

**Sacred Heart College (Autonomous)**

**Department of Zoology**

**Master of Science [Zoology]**

**Course plan**

**Academic Year: 2017 – 18**

**Semester IV**

**Course I3: 16P4ZOOT13: ENVIRONMENTAL SCIENCE: CONCEPTS AND APPROACHES**

<b>PROGRAMME</b>	<b>MASTER OF SCIENCE [ZOOLOGY]</b>	<b>SEMESTER</b>	<b>4</b>
<b>COURSE CODE AND TITLE</b>	<b>16P4ZOOT13: ENVIRONMENTAL SCIENCE: CONCEPTS AND APPROACHES</b>	<b>CREDIT</b>	<b>5</b>
<b>HOURS/WEEK</b>	<b>5</b>	<b>HOURS/SEM</b>	<b>90</b>
<b>FACULTY NAME</b>	<b>MONCEY VINCENT &amp; MATHEW M.J.</b>		

<b>COURSE OBJECTIVES</b>
<b>To examine the concepts of physical environment – Lithosphere, atmosphere and hydrosphere</b>
<b>To differentiate the fundamental and advanced concepts of weather and climate</b>
<b>To know about the climate of India</b>
<b>To examine the concepts of Landscape ecology</b>
<b>To appreciate the need for Biodiversity Conservation</b>
<b>To evaluate the major environmental/conservation laws and rules and biogeography of India</b>
<b>To examine the concepts of biological invasions</b>

<b>SESSION</b>	<b>TOPIC</b>	<b>LEARNING RESOURCES</b>	<b>VALUE ADDITIONS</b>	<b>REMARKS</b>
<b>Module I. The Physical Environment</b>				
<b>1</b>	<b>Lithosphere - Weathering and soil formation,</b>	<b>Lecture with Visual supplements</b>	<b>Q &amp; A Session</b>	
<b>2</b>	<b>Soil colloids, adsorption and exchange of anions and cations.</b>	<b>Lecture with Visual supplements</b>		
<b>3</b>	<b>Role of microbes in soil, types of soil, soil profile</b>	<b>Lecture with Visual supplements</b>		
<b>4</b>	<b>Classification of rocks and their environmental significance.</b>	<b>Lecture with Visual supplements</b>		
<b>5</b>	<b>Classification of folds and faults and their environmental significance.</b>	<b>Lecture with Visual supplements</b>		
<b>6</b>	<b>Classification of dykes and their environmental significance.</b>	<b>Lecture with Visual supplements</b>		

7	Geomorphological processes-plate tectonics, sea floor spreading, mountain building.	Lecture with Visual supplements		
8	Geomorphological processes- Evolution of continents and structural deformation.	Lecture with Visual supplements		
9	Atmosphere -Physico-chemical characteristics, divisions, composition and significance of atmospheric components.	Lecture with Visual supplements		
10	Hydrosphere -Visible and invisible hydrosphere, Range of aquatic habitats,	Lecture with Visual supplements		
11	Hydrosphere -Visible and invisible hydrosphere, Range of aquatic habitats contd...	Lecture with Visual supplements		
12	Water cycles between earth and the atmosphere,	Lecture		
13	Global water balance, ice sheets, origin and composition of sea water	Lecture with PowerPoint		
14	Global water balance, ice sheets, origin and composition of sea water contd..	Lecture with PowerPoint		
15	Sea level changes	Lecture with PowerPoint	video	
16	River basins and watershed.	Lecture with PowerPoint	video	
17	Physico-chemical characteristics of water- diffusion of oxygen from the atmosphere to surface waters.	Lecture with PowerPoint		
18	Influence of pH, turbidity and light on aquatic life.	Lecture with PowerPoint		
19	Influence of pH, turbidity and light on aquatic life.contd..	Lecture with PowerPoint		
20	Revision			
<b>Module II. Weather and Climate</b>				
21	Definitions and scope of climatology, weather and climate	Lecture with PowerPoint	Q & A Session	
22	Components of climate system	Lecture with PowerPoint		
23	Earth's thermal environment, earth intercepts solar radiation, seasonal variation in intercepted solar radiation	Lecture with PowerPoint		
24	Air temperature in relation to altitude, global circulation of air masses	Lecture with PowerPoint		
25	Wind and earth's rotation on ocean currents	Lecture with PowerPoint	video	
26	Influence of temperature on moisture content of air, global pattern of precipitation, influence of topography on regional pattern of precipitation.	Lecture with PowerPoint		
27	Classification of climate-Koepfen's classification and Thornthwaite's scheme, climatic types and zones.	Lecture with PowerPoint		
28	Global climatic phenomena-El Nino and La Nina, causes and factors of climate change.	Lecture with PowerPoint		

