ಬಿ.ಎಂ.ಎಸ್.ತಂತ್ರಿಕಮಹವಿದ್ಯಾಲಯ

(ಸ್ವಾಯುತ್ತವಿದ್ಯಾಸಂಸ್ಥೆ)

ಬಥಂಗಳೂರು -೫೬೦೦೧೯

BMS COLLEGE OF ENGINEERING

(Autonomous college under VTU)

Bangalore-560019

DEPARTMENT OF CIVIL ENGINEEIRING

SCHEME & SYLLABUS

FOR AUTONOMOUS PROGRAM

M. Tech.
Environmental Engineering

I to IV SEMESTER

(Admission Year: 2018 onwards)

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Environmental Engineering

I to IV SEMESTER

(Admission year: 2018 onwards)

BMS COLLEGE OF ENGINEERING

Bull Temple Road, Bangalore-19

BMS COLLEGE OF ENGINEERING

(Autonomous College under VTU)

BANGALORE-560 019

DEPARTMENT OF CIVIL ENGINEEIRING

VISION OF INSTITUTE

Promoting prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training

MISSION OF INSTITUTE

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society.

VISION OF THE DEPARTMENT

To be an excellent center for imparting quality higher education in Civil Engineering for a constantly changing societal needs with credibility, integrity and ethical standards.

MISSION OF THE DEPARTMENT

Accomplish excellence in curricular, co-curricular activities with a committed faculty through teaching and research which creates technically competent and dedicated civil engineers to serve their surroundings with pride.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Possess the knowledge, attitude and skills needed for a professional career in the field of Environmental engineering and Management.

PEO2: Continue to advance career through higher education and professional development.

PEO3: Advocate environmental engineering for societal issues and sustainable development of society.

Programme Outcomes (POs):

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GAs of PG programmes are examples of the attributes expected from a graduate of an accredited programme. The Graduate Attributes of PG programmes of the NBA are as following:

PO1 - An ability to independently carry out research/investigation and development work to solve practical problems.

PO2 - An ability to write and present a substantial technical report/document

PO3 - Students should be able to demonstrate a degree of mastery over the area as per the specialization of the programs. The mastery should be at a level higher than the requirements in the appropriate bachelor programme.

Percentage Credit Distribution

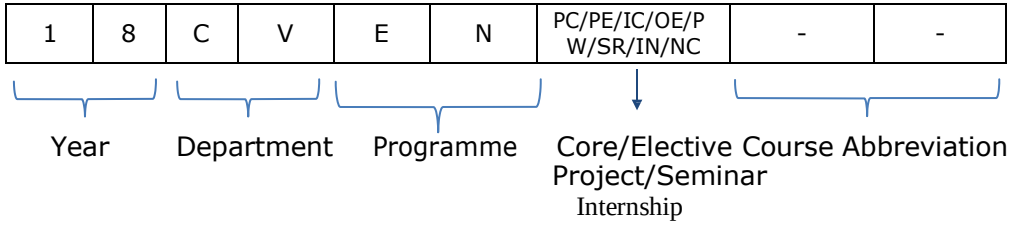
SI.No	Subject area	Percentage distribution of credits
1	Institute Core Courses	02
2	Program Core Courses	27
3	Institute Electives Courses	05
4	Program Electives Courses	21
5	Internship & Seminar	11
6	Major Project	34

Scheme of Instruction for **First Semester** M. Tech. in Environmental Engineering -2018-2019

I Semester

Course Code	Name of the Course	Credits			Total Credits
		L	T	P	
18CVENPCCM	Applied Environmental Chemistry & Microbiology	3	0	1	4
18CVENPCWT	Water Treatment Technology	3	1	0	4
18CVENPCAC	Atmospheric Environmental Pollution and Control	3	0	1	4
18CVENPEXX	Elective - I	3	1	0	4
18CVENPEXX	Elective – II	3	1	0	4
18ALLPICRM	Research Methodology and IPR	2	0	0	2
Total					**22**

L – Lecture; T - Tutorial; P – Practical ; CIE- Continuous Internal Evaluation; SEE- Semester End Examination



LIST OF ELECTIVES FOR FIRST SEMESTER

Elective - I		Elective - II	
18CVENPEWR	Water Resources Engineering & Applied Hydraulics	18CVENPESH	Solid and Hazardous waste Management
18CVENPELP	Environmental Legal Aspects and Policy Guidelines	18CVENPEEG	Environmental Geo-technology
18CVENPEGC	Global warming and climate change	18CVENPERF	Renewable Energy and Alternative fuels

