.
3. Geography and Geographers: Values in Geography and Anne Buttimer; Diffusion and time geography and Torsten Hagerstrand; Models and modelling in geography and Peter Haggett; Indian geographers: S.P. Chatterjee, C.D. Deshpande; R.L. Singh; R.P. Misra; R. Vaidyanathan; A. Ramesh and little known geographers.
4. Geography and Theorising: Deduction, Induction and Paradeduction; Description, Explanation, Prediction and Prescription; Types of Explanation: Genetic, deductive, inductive and functional; Quantitative and Qualitative Revolutions in geography: Positivistic and humanistic methods.
5. Geographical Research and Future of Geography: Applied geography and applied research; interdependence and uniformity among social and other sciences; The future of geography and geographers.

References

1. Hartshorne, Richard 1939: Nature of Geography, USA: Association of American Geographers.
2. Hartshorne, Richard 1959: Perspectives on the Nature of Geography, USA: Association of American Geographers.
3. Bunge, William 1966: Theoretical Geography, Lund Studies in Geography, Lund, Sweden: The Royal university of Lund, Gleerup.
4. Harvey, David 1969: Explanation in Geography, London: Arnold.
5. McBoyle, G.R. (ed) 1989: Geography Unfolding, Department of Geography: University of Waterloo, Waterloo, Canada.

EAS E 002	Information System Management	E	2	1	0	3
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1. Information Technology: Meaning, scope and developments in information technology; Information technology firms: What they are and how they do things; IT industries and development
2. Information Systems: Concepts and overview of information systems; A systematic framework for Information Systems; Components of information systems; Information systems design, analysis and management
3. Database Management Systems for Information Systems: Data resources, structure and functional aspects; graphic database, data storage and hypermedia; Data models
4. Internet and Information Management: Internet, Intranet, and Extranet; Electronic communication tools: electronic mail, e-conferencing, web-publishing and file transfers;
5. Information Systems – Management information systems: needs, design and action; library resource information systems; human information systems- Information decision support system: Knowledge-based search process; Artificial intelligences and Expert Systems.

References

1. O'Brien, J.A. 1999: Management Information Systems, New York: Irwin-McGraw Hill.
2. Turban, E., R.K. Rainer Jr., and R.E. Potter 2000: Introduction to Information Technology, New Delhi: John Wiley.
3. Laurini, R. 2001: Information Systems for Urban Planning: A Hypermedia Co-operative Approach, London and New York: Taylor and Francis.

EAS E 003	Watershed Management	E	2	1	0	3
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1. Watershed: Philosophy and Concept of Watershed - Delineation and codification of watershed – Watersheds and administrative decisions.
2. Structure and functions: Geomorphic, meteorological and hydrological Parameters: Rainfall intensity, runoff characteristics, sedimentation rate and discharge rate, soil, landuse characteristics on runoff and infiltration.
3. Natural resources and human responses in watershed: soil, forest, water as natural resources and population interaction with them
4. Integration of watershed functions, processes and human interactions - Resource management: (Water conservation and water Harvesting – Soil conservation - Joint forestry management – landuse management).
5. Maintenance and We: Participatory Rural Appraisal in Watershed programme - Empowerment of Women and other gender issues - Equity issues in Watershed management – Financial management and Accounting procedures – Monitoring and Evaluation in Watershed

References

1. Elango, L. and R. Jayakumar (2001), “Modeling in Hydrology”, UNESCO, New Delhi.
2. Murty, JVS (1994), “Watershed Management in India”, Wiley Eastern Ltd., New Delhi.
3. Rajesh Rajora (2002), “Integrated Watershed Management”, Rawat Publications, New Delhi

EAS E 004	Geographies of Crime and Justice	E	2	1	0	3
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1. Crime and Geography Approaches to Psycho-geography of Crime: Ecological Approach Approaches to Psycho-geography of Crime:
2. Environmental Criminology Approaches to Psycho-geography of Crime: Environmental Psychology
3. Mapping Crime Geographic Profiling Offenders Spatial Decision Making Geography and Crime Investigation
4. Analysis of crime data – Geographical approach –Mapping of Crimes
5. Geospatial technology and Crime mapping-Applications-Case studies