29	Effect of climate change on ecosystems and human welfare. Organisms and microclimate.	Lecture with PowerPoint		
30	International Agreements on Climate Change – UNFCCC - 1992	Lecture with PowerPoint		
31	Kyoto Protocol – 1997 Copenhagen accord, Paris agreement - 2015	Lecture with PowerPoint	Debate	
32	Revision			
33	CIA-1			
<b>Module III. Climate of India</b>				
34	Climatic regions of India, tropical monsoon climate-onset	Lecture with PowerPoint	Q & A Session	
35	Rain bearing systems and influence of oceanic and continental factors on rain.	Lecture with PowerPoint		
36	Break in the monsoon, retreat of monsoon.	Lecture with PowerPoint		
37	Monsoon in Kerala	Lecture with PowerPoint		
<b>Module IV. Landscape Ecology</b>				
38	Land and Landscape processes; Hierarchy: ecosystems to land units;	ICT Enabled (ppt & images, video clippings); discussion	Q & A Session	
39	Ecological principles at work with Landscapes	ICT Enabled (ppt & images, video clippings); discussion		
40	Concept of ecological land degradation desertification, water logging, salinisation and soil erosion	ICT Enabled (ppt & images, video clippings); discussion		
41	Concept of ecological land degradation desertification, water logging, salinisation and soil erosion..contd...	ICT Enabled (ppt & images, video clippings); discussion		
42	Ecological assessment of landscape for vegetation and habitats	ICT Enabled (ppt & images, video clippings); discussion		
43	Integrated analytical techniques- land suitability analysis and carrying capacity studies	ICT Enabled (ppt & images, video clippings); discussion		

44	Use of soil survey, aerial photos, topographic maps and other resource data in landscape management	ICT Enabled (ppt & images, video clippings); discussion		
45	Use of soil survey, aerial photos, topographic maps and other resource data in landscape management contd..	ICT Enabled (ppt & images, video clippings); discussion		
46	Revision			
<b>MODULE V. Biodiversity and Conservation</b>				
47	Types of biodiversity-wild biodiversity, agro-biodiversity, domesticated biodiversity	ICT Enabled (ppt & images, video clippings); discussion		
48	Types of biodiversity-wild biodiversity, agro-biodiversity, domesticated biodiversity contd..	ICT Enabled (ppt & images, video clippings); discussion		
49	Values of biodiversity	ICT Enabled (ppt & images, video clippings); discussion		
50	Values of Biodiversity contd...	ICT Enabled (ppt & images, video clippings); discussion		
51	Ecosystem functions and biodiversity, mobile links and valuating ecosystem services	ICT Enabled (ppt & images, video clippings); discussion		
52	Drivers of biodiversity loss	ICT Enabled (ppt & images, video clippings); discussion		

53	Tools and techniques for biodiversity estimation- biodiversity indices	ICT Enabled (ppt & images, video clippings); discussion		
54	Tools and techniques for biodiversity estimation	ICT Enabled (ppt & images, video clippings); discussion		
55	Tools and techniques for biodiversity estimation contd....	ICT Enabled (ppt & images, video clippings); discussion		
56	Strategies for biodiversity conservation- In-situ conservation: sanctuaries, biospheres reserves, national parks, nature reserves, preservation plots.	ICT Enabled (ppt & images, video clippings); discussion		
57	Ex-situ conservation: botanical gardens, zoos, aquaria, homestead garden; herbarium.	ICT Enabled (ppt & images, video clippings); discussion		
58	In-vitro Conservation: germplasm and gene bank; tissue culture: pollen and spore bank, DNA bank. GEF-World Bank initiatives	ICT Enabled (ppt & images, video clippings); discussion		
59	Biodiversity hotspots and their characteristics, global distribution	ICT Enabled (ppt & images, video clippings); discussion		
60	National and international programmes and agencies for biodiversity conservation and environmental management: UN Conventions and Protocols, CBD, IUCN, WCMC, WRI	ICT Enabled (ppt & images, video clippings); discussion		
61	WWF, CI, CITES, TRAFFIC, Green Peace. National and Local NGOs. UNFCCC and IPCC	ICT Enabled (ppt & images,		

