



Annexure 'A' of Agenda Item No. AC/11/01  
(Total Page A-11 to 1-18) 11/01/A-01  
GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY

Sector - 16C Dwarka, New Delhi - 110078

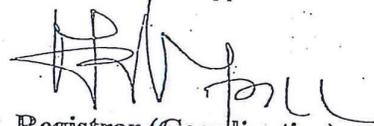
F.No. IPU/JR(C)/40th AC/2016/47

Dated: 05.03.2016

Subject- Proceedings of the 40<sup>th</sup> meeting of Academic Council.

Please find enclosed herewith the proceedings of the 40<sup>th</sup> meeting of Academic Council of Guru Gobind Singh Indraprastha University held on Tuesday, 1<sup>st</sup> March 2016 at 11.30 a.m. in the Conference Hall of the University, Administrative Block-'A' wing, Dwarka Campus, New Delhi-110078 for approval.

Observations, if any may kindly be communicated to the office of the undersigned within week, consequent to no observation(s), communicated, the proceedings will be assumed as deemed approved.

  
Jt. Registrar (Coordination)  
coordination112@gmail.com  
09868527302/011-25302135

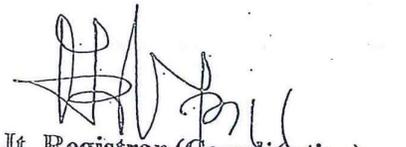
Dated: 05.03.2016

F.No. IPU/JR(C)/40<sup>th</sup> AC /2016 /47

- 1) All Deans and Directors of Guru Gobind Singh Indraprastha University
- 2) Prof.P.K.Julka, Dept. of Clinical Oncology, AIIMS, New Delhi.
- 3) Prof.M.C.Sharma, School of Education, (IGNOU), New Delhi.
- 4) Prof.M.P.Gupta, Department of Management Studies, IIT, Delhi.
- 5) Prof.A.K.Maitra, Former Director, School of Planning & Architecture, Delhi.
- 6) Prof.Karmeshu, School of Computer & System Sciences, JNU, New Delhi.
- 7) Prof. Surender kumar, Deptt. of Chemical Technology, IIT Roorkee, Uttarakhand.
- 8) Prof.J.P.Khurana, Dept. of Plant Molecular Biology, Faculty of Interdisciplinary & Applied Sciences, University of Delhi, South Campus.
- 9) Prof. Lallan Prasad, Retired Head and Dean of Dept. of Business Economics, Faculty of Applied Social Sciences, University of Delhi, South Campus.
- 10) Shri Arvind Misra; Former Dean, Faculty of Law, Dr. B.R. Ambedkar University, Agra, Ex.Director /Head, Post Graduate Deptt. of Law Agra College, Agra Former OSD (Law) to H.E. the Governor of UP, Lucknow.
- 11) Shri Sandeep Gupta, CEO, Academy of Embedded Technology, Delhi.
- 12) Prof. J.K. Garg, Professor, University School of Environment Management
- 13) Dr.Amar Pal Singh, Professor, University School of Law & Legal Studies.
- 14) Dr. Manpreet Kang, Associate Professor, University School of Humanities & Social Sciences
- 15) Dr. Meenu Kapoor, Associate Professor, University School of Biotechnology
- 16) Dr. Vaishali Singh, Associate Professor, University School of Basic and Applied Sciences

Copy for kind information of the Competent Authority:

- (i) AR to the Vice Chancellor GGSIP University
- (ii) SO to the Pro-Vice Chancellor GGSIP University
- (iii) AR to the Registrar GGSIP University

  
Jt. Registrar (Coordination)  
coordination112@gmail.com  
09868527302/011-25302135

24/01/A-02



GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY

**GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY**

**FORTIETH MEETING**

**OF THE**

**ACADEMIC COUNCIL**

*DATE* : 01<sup>st</sup> March, 2016 (Tuesday)

*TIME* : 11:30 a.m. onwards

*VENUE* : CONFERENCE ROOM

**PROCEEDINGS**

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SECTOR -- 16C, DWARKA, NEW DELHI.

