Tribhuvan University

Institute of Science and Technology

Central Department of Botany

Kirtipur, Kathmandu

MSc Biodiversity and Environmental Management Curriculum

Second Semester

2074 (2017)

M.Sc. in Biodiversity and Environmental Management

COURSE STRUCTURE (2074)

SEMESTER II: Theory + Practical

Credit: 17; Full marks: 425

Course No		**Title**	**Credit**	**FM**
Paper VI	BEM 551	Conservation Biology (theory)	3	75
	BEM 552	Conservation Biology (practical)	1	25
Paper VII	BEM 553	Natural Resource Management (theory)	3	75
	BEM 554	Natural Resource Management (practical)	1	25
Paper VIII	BEM 555	Environmental change and Management (theory)	3	75
	BEM 556	Environmental change and Management (practical)	1	25
Paper IX	BEM 557	Remote sensing and GIS (theory)	2	50
	BEM 558	Remote sensing and GIS (practical)	2	50
Paper X	BEM 559	Term paper/Seminar II	1	25
	Total		**17**	**425**

Paper VI. Conservation Biology

Course title: Conservation Biology	**Total credit:** 3
Course No: BEM 551	**Full marks**: 75
Nature of the course: Theory	**Pass marks**: 37.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 48

OBJECTIVES

The overall aim of this course is to provide critical understanding of conservation biology science, and the processes and approaches of biodiversity conservation and management.

COURSE CONTENTS

Unit 1. Science of conservation biology: Introduction, history and philosophical roots, ethical principles. **1 h**

Unit 2. Threats and extinctions: (i) Overview of drivers of biodiversity loss. (ii) Extinction: types, processes and rates of extinction, prediction of extinction rates, vulnerability to extinction (factors responsible for high extinction risk). (iii) Endemism: introduction, types of endemism, Global pattern of endemism, endemism in the Himalaya. (iv) Rarity: introduction, causes of rarity, classification of rarity. (v) Threat assessments and priority setting: methods and approaches (IUCN threat categories, CAMP method, RVA method). **13 h** (2+3+2+2+4)

Unit 3. Conservation biology of small populations: (i) Small population: concepts and causes. (ii) Extinction forces and consequences: concept of deterministic and stochastic forces; environmental, demographic and genetic consequences. (iii) Minimum viable population and effective population size. (iv) Conservation approaches: overview of *In-situ* and *ex-situ* conservation, solutions to small population problems, demographic approaches [demography and population viability analysis (PVA)], metapopulation approach, conservation genetics and the management of populations. **12 h** (1+4+2+5)

Unit 4. Conservation approaches and strategies: (i) Ecosystem level approach: ecosystem resilience, conservation through protected area (PA) systems (introduction, history, importance, categories, management planning model and processes). (ii) Shifting in the conservation paradigm (SLOSS debate), conservation outside PAs, ecological restoration. (iii) Landscape-level approaches: landscape ecology and spatial heterogeneity, concept of corridors, landscape-based models for conservation, trans-boundary conservation. **12 h (**4+4+4)

Unit 4. ***Local society, TEK and biodiversity conservation*****:** (i) Local society and indigenous knowledge: introduction and definitions. (ii) Ethnoecology and Traditional Ecological Knowledge (TEK): definitions, theoretical advancement, epistemological concerns, principles, assumptions and components, categories of ethnoecological classification. (iii) TEK and biodiversity conservation: traditional resource management (TRM) system (with reference to

Nepal), community institutions and conservation practices, application of integrating TEK in biodiversity assessment and conservation planning. (iv) Sustainable production and harvest of biological resources: concept, approaches and practices with focus on non-timber forest products. (iv) Conservation instruments: laws, strategies, action plans, international conservation agreements. **10 h** (1+3+2+2+2)

Course title: Conservation Biology	**Total credit:** 1
Course No: BEM 552	**Full marks**: 25
Nature of the course: Practical	**Pass marks**: 12.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 16×4

Objectives: The overall aim of this course is to provide practical and analytical knowledge related to the principles and approaches of biodiversity conservation.