Note : one elective to be chosen from each group of electives :
Elective will be offered for a minimum strength of six candidates (out of 18) / eight candidates (out of 24)

B M S COLLEGE OF ENGINEERING, BANGALORE-560019
(Autonomous College under VTU)

Scheme of Instruction for **Second Semester** M. Tech. in Environmental Engineering - 2018-2019

II Semester

Course Code	Name of the Course	Credits			Total Credits
		L	T	P	
18CVENPCWW	Wastewater Treatment Engineering	3	0	1	4
18CVENPCRG	Remote Sensing & GIS in Environmental Engineering	3	0	1	4
18CVENPCSC	Statistics and Computational Methods	3	1	0	4
18CVENPEXX	Elective - III	3	0	0	3
18CVENPEXX	Elective - IV	3	0	0	3
18CVENOEXX	Open Elective	3	1	0	4
Total					**22**

L – Lecture; T - Tutorial; P – Practical

LIST OF ELECTIVES FOR SECOND SEMESTER

Elective - III		**Elective - IV**	
18CVENPEEA	Ecology and Environmental Impact Assessment	18CVENPEEM	Environmental Planning and Management
18CVENPETA	Toxicology and Environmental Risk Assessment	18CVENPEIW	Industrial Wastewater Treatment
18CVENPENM	Non-point Source of Pollution and Management	18CVENPEWE	Waste to Energy

Note : One elective to be chosen from each group of electives :
Elective will be offered for a minimum strength of six candidates (out of 18) / eight candidates (out of 24)

Scheme of Instruction for **Third Semester** M. Tech. in Environmental Engineering -2018-2019

III Semester

Subject Code	Course Title	Credits			Total Credits
		L	**T**	**P**	
18CVENPWP1	Major Project Phase - I	-	-	18	18
18CVENPEXX	Elective - V	3	1	0	4
18CVENNCXX	Audit Course - 1				2 units
	Total				**22**

Elective - V	
18CVENPETM	Transport Processes and Modeling of Aquatic Systems
18CVENPEOM	Operation & Maintenance of Environmental Facilities
18CVENPEEB	Environmental Biotechnology

Scheme of Instruction for **Fourth Semester** M. Tech. in Environmental Engineering -2018-2019

IV Semester

Subject Code	Course Title	Credits			Total Credits
		L	**T**	**P**	
18CVENPCIN	Internship			08	08
18CVENPWP2	Major Project Phase – II	-	-	12	12
18CVENPCSR	Seminar			02	02
18CVENNCXX	Audit Course - 2				2 units
Total					**22**

Audit course 1 & 2	
18CVENNCXX	Disaster Management
18CVENNCXX	Pedagogy Studies
18CVENNCXX	Value Education
18CVENNCXX	English for Research Paper Writing

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APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

Course Name	Applied Environmental Chemistry And Microbiology	Course Code	18CVENPCCM	SEE Duration	03 Hrs
Credits	04	L-T-P	3-0-1	CIE+SEE	50+50

Course Objectives: The course provides a in depth knowledge of various branches of Chemistry, microbiology and its application in treatment and characterization of environmental pollutants.

Course Outcomes: On completion of this course, students are able to

CO1: Explain concepts behind principles of Physical, Colloidal, analytical chemistry, Electrochemistry and microbiology in Environmental engineering processes.

CO2: Apply the principles of Physical, Electrochemistry and Analytical chemistry in Environmental Engineering process.

CO3: Conduct experiments to evaluate water quality parameters.

Unit – I

Introduction: Importance of Environmental Chemistry, types of reactions, redox reactions, reaction kinetics. Physical and equilibrium chemistry – fundamentals and applications.

Unit – II

Electrochemistry: Electrolytes, types of electrodes and its applications. pH – Principle, Measurement, Numerical Examples, Buffers and Buffer index.

Colloidal Chemistry – Properties of colloids, colloidal dispersions, stability of colloids and applications.

Unit – III

Instrumental Method of analysis: Colorimetry - Principles and applications. Applications of Analytical Chemistry – emission and absorption techniques.

Water and Wastewater analysis: Acidity, alkalinity, Hardness, DO, BOD and COD. Trace Contaminants and their analyses.

Unit – IV

Microbiology - Microorganisms of importance in air, water and soil environment Principles and applications of microscopy, microscopic flora and fauna of importance. Metabolism and metabolic pathways, Bioconcentration, Biomagnification and Bioaccumulation.