References

1. Ainsworth, P. B (2001), Offender Profiling and Crime Analysis, Willan Publishing
2. Y Rossomo, K., Geographic Profiling, CRC Press, 2000, Y Weisburd, D. and McEwan, T. (1998)
3. Introduction: crime mapping and crime prevention, n/a, Y Shaw, C. R., & McKay, H. D. (1972), Juvenile Delinquency and Urban Areas., University of Chicago Press.
4. Y Brantingham, P., & Brantingham, P. (1991), Environmental Criminology,
5. Y Canter, D. V., & Larkin, P. (1993), The Environmental Range of Serial Rapists. Journal of Environmental Psychology

II SEMESTER - ELECTIVES

EAS E 005	Bio-Geography	E	2	1	0	3
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1. Mapping Distribution: Sources of Information – Methods of Survey – Methods of Mapping Distribution – Mapping Vegetation.
2. Biotic resources use and misuse – ecosystem stability and disturbance; human impact – ecosystem and environmental pollution, managed and urban eco-system.
3. Distribution as a geographical quantity: Patterns of distribution in small territories – Patterns of distribution at continental scale – clustered and dispersed distributions – Comparison of regional and continental distribution – The Historical perspective
4. Vegetation classification and correlation: structural classification functional classification – humid temperate climates and forest types – Raunkiaer Analysis – Altitudinal compassion of life- Desert climates and vegetation types.
5. Migration and dispersal: seasonal and periodic migration – permanent migration – Goods theory of plant migration – effect of topography – inter-continental migration.

References

1. Joytivy (1993) Biogeography : A study of Plants in the Ecosphere, Longman Scientific & Technical Co-published in the USA with John Weiley & sons, Inc. New York.
2. Brian Seddon (1971) Introduction to Biogeography, Gerald Duckworth adn Co. Ltd., London.
3. Jean Tricart and Conrad Kiewietde Jonge (1992) Eco Geography and rural Development.Longman Scientific & Technical Co-published in the USA with John Weiley & sons, Inc. New York.

EAS E 006	Environmental Impact Assessment	E	2	1	0	3
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1. The Concept of Environment and Ecosystem: The Problem - Environmental Impacts of Human Actions - Environmental Changes Natural and Man Made - Environmental Impacts and the stage of Technological Development
2. Administrative Procedure: Designing Administrative Procedure – Sequence of Environmental Planning – Decision-making
3. EIA: Definition – Need - Initial Environmental Initiation – Steps in EIA – Systematic Approach for using EIA – EIA Methodologies
4. Assessment of Impact: on Development Activities and Land use – on Surface Water Environment – Prediction and Assessment of Impacts – Environmental Audit
5. Environmental Planning and Management: Concept of Environmental Management, Aspects and Approaches to Environmental Management

References

1. Eugene P. Odum (1997); Ecology – A Bridge Between Science and Society; Sinauer Associates, Inc., Massachusetts, U.S.A.
2. Andrew R.W. Jackson and Julie M. Jackson (1996); Environmental science – (The natural environment and human impact); Longman, London.
3. Gilbert M. Masters (1990); Introduction to Environmental Engineering and science; Prentice, Hall of India Pvt. Ltd., New Delhi.
4. John S. Dryzek & David Schlosberg (1999); Debating the Earth – The Environmental Politics Reader; Oxford University Press, New York.
5. Anjaneyulu, Y. 2002: Environmental Impact Assessment Methodologies, BSP Publications, Hyderabad.
6. Munn, R.E. 1979: Environmental Impact Assessment Principles and Procedures, SCOPE 5, John Wiley & Sons, New York.

EAS E 007	Political Geography	E	2	1	0	3
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1. Political Geography : Definition and scope of Political geography – Geo-politics – Global strategic views (Heartland and Rimland theories)
2. Concept of Nation, State and Nation-State – Boundaries and frontiers – Politics of world resources – Geography of Federalism
3. political actions on social and economic conditions, and with the significance of geographical factors behind political situations, problems, and conflicts
4. Electoral Geography and Mapping techniques
5. Geopolitics and sustainable solutions- case studies

References

1. Glassner and Fahrer, Political Geography, 2004 (3rd ed.)
2. Agnew, John. 1987. Place and Politics. The Geographic Mediation of State and Society
3. Herbst, Jeffrey. 2000. States and Power in Africa: Comparative Lessons in Authority and Control, Princeton University Press
4. Fenno, Richard. 1978. Homestyle: House Members in their Districts. Little Brown and Company
5. Diehl, Paul. 1999. A Road Map to War. (Vanderbilt University Press)
6. Monmonier, Mark. 1991. How to Lie With Maps. (University of Chicago Press)
7. Glassner, Martin and Chuck Fahrer. 2004. Political Geography Rd Edition (Wiley)