Course Contents:

1. ***Biodiversity conservation: setting priority for action*** 1.1 Threat value and vulnerability indices

2. ***Population-level study***
   2.1 Population structure and size
   2.2 Population modelling and analysis of population dynamics and viability/extinction risks through population models using secondary data (*using RAMAS-meta Pop or 'Ecolab' software)*

3. ***Field Visit:***

   a. Ecosystem- and landscape-level study

   3.1 Assessment of habitat/landscape heterogeneity and assessment of status of biodiversity

   3.2 Observe conservation action and review operation/management plan of a protected area or a community forest.

   b. Participatory research for TEK and TRM

   3.3 Documentation of TEK (structural, relational and utilitarian aspect): land, plants, animals

   3.4 Document traditional resource management system

   c. Post field study: field data analysis and report writing

4. ***Term Paper and Seminar***

5. ***Report/Mini Dissertation***

TEXT AND REFERENCE BOOKS

Akçakaya H.R., Burgman M.A. and Ginzburg L.R. 1999. *Applied Population Ecology*. Sinauer Associates, Inc. Sunderland, MA, USA.

Krebs C.J. 2001. *Ecology: the Experimental Analysis of Distribution and Abundance.* Fourth Edition. Addison-Wesley Educational Publishers, Inc., USA.(Fifth edition).

Primack R.B. 2006. *Essentials of Conservation Biology*. Fourth Edition. Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.

SUGGESTED FURTHER READINGS

Burroughs W.J. 2001. *Climate Change: A Multidisciplinary Approach*. Cambridge University Press.

Cunningham A.B., 2001. *Applied Ethnobotany:People, Wild Plant Use and Conservation*. Earthscan, London, UK.

Eiedler L.P. and Jain S.K. (eds.). 1992. *Conservation Biology: the Theory and Practice of Nature Conservation, Preservation and Management*. Chapman and Hall, NY, USA.

Ghimire S.K., Sapkota I.B., Oli B.R. and Parajuli R.R. 2008. *Non-Timber Forest Products of Nepal Himalaya: Database of Some Important Species Found in the Mountain Protected Areas and Surrounding Regions*. WWF Nepal, Kathmandu.

GoN 2014. *Nepal National Biodiversity Strategy and Action Plan 2014-2020*. Government of Nepal Ministry of Forests and Soil Conservation, Kathmandu, Nepal.

Groom M.J., Meffe G.K., and Carroll C.R. 2005. *Principles of Conservation Biology*, 3rd edition. Sinauer Associates Inc.

Hamilton A. and Hamilton P. 2006. *Plant Conservation: An Ecosystem Approach*. Earthscan, London, UK.

Hubel S.P. 2001. *The Unified Neutral Theory of Biodiversity and Biogeography*. Princeton University Press, Princeton and Oxford.

Huston M.A. 1994. *Biological Diversity: The Coexistence of Species on Changing Landscapes*. Cambridge University Press, UK.

Laird S. (ed.), 2002. *Biodiversity and Traditional Knowledge: Equitable Partnerships in Practice*. Earthscan, London, UK.

Lomolino, M.V., Riddle, B.R. and Brown, J.H. 2006. *Biogeography*. Sinauer Associates, Inc. Massachusetts, USA (Third edition).

Magurran, A. E., Magurran, A. E. (1988). Ecological diversity and its measurement. Princeton university press, Princeton

Martin G.J. 1995. *Ethnobotany: a Methods Manual*. Chapman & Hall, London, UK.

Primak, R.B., Paudel, P.K., Bhattarai, B.P. (2013) *Conservation Biology: A Primer for Nepal*. Dreamland Publications, Kathmandu, Nepal.

Shrestha T.B. and Joshi R.M. 1996. *Rare, Endemic and Endangered Plants of Nepal*. WWF Nepal Program, Kathmandu, Nepal.

Silvertown J. 1987. *Introduction to Plant Population Ecology*. Second Edition. Longman Scientific & Technical, UK.

Soulé M.E. (ed.). 1986. *Conservation Biology*: *The Science of Scarcity and Diversity*. Sinauer Associates, USA.

Soulé M.E. and Wilcox B.A. (eds.). 1980. *Conservation Biology: an Evolutionary-Ecological Perspectives*. Sinauer Associates, USA.

Tandon V., Bhattarai N.K. and Karki M. (eds.). 2001. *Conservation Assessment and Management Prioritization (CAMP) Report*. IDRC Canada/HMG Ministry of Forest and Soil Conservation, Kathmandu, Nepal.