Unit – V

Bacteria – Morphology, typical growth curve and generation time, Measurement Techniques – APC, MPN (Probability and Thomas methods), MFT. Monod's equation and its applications.

Algae - Morphology, classification and their importance.

Fungi - Protozoa - morphology, classification and their importance.

Virology - Types, characteristics and enumeration methodology.

Enzymes - classification, kinetics - Michaelis-Menten equation, factors influencing enzyme reaction.

Laboratory Experiments:

Testing the samples for turbidity, Conductivity, Total Hardness, Iron, Fluorides, Nitrates, Phosphates, Heavy Metals. Plate Count test, MPN Tests and MFT Tests.

REFERENCES:

1. Sawyer C.N. and McCarty, P.L ., (2003), **"Chemistry for Environmental Engineering and Science**", 5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Stumn and Morgan(1995), "**Aquatic Chemistry",** 3rd Edition**,** John Willey & Sons Newyork.
3. Pelczar M.J ,Chan ECS, Krieg, NR(1998) **"Textbook of Microbiology"** 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. McKinney R.E.(1962) "**Microbiology for Sanitary Engineers**", Newyork McGraw Hill.
5. Gaudy and Gaudy (1980), "**Microbiology for Environmental Scientists and Engineers**", McGraw Hill.
6. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.
7. Relevant Journals.

e- sources:

1. http://nptel.ac.in/courses/103107084/4
2. http://nptel.ac.in/courses/103108100/41

WATER TREATMENT TECHNOLOGY

Course Name	Water Treatment Technology	Course Code	18CVENPCWT	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objectives: The course is designed to train students in the practical aspects of operating and design of water treatment plants, emphasizing safe practices and procedures.

Course Outcomes: On completion of this course, students are able to

CO1: Select the sources of water for various water uses and explain unit operations and processes of water treatment systems.

CO2: Apply the principles and design water treatment units.

Unit – I

Introduction – Sources of water, necessity of treatment, Critical Water quality parameters, water quality guidelines and standards for various water uses.

Unit operations – principles and design of aeration systems – two film theory, water in air system, air in water system. **Intake structures** – Different types, design criteria.

Unit – II

Principles of sedimentation – types of settling and settling equations, design criteria and design of settling tanks.

Principle of Coagulation and Flocculation – types of coagulants, coagulant aids, coagulation theory, optimum dose of coagulant, design criteria and numerical examples.

Unit – III

Filtration – theory, types, hydraulics of filter bed, design criteria and design of filters, filter backwash, operational problems and trouble shooting.

Adsorption Process – Types, factors affecting adsorption, kinetics and equilibrium – different isotherm equations and their applications.

Unit – IV

Unit processes - disinfection – different types, disinfectants, factors affecting disinfection, methods of disinfection, chemistry of chlorination.

Water Softening – Ions causing hardness, Langelier index, various methods.

Unit – V

Fluoridation and defluoridation – Principles and design.

Trace organic contaminants in water supplies and their removal.

Bench Scale and Pilot Plant studies in water treatment. Rural Water Supply Systems.

REFERENCES:

1. Fair, G.M., Geyer J.C and Okun, (1969) "**Water and Waste water Engineering**" Vol II, John Wiley Publications.

2. Weber W.J., (1975) "**Physico - Chemical Processes for Water Quality Control**".

3. AWWA, (1971), "**Water Quality and Treatment** "McGraw Hill.

4. CPHEEO Manual, (1991), "**Water Supply and Treatment",** GOI Publications.

5. Peavy, H.S., Rowe and Tchobonoglous,G., (1985), **"Environmental Engineering**", McGraw Hill

6. Raju, B.S.N., (1995), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt. Co. Ltd., New Delhi.

7. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.

World Health Organization, Geneva, (2004), Guidelines for Drinking Water Quality, Third Edition, Volumes 1-3.

ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL

Course Name	Atmospheric Environmental Pollution And Control	**Course Code**	18CVENPCAC	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-0-1	**CIE+SEE**	50+50

Course Objective: To familiarize the students on the principle and design of control of particulate/gaseous air pollutants, and importance of mathematical models and meteorology in air pollutant dispersion and its concentration.

Course Outcomes: On completion of this course, students are able to

CO1: Identify and explain sources, characterization of pollutants and their effects on outdoor and indoor atmosphere, plume behavior, monitoring of pollutants.

CO2: Develop governing equations for lapse rate, prediction of pollution concentration in atmosphere (Gassian, Area model), effective stock height and solve problem MMD, wind rose and concentration prediction, Controlling of particulate and gaseous pollutans.

CO3: Collect field data, historical data for investigation and analysis of air and noise quality, prepare report.