EAS E 008	Research Design and Methods	E	2	1	0	3
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1. The Scientific Method : Alternatives of scientific research- inductive and deductive reasoning- paradigms, models and theories- strategies of descriptive, experimental and historical and problem solving research
2. Research Design : Problem identification and analysis- methods of acquiring knowledge- methods, techniques and tools in research- statement of objectives and hypothesis- data and measurements- sampling and data collection
3. Methods of Study and Analysis: Pilot surveys – case study methods- field work for socio- economic survey and tools- objectives of analysis- analysis design- hypothesis testing and reliability.
4. Report Writing and Publishing : Reports, seminar papers (short and long) and dissertations – style manuals for formatting and citations – presentation and use of computer and multimedia resources- basics of manuscript editing for the press

References

1. H.N.Misra, and Vijai P.Singh (1998); Research Methodology Social, Spatial and Policy Dimensions; Rawat Publications, New Delhi.
2. Douglas Amedeo, Reginald G.Golledge (1975); An Introduction to Scientific Reasoning in Geography; John Wiley & sons Inc. New York.
3. Humbert M. Blacock, J.R,Ann B. Blalock (1971); Methodology in Social Research; Mc GRAW HILL – London.
4. Anthony C. Winkler & Jo Ray McCuen (1994); Harcourt Brace College Publishers; London.

III SEMESTER - ELECTIVES

EAS E 009	GIS Project Planning	E	2	1	0	3
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1. Meaning of accounting for spatial variations – establishing laws and theories in geography - nature and function of Theories, Models -meaning of model- multiple variable Linear Models – procedure for developing Models, Measurement and Statistics
2. Spatial manifestations of choice process – locations and migrations; gaming simulation as a mechanism for illustrating the process of locational decision making – spatial choice process and migration decisions
3. Research Design and Qualitative and Quantitative Techniques in GIS research projects and implementation
4. Current and potential approaches to GIS project management-GIS and related spatial technologies in selected applications.-GIS data handling and spatial analysis
5. Diverse of application areas : business, health and social services, the environment, municipalities- GIS data handling and spatial-analysis

References

1. Douglas Amedeo and Reginald G.Golledge (1975), An introduction to scientific reasoning in geography, John Wiley & Sons Inc. Newyork.
2. Birkin, M., Clarke, G., Clarke, M. and Wilson, A. (1996) Intelligent GIS: Location Decisions and Strategic Planning. GeoInformation International.
3. Chainey, S., and J. Ratcliffe, 2005, GIS and crime mapping, Chichester, West Sussex, England ; Hoboken, NJ : Wiley & Sons
4. Chang, Kang-Tsung, 2004, Introduction to geographic information systems, McGraw-Hill, Boston, 400p.
5. Church,R., and A. Murray, 2009, Business site selection, location analysis, and GIS, Hoboken, N.J. : John Wiley & Sons
6. Clarke, G., and Stillwell, J., Ed), 2004, Applied GIS and spatial analysis, John Wiley, Hoboken
7. Cope M. and S. Elwood, 2009, Qualitative GIS: a mixed methods approach, Los Angeles ; London

EAS E 010	Geo-informatics for Sustainable Land Resources Management	E	2	1	0	3
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1. Land Resources: Concept of land, land units and resources- land evaluation- land information requirements-land Management environmental and institutional perspectives- sustainability
2. Principles of Physical Regionalisation: Regional concepts – boundary delimitation- classification types- geomorphological and ecological concepts
3. Systems for land resource assessment: Parametric and physiographic systems-landscape systems – land unit concepts
4. Assessment and Management: Land classifications, land use system, IT and Sustainable Management Model (SLM)- rural-urban sector – land use planning
5. Sustainable Land Information Management: LIM, DSS for land use planning and land management- Approaches to problem solving-LIM programmes in national and international level–UN Organizations

Text Books

1. Dale, P.F. and J.D. Mclaughlin (1990). Land Information Management, ELBS, Oxford Press, Oxford
2. Colin W.Mitchell (1991) Land Evaluation,Longman scientific& Technical,copublished with John Wiley & sons Inc, New York.

