Semester VI						
Sr No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CE 301	Environmental studies	3	0	0	6
2	CH 307	Instrumental methods for structure determination	3	0	0	6
3	CH 313	Chemistry laboratory-III	0	0	3	3
		Program Elective-V	2	1	0	3
		Program Elective-VI	2	1	0	6
4	PH 311	Institute Elective – I	3	0	0	6
		Total Credits				**30**

1	**Title of the course (L-T-P-C)**	**Environmental studies (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Nill**
3	**Course content**	**Module A:** Natural Resources, Ecosystems, Biodiversity and its conservation: Natural resources and ecosystems, Forest, grassland, desert and aquatic ecosystems, biodiversity at global, national and local levels, conservation of biodiversity **Module B:** Air PollutionIntroduction to understanding air quality management, fundamental processes of meteorology, Air Pollutants – Gaseous and particulate, Criteria for pollutants, ambient and source standards, Aerosols: Characterisation of aerosols, size distributions, measurement methods; Transport behaviour: diffusion, sedimentation, inertia; Visibility; principles of particulate control systems. **Module C:** Water TreatmentDiscussion of water quality constituents and introduction to the design and operation of water and wastewater treatment processes. **Module D:** Solid Waste Management and Climate ChangeDifferent aspects of solid and hazardous waste management. Climate change and greenhouse gas emissions, technologies would reduce the greenhouse gas emissions. Climate change and its possible causes. **Module E:** Sociology/EnvironmentalismDescription: Environmentalism in sociological tradition, Sustainability, North-South divide, Political economy approaches in environmental studies, Debates over environmental issues. **Module F:** EconomicsEnergy economics and financial markets, Market dynamics, Energy derivatives, Energy Efficiency; Sustainable Development: Concept, Measurement & Strategies, Interaction between Economic Development, and the Environment **Module G:** PhilosophyEnvironmental ethics, Deep ecology, Practical ecology, Religion and attitude towards environmental ethics, Ecofeminism, and its evolution. **Module H:** Field work and project: visit to a local area to document environmental assets, case studies of a simple ecosystem and group discussions on current environmental issues.

4	**Texts/References**	**1.** Cunningham W.P. and Cunningham M.A. (2002), Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi. **2.** Dasgupta, P. and Maler, G. (eds.), (1997), The Environment and Emerging Development Issues, Vol. I, Oxford University Press, New Delhi. **3.** Jackson, A.R.W. and Jackson, J.M. (1996), Environmental Sciences: The Environment and Human Impact, Longman Publishers. **4.** Nathanson, J.A., (2002), Basic Environmental Technology, Prentice Hall of India, New Delhi. **5.** Redclift, M. and Woodgate, G. (eds.), (1997), International Handbook of Environmental Sociology. **6.** Srivastava, K.P. (2002), An Introduction to Environmental Study, Kalyani Publishers, Ludhiana. **7.** Review articles from literature.

1	**Title of the course (L-T-P-C)**	**Instrumental methods for structure determination (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Fundamental concepts and applications of chemistry (CH101)**
3	**Course content**	**NMR spectroscopy:** Basic principles of ^{1}H-NMR, instrumentation and interpretation of NMR spectrum, chemical shift: principles, chemical shift values of major organic compound classes, and factors affecting chemical shift, spin-spin coupling, spin systems, coupling with other nuclei, 2 D-NMR (COSY, TOCSY), NOE (NOESY), ^{13}C-NMR-principles and chemical shifts for major organic compound classes, ^{1}H- ^{13}C-2D NMR (HSQC, HMBC), DEPT, ^{31}P and ^{19}F-NMR, solid state NMR and applications in chemistry. **Mass Spectrometry:** Instrumentation and techniques (ionization techniques, mass analysers, and detection techniques, tandem MS or MS/MS, LC-MS, GC-MS, MALDI-TOF-MS etc.), interpretation of mass spectra, fragmentation patterns of major organic compound classes including rearrangement reactions and applications of mass spectrometry in chemistry and biology. FTIR and UV-Visible spectroscopy: Basic concepts and applications in functional group characterization and organic structure elucidation
4	**Texts/References**	**1.** R. Silverstein, F. Webster, D. Kiemle, and D. Bryce "Spectrometric identification of organic compounds", 8th Ed., Wiley, 2015. **2.** P. Crews, J. Rodriguez, and M. Jaspars, "Organic structure analysis", 2nd Ed., OUP USA, 2009. **3.** D. Williams and I. Fleming, "Spectroscopic methods in organic chemistry", 6th Ed., McGraw Hill Education, 2011. **4.** W. Kemp, "Organic spectroscopy", 2nd Ed., Red Globe Press, 2019. **5.** D. Pavia "Introduction to spectroscopy" Cengage Learning India Private Ltd., 5th Ed., 2015. **6.** C. Banwell and E. McCash "Fundamentals of molecular spectroscopy" 4th Ed., McGraw Hill Education, 2017. **7.** J. Keeler "Understanding NMR spectroscopy" 2nd Ed., Wiley, 2011. **8.** K. Chary and G. Govil "NMR in biological systems: from molecules to human" 1st Ed., Springer, 2008.