Unit-I

Definition, sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance, composition and structure of the atmosphere, effect on visibility

Unit-II

wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Windrose diagram, **plume behaviour**, problems.

Monitoring of particulate matter and gaseous pollutants – respirable, non-respirable and nano - particulate matter. CO, CO_2, Hydrocarbons (HC), SO_X and NO_X, photochemical oxidants

Unit-III

Pollutants dispersion models – description and application of point, line and areal sources, effective **stack height, problems**

Unit-IV

Air Pollution Control equipment for particulate matter & gaseous pollutants – gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – adsorption, absorption, scrubbers, condensation and combustion**.**

Unit-V

Indoor Air Pollution – sources, effects and control, standards

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Laboratory Experiments:

- Measurement and analyses of primary air pollutants SO_2, NO_x, and SPM using high volume sampler;
- Wind speed and wind direction measurements using Anemometer;
- Wind rose plotting based on the winds measurements;
- Noise level measurements using Sound level meter.

REFERENCES:

1. Wark K ., Warner C.F., and Davis W.T., (1998), "**Air Pollution - Its Origin and Control**", Harper & Row Publishers, New York.

2. Lee C.C., and Lin S.D., (1999), **"Handbook of Environmental Engineering Calculations**", McGraw Hill, New York.

3. Perkins H.C.(1974), "**Air Pollution**", McGraw Hill.

4. Crawford M.,(1976) "**Air Pollution Control Theory**", TATA McGraw Hill.

5. Stern A.C., "**Air Pollution**", Vol I, II, III.

6. Seinfeld N.J., (1975), "**Air Pollution",** McGraw Hill.

7. Stern A.C.(1968), (ed) Vol. V, "**Air Quality Management**".

WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS

Course Name	Water Resources Engineering And Applied Hydraulics	**Course Code**	18CVENPEWR	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-1-0	**CIE+SEE**	50+50

Course Objective: To make the knowledge base of the student in Hydrology and Hydraulics stronger and broader so that they can handle the design and analysis of the environmental systems with confidence.

Course Outcomes: On completion of this course, students are able to

CO1: Estimate rainfall, optimum rain gauges and consistency with the concept hydrology, Analysis of hydrograph, low and high flows, Estimate discharge in rivers, streams and overland peak flows, design of storm drains and outfall sewer.

CO2: Apply the concepts of hydraulics to design water mains, steady state groundwater problems.

CO3: Collect field data, historical data for investigation and analysis of trend, average quantities

Unit-I

Water resources of the world, India and Karnataka, National Water Policy.

Hydrology - Hydrologic cycle, estimation of missing precipitation and rain guage density.

Unit-II

Hydrograph theory - Unit hydrograph – derivation, flow routing, low flow analysis.

Urban Hydrology - Run-off estimation – Design of Storm-water Drains.

Unit-III

Design of water mains - Frictional head loss in pressure flow, minor heads losses, water distribution pipe networks Design

Unsteady Flow through Conduits - Water hammer analysis, Water hammer protection methods - surge tanks,

Unit-IV

Flow Measurements – Area –Velocity method, Weir method, flumes, end-depth method & chemical and radioactive tracers method

Unit-V

Groundwater - Basic equations of flow, confined and unconfined aquifers, sea water intrusion, artificial recharge, groundwater pollution, borewells - types & design principles, open wells – types, yield tests.

REFERENCES:

1. Raghunath H.M.(1988), "**Advanced Hydrology**", Wiley Eastern Ltd New Delhi

2. Subramanya K.S(1994)., "**Advanced Hydrology".Tata Mc Graw Hill, New Delhi**

3. David Keith Todd(1980), "**Ground Water Hydrology**".2nd Edition John Wiley & Sons New Delhi

4. Sabins F.F(1997)., "**Remote Sensing – Principles and Interpretations**", W.H. Freeman & Co.

5. Anji Reddy, (2001), "**Remote Sensing and GIS**", B.S. Publications, Hyderabad.

6. Ven T. Chow (1988), "**Hand Book of Applied Hydrology",** 1st Edition Mc Graw Hill Publications .

7. Hammer M.J, and Mackichan K.A.(1981), "**Hydrology and Quality of Water Resources**", Newyork:Wiley.

8. John Permankian, **"Water Hammer Analysis**".

9. Linsley, Franzini, Freyberg, Tchobanoglous G.(1992), "**Water Resources Engineering**", TATA McGraw Hill Series.

10. Linsley, Kohler and Paulhes(1975), "**Hydrology for Engineers**", McGraw Hill.

11. Mays L.W. (2004), **"Water Resources Engineering**", John Wiley and Sons Publications.

ENVIRONMENTAL LEGAL ASPECTS AND POLICY GUIDELINES

Course Name	Environmental Legal Aspects And Policy Guidelines	Course Code	18CVENPELP	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objective: The course provides an overview of some of the major environmental statutes in India. The course addresses the variety of regulatory tools and concepts that can be used to prevent environmental harm, focusing on the proper match between regulatory tool and environmental harm.