		video clippings); discussion		
62	National Board of Biodiversity, State Board of Biodiversity	ICT Enabled (ppt & images, video clippings); discussion		
63	Ecosystem people and traditional conservation strategies	ICT Enabled (ppt & images, video clippings); discussion		
64	People's participation in conservation-PFM, Community reserves, Sacred groves,	ICT Enabled (ppt & images, video clippings); discussion		
65	Biovillages, People's Biodiversity Register (PBR). Biodiversity Management Committee (BMC).	ICT Enabled (ppt & images, video clippings); discussion		
66	Wildlife values and eco-tourism, wildlife distribution in India. Threatened animals of India.	ICT Enabled (ppt & images, video clippings); discussion	Group Discussion	
67	Restoration Ecology- need and policies, case studies and success stories - global and national;	ICT Enabled (ppt & images, video clippings); discussion		
68	Restoration Ecology- need and policies, case studies and success stories - global and national contd..	ICT Enabled (ppt & images, video clippings); discussion		
69	Restoration Ecology- need and policies, case studies and success stories - global and national contd..	ICT Enabled (ppt & images, video clippings); discussion		

70	Revision			
71	CIA-2			
<b>MODULE VI. Major environmental/conservation laws and rules in India</b>				
72	Wildlife Protection Act 1972 amended 1991, Forest Conservation Act, 1980	Seminar; discussion		
73	Air (Prevention and Control of Pollution) Act 1981, Water (Prevention and Control of Pollution) Act 1974, amended 1988,	Seminar; discussion		
74	The Environment Protection Act, 1986 and Rules, 1991. The Biological Diversity Act 2002, Rules 2004	Seminar; discussion		
75	Coastal Regulation Zone (CRZ) Notification 1991 & 2011 – Classification of Coastal Zones and regulation of developmental activities.	Seminar; discussion	Group Discussion	
<b>MODULE VII. Biogeography</b>				
76	Major terrestrial Biomes	ICT Enabled (ppt & images, video clippings); discussion		
77	Theory of island biogeography	ICT Enabled (ppt & images, video clippings); discussion		
78	Bio-geographical zones of India	ICT Enabled (ppt & images, video clippings); discussion		
79	Western Ghats and its significance	ICT Enabled (ppt & images, video clippings); discussion		
80	Western Ghats and its significance contd...	ICT Enabled (ppt & images, video clippings); discussion	Group discussion	
<b>MODULE VIII. Biological Invasions</b>				
81	Introduction Elton's hypothesis	Seminar; discussion		



82	Invasion patterns and process biological attributes for invasion: Reproductive potential, Allelopathy Phenotypic plasticity, fitness to the new environment.	Seminar; discussion		
83	Invasion patterns and process biological attributes for invasion: Reproductive potential, Allelopathy Phenotypic plasticity, fitness to the new environment...contd..	Seminar; discussion		
84	Hypotheses for invasion success: Natural enemy hypothesis evolution of invasiveness hypothesis, empty niche hypothesis, novel weapon hypothesis, disturbance hypothesis and Propagule pressure hypothesis.	Seminar; discussion		
85	Invasive alien species of India (plants and animals).	Seminar; discussion		
86	Databases of biological invasions.	Seminar; discussion		
87	Impacts and management of invasions: impacts of exotics on biodiversity, productivity, nutrient cycling	Seminar; discussion		
88	Management: Bio-control programmes, mechanical and chemical control Positive utilization Quarantine	Seminar; discussion		
89	EIA of biological invasion	Seminar; discussion		
90	Revision			

#### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	12/01/2018	Environmental Acts Rules
2	19/01/2018	Biological Invasions

#### GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	10/02/2018	Pros and cons of CRZ acts and rules (Group Discussion)