Whittaker R.J., Araújo M.B., Jepson P., Ladle R.J., Watson J.E.M and Willis K.J. 2005. Conservation biogeography: assessment and prospect. *Diversity and Distributions* 11: 3-23.

Whittaker, R.J. and Fernández-Palacios, J.M. 2007. *Island Biogeography: Ecology, Evolution, and Conservation*, 2nd edn. Oxford University Press, Oxford.

Wilson E.O. 1988. *Biodiversity*. National Academic Press, Washington, D.C.

Wilson E.O. 1992. *The Diversity of Life*. Harvard Belknap, Cambridge.

Paper VII. Natural Resource Management

Course title: Natural Resource Management	**Total credit:** 3
Course No: BEM 553	**Full marks**: 75
Nature of the course: Theory	**Pass marks**: 37.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 48

OBJECTIVES

After completing the course students will have broad concept about environment and natural resources management. They will learn the valuation techniques of resources and externalities. After completing this course, student will be able to:

- Identify managers of environment and natural resources with their roles.
- Learn about externalities of environment and policy measures to manage externalities.
- Apply appropriate valuation methods of environmental goods and services.
- Value property right regimes on Natural Resource Management.
- Distinguish categories of production systems and uses of wild resources.
- Know sustainability principles focused to conserve environment and natural resources.
- Grasp knowledge about cost-benefit analysis and decision criterion for project development.
- Value biological resources and their use categories.

COURSE CONTENTS

Unit 1. Natural resource management, theories, politics and policies: theory of access to common property; (i) Environmental management: concept; environmental managers; uncertainty; predictability; environmental worldviews, attitudes and discourses; (ii) Environmental management politics and policies: power and multi-layered environmental management, political aims and interests, conflicts and cooperation in environmental management, policy dimensions in multi-layered environmental management, policy making characteristics and policy coalitions **17 h** (8+9)

Unit 2. Management measures of environmental externalities and economic valuation: (i) Types of externalities; externalities in resource management; (ii) Environment policy measure for managing externalities; (iii) Concept of economic values: consumptive and non-consumptive value, total economic value; (iv) Valuation methods: direct and indirect methods; contingent valuation. **7 h** (1+2+2+2)

Unit 3. Natural resource management: Materials and resources; types of natural resources; concept about institutions, state and community; property regimes and natural resource;

formation of property rights; rights and rules in bio-resources; management of common property resources. **6 h**

Unit 4. Production system and sustainable development: (i) Production system: Land tenure; cropping systems; livestock systems; fish farming; organic farming; (ii) Sustainable development: anthropocentric and eco-centric perspective; weak and strong sustainability theses; discounting and intergenerational issue; preservation and utilization. **6 h** (3+3)

Unit 5. Project appraisal: (i) Social wealth maximization: Pareto criterion and consumer's surplus; (ii) Cost-benefit analysis; (iii) Decision criteria: discounting formulae and tables; common quantitative methods for decision making **5 h** (1+2+2)

Unit 6. Bio-resources and their uses: (i) Forest and forestry: forest structure, forest dynamics, timber extraction, management alternatives, tree plantation; (ii) Savannas: structure and floristic composition, savanna environments, herbivores and herbivory, savanna fire; (iii) Wildlife: Importance of wildlife, components of wildlife habitat, wildlife habitat management,approaches to wildlife conservation and management, Successes in wildlife conservation and management in Nepal; (iv) Non-timber forest products: concept, categories, policy and management **7 h** (2+2+2+1)

Course title: Natural Resources Management	**Total credit:** 1
Course No: BEM 554	**Full marks**: 25
Nature of the course: Practical	**Pass marks**: 12.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 16×4

COURSE CONTENTS

1. Natural resource management in Community Forest
2. Natural resource management in Buffer Zone areas
3. Wildlife management in protected areas
4. Natural resource management in Botanical gardens
5. Observation of wildlife habitat management techniques (wetland, grassland, Savanna, forest, shrubland, control of natural succession-grass cutting, shrub/tree uprooting, control fire, fire line creating/management
6. Project appraisal of small scale natural resource base enterprise development.

TEXT AND REFERENCE BOOKS

FAO 2004.*National Forest Inventory Field Manual Template*.Food and Agriculture Organization, UN.