Course outcomes: On completion of this course, students are able to

CO1: Outline the various acts, rules and regulations of environment protection.

CO2: Explain the role of the Central and state judiciaries, as well as state legislatures and agencies, in formulating and implementing environmental policy.

Unit – I

Environment Definitions and Acts: Environment definition in Indian law- Different environmental protection legislations- History of Environmental protection in India - Provisions in Indian Penal Code for Environmental protection-The constitutions of India – Union list- State list – Concurrent list - Panchayats and Municipalities role

Unit – II

Water (prevention & control of Pollution) Act & Air (prevention & control of Pollution) Act : Water pollution – definition – Water (Conservation and protection) Act 1974 – Objectives of Water Act – Legislation to control water pollution – Functions of CPCB and SPCB - Local bodies role – Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 - Water (prevention & control of Pollution) Cess Act 1977 as amended by Amendment Act 1987 and relevant notifications - Tolerance limits for effluents discharge and drinking water - Constitution and Resources management and pollution control – Air (prevention & control of Pollution) Act 1981-Sections of Air (prevention & control of Pollution) Act 19, 20, 21, 22-Penalties -Ambient air quality standards-Noise and the Laws.

Unit – III

Environmental (Protection) Act 1986 : Environment and pollution - definition as per Environmental law-General powers of Central and state Government under EPA-Important Notification in EPA 1986- The Indian Forest Act 1927- Forest Conservation Act 1980 - Wild Life (Protection) Act - Constitution of Pollution Control Boards - Powers, functions, Accounts, Audit etc. – Equitable remedies for pollution control

Unit – IV

Municipal Solid Waste Management Rules: Solid waste management – Hazardous Wastes (Handling and Management) Rules 1998-Bio-medical Wastes (Handling and Management) Rules 1998-Recyclled plastics (Manufacture and Usage) Rules, 1999-Municipal Solid Waste Management Act 2003- Rules - E.I.A and Public Hearing- Eco-labeling-Eco Mark.

Unit – V

Coastal Regulation Zone Notification and Green Benches Coastal Regulation Zone - definition-Importance of coral reef-Regulation activities in CRZ - The Biological Diversity Act 2002-Bio diversity Rules 2004-The Intellectual Property Rights (IPR)-National Environment Appellate Authority –Environmental Tribunal and Green Benches - Some Important cases on Environment - International Conventions - Protocols for protection of the Environment

REFERENCES:

1. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
2. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.
3. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997.
4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.
5. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification.
6. Environmental Laws of India-C.P.R. Environmental Education Centre.

GLOBAL WARMING AND CLIMATE CHANGE

Course Name	Global Warming And Climate Change	Course Code	18CVENPEGC	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objective: To enable the students to learn important issues and aspects of Climate change, and control methods like cleaner technologies and carbon sequestration.

Course Outcomes: On completion of this course, students are able to

CO1: Identify the various issues pertaining to climate change, Outline the various impacts of climate change globally and on regional scale.

CO2: Explain cleaner technologies and carbon sequestration to check global warming.

Unit – I

Energy Issues and Climate Change, Alternate Energy Sources.

Unit – II

Green-House Effect as a Natural Phenomenon, Green House Gases (GHGs) and their Emission Sources Quantification of CO_2 Emission, Global Warming Potential (GWP) of GHGs.

Unit – III

Modeling Climate change, Ozone layer depletion and its control .

Impacts of climate change – Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss.

Unit – IV

Kyoto Protocol – Importance, Significance and its role in Climate Change.

Carbon Trading - Mechanisms , Various Models (European, Indian) Global and Indian Scenario.

Unit – V

Cleaner Development Mechanisms – Various Projects related to CO_2 Emission Reduction.

Alternatives of Carbon Sequestration – Conventional and non-conventional techniques, Role of Countries and Citizens in Containing Global Warming.