## References

- Alongi, D. M. 1998. Coastal Ecosystem Processes. CRC Press, New York.
- Chapman, G.P. 1977. Human and Environmental Systems: A Geographer's Appraisal. Academic Press, London.
- Chapman, J.L. and Reiss, M.J. 2005. Ecology: Principles and Applications. Cambridge University Press, London.
- Elton, C.S. 1958. The Ecology of Invasion by Plants and Animals. Methuen, London.
- Forman, R.T. 1995. Land Mosaics: The Ecology of Landscapes and Regions. Cambridge Univ. Press, Cambridge, UK.
- Forman, R.T.T. and Godron, M. 1986. Landscape Ecology. John Wiley & Sons, New York.
- Fox, C.W., Roff, D.A. and Fairbairn, D.J. 2001. (Eds.). Evolutionary Ecology: Concepts and Studies. Oxford University Press.
- Krebs, C.J. 2008. Ecology: The Experimental Analysis of Distribution and Abundance. (6th edn.). Benjamin Cummings Publ., USA.
- Krishnamurthy, K.V. 2004. An Advanced Textbook on Biodiversity: Principles and practice. Oxford and IBH. Publ. Co. New Delhi.
- Kurian Joseph and Nagendran, R. 2004. Essentials of Environmental Studies. Pearson Education( Singapore) Pvt.Ltd.New Delhi.
- Levin, S. A. 2000. (Ed.). Encyclopedia of Biodiversity. Academic Press.
- Mayhew, P.J. 2006. Discovering Evolutionary Ecology: Bringing Together Ecology and Evolution. Oxford University Press.
- Miller, G.T. 2004. Environmental Science. Thomson, California.
- Odum, E.P. and Barrett, G. W. 2005. Fundamentals of Ecology. Thomson Asia Pvt. Ltd., Singapore
- Primack, R.B. 1998. Essentials of Conservation Biology. Sinauer Associates.
- Pullin, A.S. 2002. Conservation Biology. Cambridge University Press, UK.
- Ray, J.G. 2010. Basic Principles of Ecology and Environment. Pratibha Publications, Changanacherry, Kerala.
- Ramakrishnan, P.S. 1991. Ecology of Biological Invasion in the Tropics. International Scientific Publications, New Delhi.
- Ramakrishnan, P.S. 1992. Shifting Agriculture and Sustainable Development. UNESCO, MAB, Paris.
- Rana, S.V.S. 2005. Essentials of Ecology and Environmental Science. Prentice Hall of India, New Delhi

- **Rose, M.R. and Mueller, L.D. 2006. Evolution and Ecology of the Organisms. Pearson Prentice Hall. Singh, J. S., Singh, S. P. and Gupta, S. R. 2006. Ecology, Environment, and Resource Conservation. Anamaya Publ., New Delhi.**
- **Smith, T.M. and Smith, R.L. 2006. Elements of Ecology. (6th edn.). Pearson. New Delhi**  
**Soule, M.E. 1986. (Ed.). Conservation Biology. Sinauer Associates, New York.**
- **Steiner, F. 1999. The Living Landscape: An Ecological Approach to Landscape Planning. (2nd edn.). McGraw Hill, Inc., New York.**
- **Steiner, F. 1999. The Living Landscape: An Ecological Approach to Landscape Planning, 2nd Edition. McGraw Hill, Inc., New York.**
- **Williamson, M. 1996. Biological Invasion. Chapman & Hall, London.**

**COURSE 14: 16P4ZOOT14: ENVIRONMENTAL POLLUTION AND TOXICOLOGY**

<b>PROGRAMME</b>	<b>MASTER OF SCIENCE [ZOOLOGY]</b>	<b>SEMESTER</b>	<b>4</b>
<b>COURSE CODE AND TITLE</b>	<b>16P4ZOOT14: ENVIRONMENTAL POLLUTION AND TOXICOLOGY</b>	<b>CREDIT</b>	<b>5</b>
<b>HOURS/WEEK</b>	<b>5</b>	<b>HOURS/SEM</b>	<b>90</b>
<b>FACULTY NAME</b>	<b>RAAGAM PM, RAJU M K &amp; VIDHU VIJAYAN</b>		

**COURSE OBJECTIVES**

<b>To understand the concepts of pollution</b>
<b>To understand air and water pollution</b>
<b>To understand the sources and the factors affected by soil pollution</b>
<b>To understand the management of solid waste, the various rules in place regarding hazardous waste, biomedical and plastic waste</b>
<b>To understand the concepts of noise, thermal and oil pollution</b>
<b>To understand the concepts of Radiation pollution</b>
<b>To understand the definition, doses and toxic chemicals in the environment</b>
<b>To understand occupational toxicology, toxicity testing and biomonitoring of toxic chemicals</b>