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AC40.02	Action Taken Report on the Proceedings of 39 <sup>th</sup> meeting of the Academic Council, held on 25 <sup>th</sup> June, 2015.	07
AC40.03	To ratify the decision to include additional information, for all programmes of studies governed by the revised the University Ordinances No. 10 and 11.	07
AC40.04	To ratify the notification of the guidelines to address the operational difficulties arisen due to revision of the University Ordinances No. 10, 11 and repealing of the University Ordinance No.27, for the student batches admitted up to the academic session 2014-2015.	07-08
AC40.05	To ratify the decision regarding the specification of degrees as per the University Grants Commission (UGC), Gazette Notification dated 05 <sup>th</sup> July, 2014 No.F.5-1/2013 (CPP-II).	08
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AC40.10	To ratify the delinking of the B.Tech. and M.Tech. degrees and to run a single M.Tech. programme (in place of the two at present) as per the revised curriculum, scheme of examinations and admission criteria to be implemented by the University School of Biotechnology (USBT) from the academic session 2016-2017.	10-11
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*hired*

41.01/A-05

AGENDA No.	AGENDA ITEM(S)	Page No.
AC40.21	To consider and approve the implementation of the minor modification(s) in the existing scheme and syllabus of Master of Technology (M.Tech.) in the following programmes approved by the Board of Studies of the University School of Information and Communication Technology (USICT), from the academic session 2015-2016:- <u>M.Tech.(Regular Programme):-</u> (i)Information Technology, (ii) Computer Science & Engineering,(iii) Information Security , (iv)Electronics & Communication Engineering, (v)Digital Communication, (vi)Signal Processing, (vii) RF & Microwave Engineering and (viii)VLSI Design <u>M.Tech.(Weekend Programme):-</u> (i) Computer Science & Engineering (ii) Information Technology (iii) Electronics & Communication Engineering	15-16
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AC40.24	To ratify the extension of last date of submitting eligibility proof by November 2, 2015 for result awaited students of Engineering, B. Arch. & Professional Programmes (Except MBBS / BDS / PGMC / SSMC), admitted during Academic Session 2015-2016.	17

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**Agenda Item No. AC40.14: To ratify the implementation of revised scheme of evaluation and syllabus for Master of Law (One year), Alternative Dispute Resolution (ADR) course offered by the University School of Law & Legal Studies (USLLS), from the academic session 2015-2016.**

The University School of Law & Legal Studies (USLLS) has revised the scheme of evaluation and syllabus for Master of Law (One year), Alternative Dispute Resolution (ADR) course, as approved by the sub-committee of the Academic Council (12<sup>th</sup> August 2015). The same has been implemented with the approval of Competent Authority from the Academic Session 2015-2016. The Academic Council after consideration ratified the implementation of revised scheme of evaluation and syllabus for Master of Law (One year), Alternative Dispute Resolution (ADR) course for University School of Law & Legal Studies. *Annexed as Annexure 'L' of Agenda Item No AC 40.14 (Page L-01 to L-16)*

**Agenda Item No. AC40.15: To ratify the implementation of syllabus, course curriculum, scheme of evaluation, eligibility criteria and admission procedure of M. Phil (Psychiatric Social Work) course offered by the University School of Medical and Para Medical Health Sciences (USMPHS), from the academic session 2015-2016.**

The University School of Medical and Para Medical Health Sciences (USMPHS) has implemented the syllabus, course curriculum, scheme of evaluation, eligibility criteria and admission procedure of M.Phil. (Psychiatric Social Work) course, as approved by the sub-committee of Academic Council of USMPHS (31<sup>st</sup> July, 2015). The same has been implemented with the approval of Competent Authority from the Academic Session 2015-2016. The Academic Council after consideration ratified the syllabus, course curriculum, scheme of evaluation, eligibility criteria and admission procedure of M.Phil. (Psychiatric Social Work) course for USMPHS as implemented from academic session 2015-2016. The Academic Council also suggested that the Dean, USMPHS should reorganize details of the references and required readings paper-wise. *Annexed as Annexure 'M' of Agenda Item No AC 40.15 (Page M-01 to M-35)*

**Agenda Item No. AC40.16: To ratify the implementation of revised course curriculum and scheme of examinations for the following programmes offered by University School of Environment Management (USEM), from the academic session 2015-2016:-**

- (i) M.Sc. (Environment Management)
- (ii) M.Sc. (Biodiversity and Conservation)
- (iii) M.Sc. (Natural Resource Management)
- (iv) Ph.D. (Environment Sciences)

University School of Environment Management (USEM) has revised the course curriculum and scheme of examinations as approved by the sub-committee of Academic Council (31<sup>st</sup> July' 2015) for the following programmes:

- (i) M.Sc. (Environment Management)
- (ii) M.Sc. (Biodiversity and Conservation)
- (iii) M.Sc. (Natural Resource Management)
- (iv) Ph.D. (Environment Sciences)

*Amal*

The course curriculum and scheme of examinations for the above programmes have been revised as per the UGC guidelines, merging some old papers and including important aspects like wetland. The revised scheme and syllabus has been implemented with the approval of Competent Authority from Academic Session 2015-2016. The Academic Council after consideration ratified the revised course curriculum and scheme of examinations for the above programmes offered by University School of Environment Management as implemented from academic session 2015-2016.

*Annexed as Annexure 'N' of Agenda Item No. AC40.16 (Page N-01 to N-4)*

**Agenda Item No. AC40.17: To ratify the implementation of revised scheme and syllabus of Ph.D. course work of University School of Education (USE), from the academic session 2015-2016.**

In pursuance of the provision of regulations of the University Ordinance 12 for programmes leading to the degree of Doctor of Philosophy (Ph.D.), the University School of Education on the recommendation of sub-committee of the Academic Council (15<sup>th</sup> December 2015) has updated and revised scheme and syllabus for Ph.D. coursework. The revised scheme and syllabus has been implemented with the approval of Competent Authority from Academic Session 2015-2016. The Academic Council after consideration ratified the revised scheme and syllabus for Ph.D. coursework implemented from Academic Session 2015-2016.

*Annexed as Annexure 'O' of Agenda Item No. AC40.17 (Page N-01 to N-10)*

**Agenda Item No. AC40.18: To ratify the implementation of revised course curriculum and scheme of examinations for Ph.D. courses in the discipline of (i) Physics (ii) Chemistry (iii) Mathematics offered by the University School of Basic & Applied Sciences (USBAS) from the academic session 2015-2016.**

In pursuance of the provision of Regulations of the University Ordinance 12 for programmes leading to the degree of Doctor of Philosophy (Ph.D.), the University School of Basic & Applied Sciences has revised the course curriculum and scheme of examinations for Ph.D. courses as approved by the sub-committee of Academic Council (17<sup>th</sup> September, 2015) in the following disciplines:

- (i) Physics
- (ii) Chemistry
- (iii) Mathematics

The revised curriculum and scheme of examinations for Ph.D. programme has been implemented with the approval of Competent Authority from academic session 2015-2016.

The Academic Council after consideration ratified revised course curriculum and scheme of examinations for the above programmes as implemented from Academic Session 2015-2016.

*Annexed as Annexure 'P' of Agenda Item No. AC 40.18 (Page - P-01 to P-33).*

*Pratik*

# SYLLABUS FOR Ph.D COURSEWORK IN ENVIRONMENTAL SCIENCE

Entrepreneurship | Employability | Skill Development

The Research Scholars registered for the Ph.D programme will be required to take four courses (each of 3 credits) equivalent to 12 credits . The research scholar will have to pass in any of the courses worth 9 credits, including a compulsory course on Research Methodology

## LIST OF Ph.D COURSEWORK

Code No	Subject	L	T
PES 901	RESEARCH METHODOLOGY	3	0
PES 903	ENVIRONMENTAL BIOTECHNOLOGY AND BIOREMEDIATION	3	0
PES 905	BASIC AND APPLIED REMOTE SENSING AND GIS	3	0
PES 907	APPLIED ANALYTICAL TECHNIQUES AND INSTRUMENTATION	3	0
PES 909	INTRODUCTION TO ENERGY AND GLOBAL CLIMATE CHANGE	3	0
PES 911	BASICS OF ANIMAL FIELD BIOLOGY	3	0
PES 913	ECOSYSTEMS AND NATURAL RESOURCES MANAGEMENT	3	0
PES 915	PLANT SYSTEMATICS , REPRODUCTIVE BIOLOGY AND ETHNOECOLOGY	3	0

**UNIT-I**

**Research Formulation** – Definition, scope and objective, types, approaches, significance; scientific investigation.

**The research process** – The broad problem area, preliminary data collection, problem, selection and definition, theoretical framework, hypothesis development and elements of research design.

**Types of research:** Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical

**Experimental design** – The laboratory experiment, variables, validity, Types of experimental Designs, Instrumental methods of Environmental analysis.