REFERENCES:

1. Barry R.G., and Chorley R.L., (1992), **"Atmosphere, Weather and Climate",** 4th Edition, ELBS Publication.

2. Bolin B., (Ed.), (1981), **"Carbon Cycle Modelling",** John Wiley and Sons Publications.

3. Corell R.W., and Anderson P.A., (Eds.), (1991), **"Global Environmental Change",** Springler Verlog Publishers.

4. Francis D., (2000), **"Global Warming: The Science and Climate Change",** Oxford University Press.

5. Frame B., Medury Y., and Joshi Y., (Eds.), (1992), **"Global Climate Change: Science, Impact and Responses".**

6. Linden E., (2006), **"The Winds of Change: Climate, Weather and the Destruction of Civilizations",** Simon and Schuster Publications.

7. Mintzer I.M., (Ed.), (1982), **"Confronting Climate Change, Risks, Implications and Responses"**, Cambridge University Press.

8. Srivatsava A.K., (2007), **"Global Warming",** APH Publications.

9. Wyman R.L., (Ed.), (1991), **"Global Climate Change and Life on Earth",** Chapman and Hall Publications.

10. Yadav, Chander and Bhan, (2005), **"Global Warming: India's Response and Strategy",** RPH Publications.

SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Name	Solid and Hazardous Waste Management	Course Code	18CVENPESH	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objective: To familiarize the students on segregation, collection, transportation, recycling and disposal of municipal solid and hazardous waste in such a way that its impact is minimal on environment, economy and community.

Course outcomes: On completion of this course, students are able to

CO1: Understand and apply the basic scientific and sustainability principles behind waste management, for solving practical waste management challenges

CO2: Understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of value from waste

CO3: Make an effective oral presentation on recent trends of solid and hazardous waste management through extensive literature.

Unit – I

Solid waste – sources and engineering classification, characterization, generation and quantification.

Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Unit – II

Treatment methods - various methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis and energy recovery,

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Unit – III

Hazardous Waste Management- Introduction, Sources, Classification, Characterization, Regulations for Hazardous Waste Management.

Hazardous Waste Minimization – Approaches, Development of a Waste Tracking System, Selection of waste Minimization Process, Case Studies.

Unit – IV

Hazardous waste treatment and Design- Hazardous waste treatment technologies, design and operation of facilities for physical, chemical and thermal treatment of hazardous waste.

Hazardous waste landfills – Site selection and design approach, leachate and gaseous collection system.

Unit – V

Remediation of hazardous waste disposal site – bioremediation processes.

Biomedical Waste Management – sources, treatment and disposal.

Oral presentation on recent trends of solid and hazardous waste management through extensive literature.

REFERENCES:

1. Tchobanoglous G., Theissen H., and EIiassen R.(1991), **"Solid Waste Engineering - Principles and Management Issues**", McGraw Hill, New York.
2. Pavoni J.L(1973)., "**Handbook of Solid Waste Disposal**".
3. Peavy, Rowe and Tchobanoglous (1985), "**Environmental Engineering**", McGraw Hill Co. 4th Edition
4. Mantell C.L., (1975), "**Solid Waste Management**", John Wiley.
5. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
6. Vesiland A.(2002), "**Solid Waste Engineering**", Thompson Books.
7. Biomedical (Handling and Management) Rules 2008
8. Lehman, (1983), **"Hazardous Waste Disposal"**, Plenum Press.
9. LaGrega M.D., Buckingham P.L., and Evans J.C., (1994), **"Hazardous Waste Management**", McGraw Hill International Edition.
10. Wentz C.A., (1989), "**Hazardous Waste Management**", McGraw Hill.
11. Dawson and Mercer, (1981), **"Hazardous Waste Management**", John Wiley.
12. Fawcett, (1984), "**Hazardous and Toxic Materials: Safe Handling and Disposal"**, John Wiley.

e- sources: http://nptel.ac.in/courses/120108005/

ENVIRONMENTAL GEO-TECHNOLOGY

Course Name	Environmental Geo-Technology	Course Code	18CVENPEEG	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course objectives:

The course describes various causes of soil pollution, behavior of the pollutants and its detection and testing methods. It also outlines the application of geo synthetics in solid waste management along with current practice for waste disposal.

Course Outcomes: On completion of this course, students are able to

CO1: Identify the causes for soil pollution and behavior of the pollutants.

CO2: Evaluate and remediate contaminated sites and monitor to bring natural attenuation

Unit – I

Soil- Pollutant Interaction:

Introduction to geo environmental engineering – environmental cycle – sources, production and classification of waste – causes of soil pollution – factors governing soil-pollutant interaction-Physicochemical behavior and modelling -failures of foundations due to pollutants.