Sessi on	Topic	Method of Teaching	Value Additions	Remarks
<b>Module I. Introduction</b>				
1	Brief history of human civilization, industrialization and urbanization	Lecture	Q & A Session	
2	Definition of pollution. Different types of pollution	Lecture with interaction		
3	Air, Water and soil and their local, regional and global aspects.	„		
<b>Module II: Air pollution</b>				
4	Sources and classification of air pollution	ICT Enabled (ppt & images, video clippings)	Q & A Session	
5	Particulates and gaseous pollutants in the atmosphere.	ICT Enabled (ppt & images, video clippings)		
6	Primary and secondary pollutants.	ICT Enabled (ppt & images, video clippings)		
7	Effects of air pollutants on human health, animals, vegetation, materials and structures.	ICT Enabled (ppt & images, video clippings)		
8	Air pollution monitoring - methods	ICT Enabled (ppt & images, video clippings)		
9	Air pollution monitoring – methods.Contd..	ICT Enabled (ppt & images, video clippings)		
10	Air pollution monitoring – methods.Contd..	ICT Enabled (ppt & images, video clippings)		
11	Air quality standards; ISI, EPA.	ICT Enabled (ppt & images, video clippings)		
12	Sampling and measurement of particulate matters (SPM)	ICT Enabled (ppt & images, video clippings)		
13	Gaseous pollutants, CO <sub>2</sub> , CO, NO <sub>x</sub> , SO <sub>2</sub> , H <sub>2</sub> S, oxidants, ozone and hydrogen fluoride.	ICT Enabled (ppt & images, video clippings)		
	CIA I	1 hr; descriptive answers only		
14	Control of gaseous emission: adsorption by liquids, adsorption by solids, combustion and condensation.	ICT Enabled (ppt & images, video clippings)		
15	Control of SO <sub>2</sub> , NO <sub>x</sub> , CO, CO <sub>2</sub> and hydrocarbons.	ICT Enabled (ppt & images, video clippings)		
16	Control of SO <sub>2</sub> , NO <sub>x</sub> , CO, CO <sub>2</sub> and hydrocarbons.contd...	ICT Enabled (ppt & images, video clippings)	Quiz	

<b>Module III. Water Pollution</b>				
17	Sources of water pollution-Domestic (municipal sewage), industrial and agricultural.	Lecture and interaction	Q & A Session	
18	Health effects of water pollution	„		
19	Water borne and water related diseases.	„		
20	Effects of water pollution on aquatic system.	„		
21	Water quality standard for potability - Pollution parameters, BOD, COD, Coliform bacteria.	„		
22	Treatment of water for potable purpose (mixing, sedimentation, coagulation, filtration and disinfection)	„		
23	Primary and secondary treatment	„		
24	Sludge disposal. Biological treatment	„		
25	Kinetics of Biological growth- activated sludge treatment	Lecture and interaction		
26	Trickling filters - anaerobic digestion	„		
27	Combined aerobic and anaerobic treatment process, aerobic process	„		
28	Advanced waste water treatment - removal of dissolved organics and inorganic - precipitation	„		
29	Ion exchange, reverse osmosis, electro dialysis, adsorption and oxidation.	„		
30	Removal of nutrients	„		
31	Removal of heavy metals - overall waste water treatment for sewage water.	„	Quiz	
<b>Module IV. Soil Pollution</b>				
32	Introduction	Lecture	Q & A Session	
33	Sources of soil pollution	ICT Enabled (ppt & images, charts)		
34	Agricultural, industrial and domestic.	ICT Enabled (ppt & images, )		
35	Hazardous waste compounds, formulations and classes of substances,	ICT Enabled (ppt & images, charts)		
36	Chemical classification of hazardous waste.	ICT Enabled (ppt & images, charts)		
37	Soil factors affected by pollution – physico-chemical	ICT Enabled (ppt & images, video clippings)		
38	Soil factors affected by pollution – biological impacts	ICT Enabled (ppt & images, video clippings)		
39	Case studies on soil pollution in wetland soils in Kerala	ICT Enabled (ppt & images, video clippings)		
40	Case studies on soil pollution in Highland soils in Kerala	ICT Enabled (ppt & images, video clippings)		