**UNIT-II**

**Data collection** – Sources of data; data collection methods; Methods for selecting sampling locations and times; Simple random sampling, Stratified random sampling, Systematic sampling

**Processing and Analysis of Data:** Central tendency dispersion, Estimation of parameters; Confidence interval estimation; Measurement of the spread of data-range; Asymmetry, Normal probability distribution, Skewness and Kurtosis, Karl Pearson correlation coefficient, Correlation and regression analysis, Introduction to Statistical Software.

**UNIT-III**

**Statistical inference-** Tests of Hypotheses, Type I and Type II Errors; Level of significance, Concept of standard error, Normal distribution, Tests of significance for large samples: Z test, Types of Z test (one sample and two sample), Standard error for Z test; Tests of significance for small samples: t-test (One sample, Two Sample: Independent and Dependent), Standard error for t-test, Comparison of Variance: F-test, Goodness of Fit: Chi –square –test, ANOVA, Quality of data: Q test; Nonparametric tests – Sign test, Wilcoxon Signed Rank test, Kruskal-Wallis test

**UNIT-IV**

**Technical writing and Report Generation:** Basic concept of paper/thesis writing, Ethical issues, Copy right, Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism; Citation and acknowledgement.

References :

1. Kothari, C.R (2009) Research Methodology and Techniques, Delhi: New Age international Publisher.

2. Donald H.McBurney(2006) Research Methods, 5th Edition, Thomson Learning.
3. Donald R. Cooper, Pamela S. Schindler (2006) Business Research Methods, 8/e, Tata McGraw-Hill Co.Ltd.
4. P. Oliver,(2004) Writing Your Thesis, New Delhi: Vistaar Publications,.
5. Gregory(2005) Ethics in Research, Continuum, 2005.
6. Malkote, S.R. (1991), Communication for Development, New Delhi: Sage Publication.
7. Rosengreen, K.E. (2000), Communication: An Introduction. New Delhi: Sage Publication.

### Unit-I

**Basics of Environmental Biotechnology:** Introduction, scope and importance, Applications, Genetic engineering, GMOs and Bioethical issues

Techniques – Electrophoresis, enzyme detection-Zymography, Protein quantification, PCR, Gene probe Technology

Biomarkers, Biosensors of pollution ; Biofuels and bioplastics

### Unit-II

**Enzyme Technology:** Introduction, enzyme specificity, enzyme catalysis, quantization of enzyme activity, enzyme characterization and Michelis-Menten kinetics, enzyme inhibition. Enzyme immobilization: Concept, methods of immobilization, applications of immobilized enzymes in environmental research

Industrial enzymes: Enzyme applications in food industry, paper and pulp industry, textile industry.

### Unit-III

**Wastewater treatment Technologies :** Treatment processes, Aerobic and anaerobic treatment methods – Role of microbes, methanogens, acetogens, fermentative bacteria, biofilms,

**Waste management :** Solid waste composting and vermicomposting

**Biodegradation of Xenobiotics:** Xenobiotic compounds and their microbial degradation

### Unit-IV

**Bioremediation Technologies:** Ex-situ and in-situ Bioremediation, microbial removal of toxic metals, Bioremediation of oil spills, Phytoremediation

Bio-sequestering techniques for carbon dioxide

Microbial leaching of ores; Microbes for enhanced oil recovery

### Recommended Books:

1. Alan Scragg (2005) Environmental Biotechnology, 2<sup>nd</sup> Edition, Oxford University Press.
2. Bruce Rittman, Perry L. McCarty (2000) Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill.
3. I. S. Thakur (2011) Environmental Biotechnology: Basic Concepts and Applications. 2<sup>nd</sup> Edn, I K International Publications.
4. B.C. Bhattacharya and Rintu Banerjee (2007). Environmental Biotechnology, Oxford University Press, 2007.
5. L. Stryer (2002) Biochemistry, 5th edition, W.H. Freeman and Company.
6. N. C. Price and L. Stevens (2000) Fundamentals of Enzymology, 3<sup>rd</sup> edition, Oxford University Press, USA.
7. Wolfgang Aehle ( 2007) Enzymes in Industry: Productions and Applications, 3<sup>rd</sup> edition Wiley-VCH.
8. M.J. Pelczar, E.C.S Chan, N.R. Krieg, 1998. Textbook of Microbiology, 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi.