Gopal R. 1992.*Fundamentals of Wildlife Management*. Justice Home, India.

Grimble R. 1996. *Carrying Capacity: Sustainable Use and Demographic Determinants of Natural Habitats and Ecosystem Management*. The World Bank.

Hanna S.S., Folke C., and Maler K.G. 1996.*Right to Nature: Ecological, Economic, Cultural, and Political Principles of Institutions for the Environment*. Island Press, Washington DC.

International Atomic Energy Agency 1989.*Feeding Strategies for Improving Productivity of Ruminant Livestock in Developing Countries*.International Atomic Energy Agency, Vienna.

Kochhar S.L. 1992. *Economic Botany in the Tropics*. Macmillan.

Odum E.P. 1997. *Ecology: a Bridge Between Science and Society*. Sinauer Associates, Inc. Publishers, USA.

Schwartz H. J. 1988.*Improving the Utilization of Natural Resources in Arid Areas of Africa Through Multiple Species Grazing Systems*. Technical University of Berlin.

Sharma B. K. 2014. *Bio-resources of Nepal*.S Sharma, Nepal.

Turner R.K. 1993. *Sustainable Environmental Economics and Management Principles and Practice*. Belhaven Press.

Upton M. 1996. *The Economics of Tropical Farming Systems*.Cambridge University Press.

Wilson G.A. and Bryant R.L. 1997.*Environmental Management: New Directions for the Twenty-First Century*. UCL Press.

Paper VIII. Environmental Change and Management

Course title: Environmental Change and Management	**Total credit:** 3
Course No: BEM 555	**Full marks**: 75
Nature of the course: Theory	**Pass marks**: 37.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 48

OBJECTIVES

The objectives of the course are (i) to familiarize students with the various environmental problems, (ii) to understand the impact of environmental changes on biological systems, and (iii) to discuss control measures of the environmental problems.

COURSE CONTENTS

Unit 1. Environmental ethics: concept and application **1 h**

Unit 2. Environmental pollution: 1) Water pollution (sources and impacts, waste water treatments, biological monitoring of water quality); 2) Air pollution (sources and impacts, acid rain, ozone layer depletion, air quality monitoring); 3) Soil/land pollution (sources and impacts, solid waste management); 4) Noise pollution: sources, impacts and control; 5) Hazardous wastes: types, sources, impacts and management; 6) Chemical fertilizers: trends of fertilizer uses, ecological impacts, efforts to minimize fertilizer uses; 7) Pesticides: trends of pesticide uses, types and persistence, environmental and health hazards, efforts to minimize pesticide uses. **12 h** (2+2+1.5+1+2+1.5+2)

Unit 3. Climate change: 1) Introduction: climate vs. weather, climate change vs. climate variability, historical account of climate change research, climate change denialism; 2) Components and causes of climate change; 3) Patterns of climate change: global and regional patterns of changes in temperature, precipitation, extreme events; 4) Climate change impacts on biodiversity/ecosystem, agriculture, water resources, and human health; 5) Tools to study climate change; 6) Mitigation and adaptation including policy related to climate change.

12 h (2+2+2+2+2+2)

Unit 4. Land use and land cover change: 1) Patterns, causes and impacts of land use and land cover changes; 2) Deforestation and global carbon dynamics in the context of REDD; 3) Ecological impacts of infrastructure development and urbanization; 4) Biodiversity in modified ecosystems: urban area, agroecosystem; 5) Restoration ecology: Conceptual framework; restoration of degraded ecosystems: river, forest, and landslide area.

11 h (2+2+2+1+4)

Unit 5. Biological invasion (11 h): 1) Introduction and terminology; 2) Invasion process: dispersal, establishment, persistence and spread, and evolution; 3) Life history traits of

invasive alien species: plants and animals; 4) Theories related to biological invasion: Enemy release hypothesis, Darwin's naturalization hypothesis, Evolution of increased competitive ability hypothesis, Novel weapons hypothesis, Fluctuating resources hypothesis, Biotic resistance hypothesis, Invasional meltdown; 5) Impacts: ecological, evolutionary, economic and health; 6) Management of invasive alien species; 7) Overview (diversity, distribution, spread and management) of invasive alien species in Nepal. **12 h** (1+2+1+3+1+2+2)