41	Control of soil pollution. Soil quality parameters and test methods.	ICT Enabled (ppt & images, video clippings)		
<b>Module V. Solid Waste Management</b>				
43	Municipal solid wastes (MSW) - quantities and characteristics	ICT Enabled (ppt & images, video clippings)		
44	Waste collection and transport, waste processing and resources recovery and recycling	ICT Enabled (ppt & images, video clippings)		
45	Aerobic and anaerobic systems- composting, vermicomposting	ICT Enabled (ppt & images, video clippings)		
46	Biodigesters (Biogas plants); incineration, pyrolysis, plasma pyrolysis; sanitary land fills and open dumping yards	ICT Enabled (ppt & images, video clippings)		
47	Management of plastic and e-waste	ICT Enabled (ppt & images, video clippings)		
48	Better management strategies (any two model case studies)	ICT Enabled (ppt & images, video clippings)		
49	Treatment process for unsegregated waste, fixation of hazardous solid waste prior to disposal	ICT Enabled (ppt & images, video clippings)		
50	Hazardous waste in land fill.	ICT Enabled (ppt & images, video clippings)		
51	Hazardous waste (Management and Handling) Rules 1989 - the Manufacture Storage and Import of Hazardous Chemicals Rules 1989 contd...	ICT Enabled (ppt & images, video clippings)		
52	Biomedical Waste (Management and Handling) Rules 1998	ICT Enabled (ppt & images, video clippings)		
53	Plastic Act 1999 and Extended producer responsibility.	ICT Enabled (ppt & images, video clippings)		
54	Revision and evaluation	ICT Enabled (ppt & images, video clippings)		
<b>Module VI. Noise, Thermal and Oil Pollution</b>				
55	Properties of sound and noise. Effects of noise on People and ecosystem	ICT Enabled (ppt & images, video clippings)	Q & A Session	
56	Basic principles of noise control	ICT Enabled (ppt & images, video clippings)		
57	National and International Standards	ICT Enabled (ppt & images, video clippings)		

58	Assessment and measurement of sound	ICT Enabled (ppt & images, video clippings)		
59	Thermal Pollution - causes and consequences (any two case studies)	ICT Enabled (ppt & images, video clippings)		
60	Oil pollution – causes and consequences (any two case studies)	ICT Enabled (ppt & images, video clippings)		
<b>Module VII. Radiation Pollution</b>				
61	Radiation pollution- Definition, Radioactivity, Radionuclide, Radiation emissions, sources	ICT Enabled (ppt & images, video clippings)		
62	Radioactive decay and buildup	ICT Enabled (ppt & images, video clippings)		
62-63	Biological effects of radiation	ICT Enabled (ppt & images, video clippings)		
64	Radioactive pollution impacts on ecosystem	ICT Enabled (ppt & images, video clippings)		
65	Nuclear reactor disasters (Any two case studies), safety standards.	ICT Enabled (ppt & images, video clippings)		
66	Nuclear reactor disasters (Any two case studies), safety standards contd.....	ICT Enabled (ppt & images, video clippings)		
<b>Module VII. Toxicology</b>				
67	Toxic chemicals in the Environment – Biochemical aspects of As, Cd, Pb, Hg, Cu, O3, PAN, pesticides, MIC and other carcinogens.	ICT Enabled (ppt & images, charts)		
68	Toxic chemicals in the Environment...contd...	ICT Enabled (ppt & images, charts)		
69	Toxic chemicals in the Environment...contd...	ICT Enabled (ppt & images, charts)		
70	Bio accumulation and biomagnification.	ICT Enabled (ppt & images, charts)		
71	Occupational toxicology	ICT Enabled (ppt & images, charts)		
72	Hazardous chemicals, disorders from chemical exposure at work,	ICT Enabled (ppt & images, charts)		
73	Assessment of occupational hazards.	ICT Enabled (ppt & images, charts)		
74	Toxicity testing; Bioassay – Definition, purpose, criteria for selection of test organism, methodology,	ICT Enabled (ppt & images, charts)		
75	Estimation of LC50,	ICT Enabled (ppt & images, charts)		
75	Limitation and importance of bioassay	ICT Enabled (ppt & images, charts)		



76	Acute toxicity (single); sub acute toxicity; chronic toxicity;	ICT Enabled (ppt & images, charts)		
77	Teratogenicity, carcinogenicity and mutagenicity.	ICT Enabled (ppt & images, charts)		
78	Biomonitoring of toxic chemicals, objectives	ICT Enabled (ppt & images, charts)		
79	Programs and Parameters	ICT Enabled (ppt & images, charts, video clippings)		
80	Concepts of bio indicators	ICT Enabled (ppt & images, charts, video clippings)		
81	Revision & Evaluation of the course	ICT Enabled (ppt & images, video clippings)		
82	Definition, scope and history of toxicology, Acute and chronic toxicity	ICT Enabled (ppt & images, video clippings)		
83	Selective toxicity, dose, synergism and antagonism.	ICT Enabled (ppt & images, video clippings)		
84	Dose – Response relationships – Graded response, quantal response, Time action curves	ICT Enabled (ppt & images, video clippings)		
85	Limit value (TLV); LC50; Margin of safety; Toxicity curves; Cumulative toxicity and LD50 and CTF	ICT Enabled (ppt & images, video clippings)		
	II CIA			
86	Revision and Evaluation			
87	Revision and Evaluation			
88	Revision and Evaluation			
89	Revision and Evaluation			
90	Revision and Evaluation			

#### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

S. No	Date of completion	Topic of Assignment & Nature of assignment (Individual – Written/Presentation – Graded or Non-graded etc)
1	11-12-2017	Pollution and man
2	24-01-2018	Carbon Footprint
3	02-02-2018	Soil pollution case studies

## TEXTBOOKS AND REFERENCES

- Butter, G.C.1988. *Principles of Ecotoxicology*. John Wiley and Sons.
- Cockerham, G.L. and Shane, B.S. 1994. (Eds.). *Basic Environmental Toxicology*. CRC Press.
- Eisenbude, M. 1998. *Environmental Radioactivity*. Academic Press , NY.
- Fellenberg, G.1999.*Chemistry of Pollution*. John Wiley and Sons, New Delhi
- Fellenberg, G.1999.Chemistry of Pollution. John Wiley and Sons, New Delhi
- Hayes, W.A. 2001. Principles and Methods of Toxicology.CRC Press, NY.

**COURSE 15: 16P4ZOOT15: ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT**

<b>PROGRAMME</b>	Master of Science [Zoology]	<b>SEMESTER</b>	4
<b>COURSE CODE AND TITLE</b>	16P4ZOOT15: ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT	<b>CREDIT</b>	5
<b>HOURS/WEEK</b>	5	<b>HOURS/SEM</b>	90
<b>FACULTY NAME</b>	JOBIN C THARIAN, JOBI M J & SMITHA S		

**COURSE OBJECTIVES**

To discuss the principles of environmental management, modelling and auditing
To discuss the fundamental and advanced concepts of environmental management concepts
To describe environmental planning, ecoremediation and restoration
To examine the concepts and objectives of EIA and its processes like Baseline data collection, Impact assessment, Impact prediction, EMP
To examine the concepts EIA documentation, types of impact assessment, SEA, CIA, SIA
To evaluate the concepts and principles of remote sensing and GIS and their applications to environmental studies
To understand Environment and Development, land use pattern, participatory environmental management strategies
To discuss the concepts of sustainable development

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
<b>Module I. Environmental Management</b>				
1	Basic principles of environmental management	PPT/Lecture	Video/e-resource	
2	Environmental modelling	PPT/Lecture	Video/e-resource	
3	Brief on simulation modelling	PPT/Lecture	Video/e-resource	
4	Resource management	PPT/Lecture	Video/e-resource	
5	Ecological foot print	PPT/Lecture	Video/e-resource	
6	Carbon foot print	PPT/Lecture	Video/e-resource	
7	Water foot print	PPT/Lecture	Video/e-resource	

8	Happy Planet index	PPT/Lecture	Video/e-resource	
9	Environmental auditing	PPT/Lecture	Video/e-resource	
10	Eco labelling and certification	PPT/Lecture	Video/e-resource	
11	Accreditation	PPT/Lecture	Video/e-resource	
12	Corporate responsibility	PPT/Lecture	Video/e-resource	
13	Corporate environmental responsibility	PPT/Lecture	Video/e-resource	
14	ISO standards	PPT/Lecture	Video/e-resource	
15	ISO 14000	PPT/Lecture	Video/e-resource	
16	ISO 26001	PPT/Lecture	Video/e-resource	
17	OHSAS 18001	PPT/Lecture	Video/e-resource	
<b>Module II Ecosystem Management</b>				
18	An overview of population	PPT/Lecture	Video/e-resource	
19	Resources and ecosystem management	PPT/Lecture	Video/e-resource	
20	Exponential growth in human numbers	PPT/Lecture	Video/e-resource	
21	Five basic laws of ecology	PPT/Lecture	Video/e-resource	
22	Paradigm shift in management	PPT/Lecture	Video/e-resource	
23	Influence of economics in ecology	PPT/Lecture	Video/e-resource	
24	Management practices for systems	PPT/Lecture	Video/e-resource	
25	Waste lands	PPT/Lecture	Video/e-resource	
26	CIA-1			
27	Reclaimed lands	PPT/Lecture	Video/e-resource	
28	Mining area	PPT/Lecture	Video/e-resource	
29	Human settlement	PPT/Lecture	Video/e-resource	
30	Industrial area	PPT/Lecture	Video/e-resource	
31	Agricultural land	PPT/Lecture	Video/e-resource	