**Course Title: BASIC AND APPLIED REMOTE SENSING AND GIS**

**UNIT I**

**Remote Sensing Fundamentals**

Remote sensing, definition, physical basis of remote sensing, electromagnetic spectrum, radiation laws, atmospheric effects, basics of optical, thermal and microwave remote sensing, history of remote sensing. EMR interaction with earth surface materials, Spectral signatures of vegetation, water, soil, snow etc. in different regions of EMR, ground truth data collection.

**UNIT II**

**Platforms and Sensors**

Aerial and spaceborne platforms, orbits, sensors types – optical (multispectral, hyperspectral), thermal and microwave, resolutions, Landsat, SPOT, IRS, ERS, Radarsat, RISAT, and other operational remote sensing satellites.

**Data Analysis and Applications of Remote Sensing**

Visual interpretation – Scale, maps and map projections, interpretation keys; image characteristics, media and formats of digital images, image enhancement, image transformations, classifiers, classification – unsupervised and supervised, accuracy estimation, change detection.

**Remote Sensing Applications:** Ecosystem inventory and monitoring – case studies on agriculture, forestry, wetlands, urban planning, snow and glaciers, coastal zone management, protected area management, climate change, air and water pollution; disaster management.

**UNIT III**

**Geographical Information System, GPS and GIS Applications**

Introduction, GIS definition and terminology, data types, raster and vector data, GIS database design, spatial database creation – digitization, scanning; processing of data, GIS implementation and project management. Commercial remote sensing and GIS softwares.

**UNIT IV**

**Satellite based navigation systems** (GPS, Gallelio, Glonass, IRNSS): concepts and applications; Map projections and datums, coordinate systems; Survey of India topographical map types and numbering system.

**GIS Applications:** Decision Support System for Forestry, Working Plan preparation, Urban Information System, WARIS (Water Resources Information System), Wetland Information System, disaster management system; Site selection- Sewage treatment Plants, Industry, Landfill sites, townships and cities; watershed management; Landslide hazard zonation; mine closure planning.

**Text/References:**

1. Joseph, George. 2005. Fundamentals of Remote Sensing, 2<sup>nd</sup> Edition. University Press India.
2. Lillisand, Thomas, Ralph W. Kiefer and Jonathan Chipman. 2007. Remote Sensing and Image Interpretation. Wiley India.
3. Jensen, John R. 2009. Remote Sensing of the Environment: An Earth Resource Perspective, 2<sup>nd</sup> Edition. Dorling Kindersley.
4. Lo, C.P., and Albert K.W. Yeung. 2009. Concepts and Techniques of Geographic Information Systems, 2<sup>nd</sup> Edition. PHI Learning.
5. Longley, Paul A., Michael F. Goodchild, David J. Maguire and David W. Rhind. 2005. Geographic Information System and Science, 2<sup>nd</sup> Edition. John Wiley and Sons.
6. Burrough, P.A. 2007. Principles of Geographic Information System. Oxford University Press.

## Course Title: Applied Analytical Techniques and Instrumentation

### UNIT 1

Principle, Methodology and Applications: Electrophoresis, Polymerase Chain Reaction (PCR), Real time PCR; Introduction to Molecular Markers: Allozyme, Randomly Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP), Single Sequence Repeats (SSR), DNA fingerprinting, Single Nucleotide Polymorphism (SNP); Cryopreservation. Numerical methods in Phylogenetic Classification.

### UNIT 2

Fundamentals of Photometry; Spectro, Electro analytical and Separative methods, Laws governing Photometry

Chromatography : General description, definition, terms and parameter used in chromatography, Classification of chromatographic methods, criteria for selection of stationary and mobile phase nature of adsorbents , Rate theory , Band broadening: Eddy diffusion , Methodology for selection of stationary phase.

### UNIT 3

Flame photometry; Principle, Construction details, fuel gases, atomiser, burner, optical system , recording system.