Course title: Environmental Change and Management	**Total credit:** 1
Course No: BEM 556	**Full marks**: 25
Nature of the course: Practical	**Pass marks**: 12.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 16×4

COURSE CONTENTS

A. Experiments

1. To determine dissolved oxygen and biochemical oxygen demand in given water samples.
2. To analyze the effect of industrial effluent on seed germination.
3. To estimate chlorophyll content in leaves of polluted and non polluted sites
4. To analyze temperature and precipitation trends of the different parts of Nepal.
5. To study the handling techniques of increment borer and examine tree rings.
6. To estimate carbon stock (vegetation + soil) of the forest stands
7. To perform a rapid assessment of invasive alien plant species in a locality.
8. To assess germination response of native and naturalized plant species to allelopathic effects of invasive alien species.
9. To study the impact of invasive alien plants on species diversity.

B. Case study (one case study by each student)

TEXT AND REFERENCE BOOKS

Burroughs WJ. 2001. *Climate Change: A Multidisciplinary Approach*. Cambridge University Press.

CloutM.N. and Williams P.A. (eds.). 2009. *Invasive Species Management*. Oxford University Press, UK

Davis M.A. 2009. *Invasion Biology*. Oxford University Press, UK.

Hobbs RJ and DA Norton. 1996. Towards a conceptual framework for restoration ecology. *Restoration Ecology* 4(2): 93-110.

IPCC 2013. Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kannan K. 1997. *Fundamentals of Environmental Pollution*. S. Chand & Company Ltd, New Delhi, India.

Lambin EF and H Geist (eds.). 2006. *Land Use and Land Cover Change: Local Process and Global Impact*. Springer.

Molders N. 2012. *Land Use and Land Cover Change: Impacts on Climate and Air Quality*. Springer.

Parmesan C. 2006. Ecological and evolutionary responses to recent climate changes. *Annual Review of Ecology, Evolution and Systematics* 37: 637-669.

Rana SVS. 2010. *Essentials of Ecology and Environmental Science*. Fourth edition. PHI Learning Private Limited.

Rolston H, III. 2003. Environmental Ethics. In: *The Blackwell Companion to Philosophy* (N. Bunnin and E.P. Tsui-James (eds.)), pp. 517-530, Blackwell Publishers Ltd.

Singh J.S., SP Singh and S.R. Gupta. 2006. *Ecology, Environment and Resource Conservation*. Anamaya Publishers, New Delhi, India.

Tiwari S., Adhikari B, Siwakoti M. and Subedi K. 2005. *An Inventory and Assessment of Invasive Alien Plant Species of Nepal*. IUCN Nepal, Kathmandu.

Wittenberg R. and Cock M.J.W. (eds.). 2001. *Invasive Alien Species: A Toolkit of Best Prevention and Management Practices*. CAB International, Wallingford, Oxon, UK.

Williamson M. 1996. *Biological Invasion.* Chapman and Hall, London, UK.

Paper IX. Geographic Information System and Remote Sensing

Course title: Geographic Information System and Remote Sensing	**Total credit:** 2
Course No: BEM 557	**Full marks**: 50
Nature of the course: Theory	**Pass marks**: 25
Level: M.Sc. BEM, II semester	**Lecture hours**: 32

OBJECTIVES

General Objective

- To educate students about the practical application of Remote Sensing (RS), Geospatial Information Science (GIS) and Global Positioning System (GPS) for biodiversity promotion and analysis.

Specific Objectives

- Key concepts of geospatial information science, GPS, and some key words
- Understand why GI Science, GPS, and RS are important and useful for assessment and analysis of spatial information of biodiversity.
- Application of geospatial data and their analysis for supporting decision-makers to biodiversity conservation

COURSE CONTENTS

Part I: Geographical Information Science and System (GIS)

Unit 1. Fundamentals of GIS: Definition, some terms, Components, Scope, and Development in global context and in Nepal. **2 h**

Unit 2. Geographic data (spatial data): Geo-referenced data, data structure- (raster, vector), layers, theme, topology; Sources of georeferenced data; Attribute referenced data – socio-economic data, feature attribute data; Time referenced data; Concept of database management, Geodatabase. **2 h**

Unit 3. Projection and Transformation: Definition and types of projection – coordinate system, datum; Concept of map extension and shape, size, scale, and direction. **5 h**