References

3. Burrough, P.A. (1986). Principles of Geographical Information Systems for Land Resource Assessment, Clarendon Press, Oxford, New York.
4. Tomlin, C.D. (1990). Geographic Information Systems and Cartographic Modelling. Prentice Hall, Englewood Cliff, New Jersey

Web Resources

1. www.worldbank.org/land

EAS E 011	India's Development and Regional Planning	E	2	1	0	3
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1. Resources are not, but they become', the nature, resources and culture relations; Economic Development: meaning and principles; Indian development: one or several paths?; social organisation and technology mix in India: phases of economic development and positioning of India
2. The physical and Human environment of India: land, relief, structure, physiographic divisions; monsoons and climate, water resources, soils and vegetation -human resources, neighborhoods and communities; human competition and conflicts; human capacity building for development; urbanization
3. Land uses and land utilisation in rural and urban areas; Agricultural development in India; stages of development; problems and prospects: agriculture is a gamble on monsoon; land holds the future for India
4. Industrial development in India: factors and stages of development in select industries: cottage industries, textile and steel industries; Infrastructures: power, energy, irrigation, trade and transport development
5. Economic development and Planning in India: community economic development and regional development; integrated rural and urban development; Regional disparities: causes and consequences; towards bridging the gap; Development planning for agriculture, industry and infrastructures: what and how; where to put what and how; Sustainable development Planning for a sustainable India

References

1. Singh, R.L. 1971:India: A Regional Geography, Varanasi: National Geographical Society of India.
2. Deshpande, C.D. 1988: A Regional Geography of India, New Delhi: ICSSR.
3. Mitchell, B. 1989: Geography and Resource Analysis, Harlow: Longman.
4. Spate, O.H.K. and A.T.A. Learmonth 1972: India and Pakistan: A General and Regional Geography, London: Methuen and Bombay: BI Publications.
5. WCED 1987: Our Common Future, New York and Oxford: Oxford University Press.

EAS E 012	Physical Survey and Field Techniques	E	2	1	0	3
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1. Objectivity in field surveys; Field work and surveys, measurement and recording
2. Field work design and sampling issues; Equipment in geomorphic and soil surveys; GPS for site fixing, routing and contouring
3. Hydrology and water quality data; Ground truth collection for remote sensing support
4. Village survey principles and methods; Urban land use surveys; Land system and land use surveys
5. Computer support for data management, interpretation and surface modelling; Data integration and GIS

References

1. Garson, G.D. and R.S. Biggs (1992). Analytic Mapping and geographic databases, SAGE Publications, London.
2. Hanwell, J.D. & M.D.Newson (1973). Techniques in Physical Geography MacMillan, London.
3. Worthinton, B.D.R. and R,Gant (1975). Techniques in Map Analysis, Macmillan, London
4. Rabenhorst, T.D. and Paul D.McDermott (1989). Applied Cartography : Source Materials fro Map Making, Merrill Publishing Company, London.
5. Rabenhorst, T.D. and Paul D.McDermott (1989). Applied Cartography : Introduction to Remote Sensing, Merrill Publishing Company, London.
6. Mitchell, C.W. (1991). Terrain Evaluation, London Scientific and Technical Co., John Wiley & Sons, Inc. New York.

IV SEMESTER - ELECTIVES

EAS E 013	Web Cartography and Spatial Information delivery	E	2	1	0	3
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1. Need for Web Cartography and GIS: New mapping environment- web maps-New cartographic realm-GIS and Web GIS-Internet and World Wide Web
2. Web map Publishing and Design: Basic publishing and web map functionality – web map design-colour-symbol design – placement of names-factors
3. Advanced mapping environment: Web Atlases– maps and multimedia systems-animated maps and multi- dimensional display-Web maps in geo-spatial infrastructure- Open GIS Web Mapping Activities
4. Visual thinking and cyberspace: Visualization and exploratory data analysis- strategies-visualizing spatial data in the Web-spatial Visualization through Cartographic Animation
5. Web map and Decision Making: Web cartography and weather, road traffic and tourism - maps, GIS and the need for rule based cartography-on-line mapping resources and mapping - spatial information policy

References

1. Menno-Jan Kraak and Allan Brown (Ed.) (2001) Web Cartography. Taylor & Francis, London
2. Menno-Jan Kraak and Ferjan Ormeling (1997) Cartography: Visualization of Cartography. Wesley Longman Limited, London
3. Earnshan, R. John Vince and HUW Jones, (1997). Visualization and Modelling, Academic Press, UK
4. <http://www.opengis.org/>

EAS E 014	Microwave Remote Sensing	E	2	1	0	3
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1. Microwave Fundamentals: EMR and Microwave Bands – Microwave interaction with atmospheric and earth’s surface features – System parameters of principles – Remote Sensing Radars.
2. Passive microwave remote sensing: Basics of emissivity – Theory of radiometry – Sensors - applications in atmospheric, land and ocean studies.
3. RADAR Imaging: Radar equation on measurements and discrimination - geometry of Radar image – Imaging and products - Image processing, SAR interferometry.
4. Radar Applications in Geomorphology, Hydrology and Geology – Oceanography – Agriculture – Rural and Urban landuse
5. Radar Applications in Soil moisture analysis – Rural landuse and land development – Urban structure – Quality assessment – Population estimation – Urban Heat Island.