Atomic absorption spectrophotometer; Theoretical concepts, Instrumentation, Hollow cathode lamps, Burners and flames, Plasma excitation sources, optical and electronic systems

### UNIT 4

High pressure liquid chromatography; Apparatus , Pumps, Column packing, Characteristics of liquid chromatography, detector; UV, IR , Refractometer and fluorescence detector

Gas Chromatography; Principle, Comparison of GSC and GLC instrumentation, Columns packed and tubular study of detectors , thermal conductivity, flame ionisation , electron capture and mass spectrophotometry, factors affecting and separating applications

Text / References:

1. D.A. Skoog,(2000), Principles of Instrumental analysis, fifth edition , Saunders college publication
2. D.H.Williams and J.Fleming(1995), Spectroscopic methods onn organic chemistry, Sixth edition , McGrawHill
3. B.K. Sharma (2007), Instrumental methods of chemical analysis, Krishna prakash media
4. J.Willard(1999), Instrumental methods of analysi, seventh edition , CBS publishers

**Course Title: Introduction to Energy and Global Climate Change**

**Unit-I- Introduction to Global Climate Change:** The Global Climate System: Energy balance of the Earth, The greenhouse effect, Atmospheric composition changes, Past Climates and Paleoclimatology, trace gasses in the atmosphere, Global temperature, Orbital variation and sunspots, The physics of the Greenhouse effects, climate sensitivity parameters, changing the albedo, equilibrium and realized temperatures.

**Unit-II-Radiative forcing of Climate Change:** Climate feedbacks (water, clouds, ice albedo). Direct forcing by green house gasses; carbon dioxide; Methane; nitrous oxide; halocarbon numbering systems; Radiative effects of aerosols, measurements technologies; impacts of aerosols on visibility and climate.

**Global Warming Potential:** Introduction to the calculation of GWP, carbon emissions from fossil fuels and global carbon cycle, carbon intensity of fossil fuels, Effects of energy efficiency on carbon intensity, target CO<sub>2</sub> levels.

**Unit-III- Modeling of Emissions and Climate System:** Simple global temperature model, Global energy balance and radiation budget of the atmosphere, Budyko's Ice-Albedo Feedback Model

- Modelling Climate I: Climate sensitivity and feedback
- Modelling Climate II: Global and regional climate models
- Modelling Climate III: Socio-Economic Scenarios
- Detection, Attribution and Uncertainty
- Climate Change Predictions
- DeNitrification and DeComposition model

**IPCC Emission Scenarios:** Average temperature forecasts for the glob, stabilizing the greenhouse gas concentrations, Regional and global impacts of climate change; the pecans and climate change:

Changes in the stratospheric Ozone: solar spectrum and ultraviolet rays, protective shield and ozone role, effect of ozone depletion on surface UV radiation.

**Unit-IV: Introduction to Atmospheric Dispersion:** Transport & dispersion of air pollutants, Turbulent diffusion: real plumes and Gaussian plumes, Wind rose diagram, Atmospheric system (stability and dispersion parameters) Gaussian Plume Models and review, Plume Downwash: Stack Height USEPA Models and their applications Screening Models (SCREEN), Puff Model,

**Texts/References:**

1. John Houghton, 2004 Global warming : The complete briefing, Cambridge University Press, Third Edition
2. R. Lal. J. M. Kimble and B.A. Stewart Editors. Global Climate Change and Tropical Ecosystems, CRC Press, London, 2000.
3. Barbara J. Finlayson-Pitts and James N. Pitts, Jr., Chemistry of the Upper and Lower Atmosphere, 1999, Academic Press.
4. John H. Seinfeld and Spyros N. Pandis, Atmospheric Chemistry and Physics: from Air Pollution to Climate Change, 2nd Edition, 2006, Wiley & Sons

**Course Title: Basics of Animal Field Biology**

**Unit 1. Introduction to Animal Taxonomy and evolution (8)**

Introduction to taxonomy and systematic as a science, Micro and Macroevolution, Lineage change, Speciation, Biological species concept, Material basis of Animal Taxonomy, Trends in Animal Taxonomy and Systematics, Concept of species complex, ICZN rules, Type concept, Etymology.

**Unit 2. Basics of Field Ecology and Conservation (7)**

Microhabitat, Habitat, Biogeography, Concept of community and biotic interactions, Feeding and foraging, Threat value assessment, Criteria for proposing conservation action plan, Ecosystem approach for conservation.

**Unit 3. Field Techniques (8)**

Line/belt transects, Quadrat sampling, Point count, Scan sampling, Focal sampling, Time constraints sampling, In-direct sighting (tracks and signs) and monitoring, Camera trapping, Radio collaring, tagging, Mark-capture recapture,

**Unit 4. Dealing with conflicts and conservation (7)**

Framing right questionnaire for data collection, Concept of conflict management, Dealing with species status- IUCN criteria, RED data book, Parameters to monitor in captive populations, Ethical issues in publication, Linking taxonomy and field ecology for conservation.