32	Eco restoration	PPT/Lecture	Video/e-resource	
33	Eco remediation	PPT/Lecture	Video/e-resource	
34	Environmentally sound biotechnological methods	PPT/Lecture	Video/e-resource	
35	Common property resources	PPT/Lecture	Video/e-resource	
36	Common property management	PPT/Lecture	Video/e-resource	
<b>Module III. Environmental Impact Assessment (EIA)</b>				
37	EIA	PPT/Lecture	Video/e-resource	
38	Definition	PPT/Lecture	Video/e-resource	
39	Objectives	PPT/Lecture	Video/e-resource	
40	History	PPT/Lecture	Video/e-resource	
41	Legal aspects	PPT/Lecture	Video/e-resource	
42	Historical aspects	PPT/Lecture	Video/e-resource	
43	Regulatory aspects	PPT/Lecture	Video/e-resource	
44	EIA process	PPT/Lecture	Video/e-resource	
45	Baseline data collection	PPT/Lecture	Video/e-resource	
46	Environmental baseline monitoring	PPT/Lecture	Video/e-resource	
47	Screening	PPT/Lecture	Video/e-resource	
48	Scooping	PPT/Lecture	Video/e-resource	
49	Terms of reference	PPT/Lecture	Video/e-resource	
50	Identification of valued environmental compounds	PPT/Lecture	Video/e-resource	
51	Impact assessment	PPT/Lecture	Video/e-resource	
52	Adhoc methods	PPT/Lecture	Video/e-resource	
53	Checklist methods	PPT/Lecture	Video/e-resource	
54	Metrics method	PPT/Lecture	Video/e-resource	
55	Network method	PPT/Lecture	Video/e-resource	

56	Map overlay method	PPT/Lecture	Video/e-resource	
57	Environment management plan	PPT/Lecture	Video/e-resource	
58	Environmental impact statement	PPT/Lecture	Video/e-resource	
59	Decision making	PPT/Lecture	Video/e-resource	
60	Public participation	PPT/Lecture	Video/e-resource	
61	Environmental clearance	PPT/Lecture	Video/e-resource	
62	Risk assessment	PPT/Lecture	Video/e-resource	
<b>CIA - II</b>				
63	Cumulative impact assessment	PPT/Lecture	Video/e-resource	
64	Life cycle assessment	PPT/Lecture	Video/e-resource	
65	Cumulative impact assessment	PPT/Lecture	Video/e-resource	
66	Social impact assessment	PPT/Lecture	Video/e-resource	
<b>Module IV. Remote Sensing and GIS</b>				
67	Principles of remote sensing	PPT/Lecture	Video/e-resource	
68	Concepts of remote sensing	PPT/Lecture	Video/e-resource	
69	Electromagnetic spectrum	PPT/Lecture	Video/e-resource	
70	Spectral characteristics	PPT/Lecture	Video/e-resource	
71	Space imaging	PPT/Lecture	Video/e-resource	
72	Satellites	PPT/Lecture	Video/e-resource	
73	Digital image processing	PPT/Lecture	Video/e-resource	
74	GPS principles	PPT/Lecture	Video/e-resource	
<b>Module V. Environment Vs Development</b>				
75	Conflicts of interest	PPT/Lecture	Video/e-resource	
76	Industrial revolution	PPT/Lecture	Video/e-resource	
77	Changes in land use pattern	PPT/Lecture	Video/e-resource	
78	Tragedy of commons	PPT/Lecture	Video/e-resource	

79	Management strategies	PPT/Lecture	Video/e-resource	
<b>Module VI. Sustainable Development</b>				
80	Our common future	PPT/Lecture	Video/e-resource	
81	International summits on development	PPT/Lecture	Video/e-resource	
81	UNCED agenda	PPT/Lecture	Video/e-resource	
82	Johannesburg conference	PPT/Lecture	Video/e-resource	
83	Commission of social development	PPT/Lecture	Video/e-resource	
84	Sustainable development goals	PPT/Lecture	Video/e-resource	
85	Agenda for sustainable development	PPT/Lecture	Video/e-resource	
86	Constraints	PPT/Lecture	Video/e-resource	
87	Barriers	PPT/Lecture	Video/e-resource	
88	Gandhian environmentalism	PPT/Lecture	Video/e-resource	
89	Sustainability indicators	PPT/Lecture	Video/e-resource	
90	Revision	PPT/Lecture	Video/e-resource	

#### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	15/01/2018	Satellites
2	22/01/2018	GPS vectors

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