Unit – II

Characterization, Stabilization and Disposal

Safe disposal of waste – site selection for land fills – characterization of land fill sites – waste characterization – stability of land fills – current practice of waste disposal- passive contaminant system – Hazardous waste control and storage system – mechanism of stabilization - solidification of wastes – micro and macro encapsulation – absorption, adsorption, precipitation- detoxification — organic and inorganic stabilization

Unit – III

Transport of Contaminants:

Contaminant transport in sub surface – advection – diffusion – dispersion – governing equations – contaminant transformation – sorption – biodegradation – ion exchange – precipitation – hydrological consideration in land fill design – ground water pollution – bearing capacity of compacted fills – pollution of aquifers by mixing of liquid waste – protecting aquifers.

Unit – IV

Detection and Testing Methods

Methodology- review of current soil testing concepts – Proposed approach for characterization and identification of contaminated ground soil for engineering purposes.

Unit – V

Remediation of Contaminated Soils:

Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation – exsitu and insitu remediation – solidification, bio – remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting – Ground water remediation – pump and treat, air sparging, reactive well- application of geo synthetics in solid waste management – rigid or flexible liners.

REFERENCES:

1. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
2. Daniel, B.E., Geotechnical practice for waste disposal, Chapman and Hall, London, 1993.
3. Fang, H.Y. Introduction to environmental Geotechnology, CRC press New York, 1997.
4. Lagrega, M.d., Bukingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.

RENEWABLE ENERGY AND ALTERNATIVE FUELS

Course Name	Renewable Energy And Alternative Fuels	Course Code	18CVENPERF	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objective:

This course creates awareness in students about importance of alternative fuels, combustion and emission characteristics of various gaseous and liquid alternative flues.

Course outcomes: On completion of this course, students are able to

CO1: Outline the need and application of various alternative fuels, **:** Explain various methods/technologies to harness various renewable energy sources, **:** Explain various methods/technologies to harness various renewable energy sources

Unit – I

Introduction to energy and resources – Renewable energy sources - Availability of solar energy – Sun-earth relationships - - Solar radiation measurement – Flat plate collectors – Solar water heating systems – Evacuated Tubular Concentrators - Solar air heating systems and applications – Concepts on solar drying, cooking, desalination, solar ponds and solar cooling - Passive heating and cooling of buildings – Basics of solar concentrators and types Solar thermal power generation

Unit – II

Biomass to energy conversion processes – Anaerobic digestion, process parameters, biogas composition, digester types, high rate anaerobic conversion systems – Alcohol from biomass – Biodiesel: preparation, characteristics and application - Biomass combustion and power generation – Briquetting – Gasification: Process, types of gasifiers, applications – Waste to energy technologies.

Unit – III

Power in the wind - Types of wind mills – WEG components, Power curves and energy estimation– Indian wind potential. Small Hydro Power: Types, site identification, head and flow measurement, discharge curve, estima tion of power potential and system components. Technologies for harnessing renewable energy sources like geothermal, wave, tidal and ocean thermal energy.

Unit – IV

Fossil fuels and their availability - Potential alternative liquid and gaseous fuels - Merits and demerits of various alternative fuels – Engine requirements Methods of production - Properties - Blends of gasoline and alcohol - Performance in SI engines – Adaptability - Combustion and emission characteristics - Performance in CI engines – Emission characteristics - Properties of alcohol esters. Production and properties of CNG, LPG, hydrogen gas, biogas and producer gas - Performance and Storage, distribution and safety aspects

Unit – V

Various vegetables oils - Properties - Esterification - Performance and emission characteristics - Bio-diesel: Feed stock, characteristics, preparation (lab and commercial), storage, applications, environmental impacts, economics, and policy.

REFERENCES:

1. Frank Kreith and D.Yogi Goswami (2007), Handbook of Energy Efficiency and Renewable Energy, CRC Press.
2. John Twidell and Tony Weir (2006), Renewable Energy Resources, 2nd Edition, Taylor & Francis, USA.
3. John A. Duffie and William A. Beckman (2006),
4. Solar Engineering of Thermal Process, 3rd Edition, John Wiley & Sons.
5. Gilbert M. Masters (2004), Renewable and Efficient Electric Power Systems, Wiley Interscience.
6. Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels, Wiley Interscience Publication, New York
7. Alcohols and Motor Fuels: Progress in Technology - Series No. 19 - SAE Publication USA C

RESEARCH METHODOLOGY AND IPR

Course Name	Research Methodology and IPR	Course Code	18ALLPICRM	SEE Duration	03 Hrs
Credits	02	L-T-P-S	2-0-0-0	CIE+SEE	50+50

Course Outcomes: On completion of this course, students are able to

CO1 Ability to write and present a substantial technical report/document
CO2 Able to demonstrate a degree of mastery over the area of specialization

Unit – I

Meaning and sources of research problem, , Objectives and Characteristics of research – Errors in selecting research problem, Research methods Vs Methodology - Types of research-Criteria of good research – Developing a research plan.