**Reference:**

1. Bibby, C; Jones, M. and Marsden, S. (1998). Expedition Field Techniques: Bird Surveys, Royal Geographical Society, London, UK.
2. Bookhout, T. A. (1996). *Research and management techniques for wildlife and habitats* (5<sup>th</sup> Ed.). The Wildlife Society, Allen Press, Kansas, USA.
3. Buckland, S. T., Anderson, D. R., Burnham, K. P. and Laake, J. L. (1993). *Distance sampling-estimating abundance of biological populations*. Chapman & Hall, London, reprinted (1999) by Research Unit for Wildlife Population Assessment, St. Andrews.
4. Woodroffe R., Thirgood S. and Rabinowitz A. (2005). *People and Wildlife, Conflict or Co-existence?* (Conservation Biology) Cambridge University.

5. Sutherland, W. J. (2000). *The conservation handbook; research, management and policy*. Blackwell Sciences Ltd. London.
6. Sutherland, W. J., Newton, I. and Green, R. E. (2004). *Bird Ecology and Conservation: A Handbook of Techniques*. Blackwell Sciences Ltd. London.
7. Groom, M.J., Meffe, G.R. and Carroll, C.R. 2006. *Principles of Conservation Biology*. Sinauer Associates, Inc., USA.
8. Primack, R. 2006. *Essentials of Conservation Biology*. Sinauer Associates, Inc., USA.
9. Kapoor, V. C. 1998. *Theory and Practice of Animal Taxonomy*. Oxford and IBH publishing.
10. Mayr, E and P. D. Ashlock. 1991. *Principles of Systematic Zoology*. MacGraw-Hill,inc., New Delhi.
11. Narendran, T. C. 2006. *An Introduction to Taxonomy*. Zoological Survey of India, Kolkata.
12. Simpson, G. G. 1962. *Principles of Animal Taxonomy*. Oxford Book Company, New York

**Course Title: ECOSYSTEMS AND NATURAL RESOURCES MANAGEMENT****UNIT -I**

**Natural Resources:** Ecosystem and concept of natural resources; classification of natural resources, Terrestrial, aquatic (freshwater, estuarine, marine) and wetland resources; Interrelationships among different types of natural resources. Biodiversity and ecosystem services; Ecological, social and economic dimension of resource management. Food resources, forest resources-distribution and types, timber, NTFP, JFM, agroforestry, energy resources-renewable and non-renewable resources. Mineral resources and their exploitation; ecological impacts of resource exploitation. Policy implications of natural resource management.

**UNIT- II**

**Aquatic and wetland resources:** Surface and ground water resources – types and distribution; Elements of structure, functions and processes in fresh water (lakes and rivers), marine and estuarine ecosystems with respect to hydrology, and biodiversity; stratification and zonation in rivers, lakes and oceans. Biological adaptations in plant and animals. Bioassessment and biocriteria in lakes and reservoirs; eutrophication and trophic state index; methanogenesis; Ramsar Convention, Convention on Biological Diversity, Ramsar sites in India. Freshwater and Marine resources: Fish, weeds and other products; biodiversity as a resource and environmental issues.

**UNIT III**

**Watershed management:** Watershed definition, types, Watershed Characteristics, land capability classification, erosion, Universal Soil Loss Equation (USLE); hydrology of watersheds. Watershed inventory, watershed restoration and prioritization catchment area conservation, integrated watershed management plan, monitoring and evaluation of watershed management activities, climate change adaptation, economics of watershed protection, ecosystem services, research issues in watershed, Indian case studies of watershed development;

**UNIT-IV**

**Ecosystem management and restoration:** Landscape elements and ecosystems-Island biogeography theory; patch, matrix and corridor model of landscapes; scale, heterogeneity, patterns; fragmentation; flows between landscape elements and ecosystems; Ecosystem management- principles, guidelines and applications; ecosystem approach for environment management; Ecosystem degradation, degraded ecosystem types and their restoration methods; relevance and applications of landscape ecology in ecosystem management

ecosystems. Sustainability and society, (social justice, development, economy). UNEP programmes towards sustainable development.