References

1. Haysem L. (1991),”Introduction to Remote Sensing”, Taylor and Francis Publication, London.
2. Hendersen, F.M., and Anthony J. Lewis (1998), “Manual of Remote Sensing”, Volume 2, Principles and Application of Imaging Radar, 3rd Edition, John Wiley and Sons, Inc. Canada, USA.
3. John R.Jensen (2003), “Remote Sensing of the Environment”, Pearson Education Pvt., Ltd., New Delhi.
4. Sabins F.F.Jr. (1987),”Remote Sensing:Principles and Interpretation”, W.H.Freeman & Co, New York.
5. Thomas M.Lillesand and Ralph W.Kiefer (2000), “Remote Sensing and Image Interpretation”, John Wiley & Sons, New York, NY.

EAS E 015	Geography of Health Care	E	2	1	0	3
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1. Approaches to Health Care Analysis: Medical Geography: Scope, Meaning and Developments; Contemporary Geography of Health Care: Approaches: Location, Social Indicator and Behavioural Approaches; Spatial Levels and Approaches.
2. Diseases and Health: Infectious, Degenerative, Chronic, Inherited, Genetic and Disorders; Disease Ecology and Epidemiology; Organic, Inorganic, Bacterial and Fungal Factors of Health.
3. Deficiencies and Health: Nutrition and Food Habits; Nutritional Deficiencies and Diseases; Disease Patterns in India and Tamil Nadu.
4. Society, Culture and Health: Sanitation, Modernisation, ways of Living and Emerging Health Issues in Indian Society and in Tamil Nadu; Food Habits, Family and Community Life, Tradition, Religion and Health.
5. Health Care and Delivery Systems: Health Care Systems and Delivery in India and Tamil Nadu; Medical Services and Facilities, Health Information and Planning; Issues and Prospects – Ecosystem Approach, The issue, The Approaches, Lessons and Successes – Future Directions

References

1. Haggett, P. 2000: The Geographical Structure of Epidemics, The Clarendon Lectures in Geography and Environmental Studies, Oxford: Clarendon.
2. Levine, A.J 1992: Viruses, New York: Scientific American.
3. Edmundson, W.C., P.V. Sukhatme and S.A. Edmundson 1992: Diet, Disease and Development, New Delhi: Macmillan.
4. Phillips, D.R. 1990: Health and Health Care in the Third World, London: Longmans Scientific.
5. Akhtar, R. and A.T.A. Learmonth (eds) 1985: Geographical Aspects of Health and Disease in India, New Delhi: Concept.
6. Lebel Jean, 2003: Health an Ecosystem Approach, IDRC, Canada.

EAS E 016	Sustainable Urban Land Management	E	2	1	0	3
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1. Introduction: The study of Ekistics – Morphogenesis of urban centres – city structure and land use ecology and functional regions of cities- Urban Land Management
2. Landscape ecology – city landscape elements – Hierarchical format of city landscape – system approach to city landscape studies and Urban management.
3. Human components of the urban areas – people and housing patterns – basic and non-basic activities on city landscape – transportation network, city movement and commuting – social facilities and social welfare
4. Urban Public administration –urban revenue system – municipalities facilities and services – crime and police administration – entertainment and shopping – public health and health care system
5. Urban survey and data management – survey equipment, GPS and Total station for field survey – Household surveys and sampling – perceptual services – GIS, Remote Sensing and GPS for Sustainable Urban Information Management.

References

1. System Approach and the City, Ed. M.D.Mesarovic, and A.Reisman, North Holland
2. Landscape Ecology and GIS, Ed. By Haines Y and David R. Green and Stephen H.Cousins, Taylor & Francus,
3. P.V.Indiresan, Managing Development, Sage Publications, New Delhi
4. Indian Cities, towards next millennium Ed. By R.Rammohan Rao and S.Simhadri, Rawat Publication, New Delhi