Unit 4. Concept of Data Handling in GIS Software: Vector data handling; Raster data handling; Application of different GIS software. **2 h**

***Unit 5. Accuracy and Errors in spatial data handling*:** Sources of errors; Concept of Root Mean Square (RMS) errors; Editing and rectification of errors; Propagation of errors. **3 h**

Part II: Remote Sensing

Unit 1. Fundamentals of Remote Sensing: Definition; Stages of remote sensing; History and development of data acquisition; Energy sources and radiation principles – principles of wavelength, Electro Magnetic Radiation (EMR) spectrums, Spectral characteristics or bands; Energy interactions – scattering in the atmosphere, absorptions in the atmosphere, incident energy, reflectance energy, absorbed energy and transmitted energy; Concept of reflectance of EMR and difference of reflectance in vegetation, soil, and water. **7 h**

Unit 2. Sensor platforms, types and characteristics: Different sensors developed in the global arena – optical, geostationary, sun synchronies, active, passive, hyperspectral, sterio pairs, thermal, etc; Resolution – spectral, radiometric, temporal, spatial. **7 h**

Unit 3. Characteristics of RS data: Concept of digital image, digital numbers (DN), image enhancement, pixel, reflectance curve; Three D view; Types of Satellite Imagery , noise and correction. **2 h**

Part 3: Global Positioning System

Concept of GPS and GIS application to capture real world data, Concept of biodiversity data, infrastructure, other location etc, GPS data overlaid on the GIS map and prepare the Spatial analysis map; Specific Application of RS, GIS & GPS: Forest cover mapping, Forest inventory, Forest change detection, Bio-mass estimation, Biodiversity management. **2 h**

Course title: Geographic Information System and Remote Sensing	**Total credit:** 2
Course No: BEM 558	**Full marks**: 50
Nature of the course: Practical	**Pass marks**: 25
Level: M.Sc. BEM, II semester	**Lecture hours**: 32×4

COURSE CONTENTS

1. Report preparation using GIS

- Data Entry – Creating shape files/coverage of vector data structure, screen digitize, geo-reference of shape files, transformation and projection
- Data management and manipulation, spatial data management, attribute data management
- Operating spatial tools – extraction, overlay, proximity, geostatitics, generalization, network analysis, surface generation and interpolation from different data layers
- Cartographic design and map production (Project work)
- Application of GIS for biodiversity (Report writing)

- Visual interpretation of land cover and land use like water, soil, and vegetation from the multiband, images, reading the image and identify the geographical features
- Download raw data from the internet data, data conversion, projection, rectification, based radiometric, spectral, spatial enhancement.

2. Report preparation based on RS layer

- Data overlaying to Google earth
- Accuracy Assessment (Confusion matrix).

3. Understanding the GIS and RS in biodiversity analysis: a case study

TEXT AND REFERENCE BOOKS

Jensen JR. 2013. *Remote Sensing of the Environment: An Earth Resource Perspective*. Pearson

Lillesand TM and RW Kiefer. 1994. *Remote Sensing and Image Interpretation*. John Wiley & Sons, New York.

Longley PA, MF Goodchild, DJ Maguire and DW Rhind. 2015. *Geographic Information Science and Systems*. John Wiley & Sons, Inc.

Otto H and RA de By. 2001. *Principles of Geographic Information System*. The International Institute for Geo-Information Science and Earth Observation (ITC), Hengelosestraat 99 Enschede, The Netherlands.

Sabins FF. 1987. *Remote Sensing, Principles and Interpretation*. 2nd Ed. W.H. Freeman & Company, New York.

Tempfli K, N Kerle, GC Huurneman and LLF Jansees. 2001. *Principles of Remote Sensing: An Introductory Textbook*. Institute for Geo-Information Science and Earth Observation (ITC), Hengelosestraat 99 Enschede, The Netherlands.

Paper X. Term paper and Seminar II

Course title: Term paper and seminar II	**Total credit:** 1
Course No: BEM 559	**Full marks**: 25
Nature of the course: Term paper and Seminar	**Pass marks**: 12.5
Level: M.Sc. BEM, II semester	**Lecture hours**: 16×4

Objectives:

- Develop skill to review scientific literatures, and their synthesis
- Develop skill for presentation and discussion in scientific meeting.