### Text/References:

1. Francois Ramade (1984). Ecology of Natural Resources. John Wiley & Sons Ltd.
  2. M. Dobson (2000). Ecology of Aquatic Management, Pearson Education
  3. Mitsch, W.J. and J.G. Gosselink (2015). Wetlands, 4<sup>th</sup> edition, John Wiley & Sons. 744p.
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4. Raymundo E. Russo (2008). Wetlands: Ecology, Conservation and Restoration. Nova Science Publishers Inc. 446p.
  5. West, P.W. Trees and Forest Management. 2004, Springer Publication
  6. Montagnini, Florencia, Jordan, Carl F. 2007 Tropical Forest Ecology: The Basis for Conservation and Management. Springer Publication
  7. James P. Kimmins 2006 Forest Ecology, Pearson Publication.
  8. Larr, Anthonie Van, Akca Alparslan 2007 Forest Mensuration, Springer Publication
  9. Jelte van Andel and James Aronson (editors) (2006). Restoration ecology : the new frontier, Blackwell Publishing, 319p
  10. Martin R. Perrow, Econ and Anthony J. Davy [Ed] (2002), Handbook of Ecological Restoration, Volume 1 and 2, Cambridge University Press.
  11. Sven Erik Jorgensen [Ed] (2009). Applications in Environmental Engineering, Elsevier B.V. Radarweg, Amsterdam, The Netherlands, 380p.
  12. Ecological Restoration (2008). A Source Book for Ecological Restoration, Foundation for Ecological Security, 104p.
  13. Watershed Planning and Management (2000)- Rajvir Singh, Yash Publication House, Bikaner-India
  14. YVN Murthy. Land and Water Management, Kalyani Publishers, New Delhi.
  15. I.W. Heathcote (1988). Integrated Watershed Management: Principles and Practice, John Wiley and Sons, Inc., New York.

## Course Title - Plant Systematics, Reproductive Biology and Ethnoecology

### Unit-1

Introduction; history and significance of Plant Systematics; Herbarium preparation, herbarium management; Introduction to Phylogenetics; Taxa, speciation, species concepts; Classification and nomenclature; ICBN(ICN); Angiosperm Phylogenetic Groups(APG); Phylocode ; Species Bar Codes

### Unit-2

Methods of studying Plant Systematics: morphology, anatomy, development, pollen, secondary chemistry (chemotaxonomy) , cytotaxonomy ; molecular systematics ;Preparation of identification Keys; Biogeography, Systematics and phylogeography

### Unit-3

Introduction to Reproductive Biology: Cone, Floral Structure, Phenology, Palynology, Pollination Biology, Seed dispersal, viability, establishment ,Reproductive Biology and Conservation

### Unit -4

Theoretical Foundations of Ethnoecology , Ethnobotany, Ethnozoology, Indigenous knowledge and Traditional Ecological Knowledge, transmission of traditional ecological knowledge; Ethnoecology and Conservation, Conservation in indigenous communities, community-based management of biodiversity, indigenous peoples and protected areas , Biocultural Diversity; Research methods in Ethnoecology: Quantitative and Qualitative methods, Information Management, Information Analysis, Databases, storage of information, Ethics in fieldwork.

### Books Recommended:

Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J. Donoghue. 2008. **Plant Systematics**. A Phylogenetic Approach. Third Edition. Sinauer Associates, Inc.

Simpson, MG. 2006. **Plant Systematics**. Elsevier Inc, Burlington MA

Roderic DM Page & Edward C Holmes .1998.**Molecular Evolution: A Phylogenetic Approach**, John Wiley & Sons

Nordenstam , B. El-Ghazaly &M. Kassas(Eds).2000.**Plant Systematics in the 21<sup>st</sup> Century**, Portland Press

[Willmer](#),P. 2011.**Pollination and Floral Ecology**, Princeton University Press

Waser,N.M.2006. **Plant-Pollinator Interactions: From Specialization to Generalization** , University of Chicago Press

Agashe ,S.P.2006. **Palynology and its applications**,Oxford &IBH Publ.

Fowler.A 1977. **Ethnoecology** Sage.

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

Martin. 2004. **Ethnobotany, Conservation, and Community Development**

Martin. 2004. **Anthropology** in Ethnobotany: A Methods Manual

Nazarea, V. (ed.) 2006. **Ethnoecology: situated knowledge/located lives**. Tucson: University of Arizona Press.

Johnson, L.M. 2009. **Trail of Story, Travelers' Path: Reflections on Ethnoecology and Landscape**. Vancouver: UBC Press.