Unit – II

Investigations of a research problem - Selecting the problem - Necessity of defining the problem – Data collections-analysis- Importance of literature review in defining a problem - Survey of literature - Necessary instrumentations

Unit – III

How to write paper-conference articles-poster preparation, thesis report writing, inclusion of references, journal reviewing process, journal selection process, filling about journal template, developing effective research proposal-plagiarism-research ethics

Unit – IV

Nature of Intellectual property, IPRs- Invention and Creativity - Importance and Protection of Intellectual Property Rights (IPRs) – procedure for grant of patents and patenting under PCT-types of patents-technological research and innovation- international cooperation on IP.

Unit – V

A brief summary of : Patents-Copyrights-Trademarks, patent rights-licensing and transfer of technology-patent databases-case studies on IPR-Geographical indications-new developments in IPR-protection of IPR rights

REFERENCE BOOKS:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2
5. Subbarau NR-Handbook of Intellectual property law and practise- S Viswanathan Printers and Publishing Private Limited 1998.

WASTEWATER TREATMENT ENGINEERING

Course Name	Wastewater Treatment Engineering	Course Code	18CVENPCWW	SEE Duration	03 Hrs
Credits	04	L-T-P	3-0-1	CIE+SEE	50+50

Course Objective: To provide a basic description and understanding of the principal unit operations and processes used in the treatment of wastewater. This will include coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design.

Course Outcomes: On completion of this course, students are able to

CO1: Explain the unit operations and processes for wastewater treatment.

CO2: Apply the principles and design unit operations and processes for wastewater treatment.

CO3: Conduct experiments to evaluate wastewater quality parameters

Unit – I

Objectives of wastewater treatment, characteristics, flow variations, types of reactors and reactors analysis. Wastewater Treatment Flow Diagrams and Hydraulic Profile.

Unit – II

Theoretical principles and design - screens, equalization basin, grit chamber, primary and secondary settling tanks. **Kinetics of biological treatment systems** – biokinetic constants and their determination, batch and continuous systems.

Unit – III

Theoretical principles and design – suspended growth system - conventional activated sludge process and its modifications.

Theoretical principles and design – attached growth system – trickling filter, bio-towers and rotating biological contactors. Principles and design of stabilization ponds

Unit – IV

Sludge Processing – separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic.

Unit – V

Advanced Wastewater Treatment – Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Wastewater disinfection.

Rural wastewater systems – septic tanks, two-pit latrines, eco-toilet, soak pits.

Laboratory Experiments:

Testing the samples for pH, Alkalinity, total solids, total dissolved solids, DO, BOD and COD, determination of SVI.

REFERENCES:

1. Benefield R.D., and Randal C.W., (1980), **"Biological Process Design for Wastewater Treatment"**, Prentice Hall, Englewood Chiffs, New Jersey.

2. Metcalf and Eddy Inc., (2003), **"Wastewater Engineering - Treatment and Reuse",** 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

3. Karia G.L., and Christian R.A., (2001**), "Wastewater Treatment Concepts and Design Approach",** Prentice Hall of India Pvt. Ltd., New Delhi.

4. Ronand L., and Droste, (1997),"**Theory and Practice of Water and Wastewater Treatment**", John Wiley and Sons Inc.

5. Fair G.M., Geyer J.G and Okun, "**Water-wastewater Engineering**".

6. Lee C.C., and Lin S.D., (1999), **"Handbook of Environmental Engineering Calculations",** McGraw Hill, New York.

7. Gaudy,(1972) "**Advanced Wastewater Treatment".**

8. **"Industrial Safety and Pollution Control Handbook", (1991),** National Safety Council and Associate (Data) Publishers Pvt. Ltd.,

9. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.

REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

Course Name	Remote Sensing and GIS In Environmental Engineering	**Course Code**	18CVENPCRG	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-0-1	**CIE+SEE**	50+50

Course Objective: To enable understanding of basics in remote sensing, GIS and applications in environmental engineering

Course outcomes: On completion of this course, students are able to

CO1: Explain the basic principles of remote sensing, Outline the importance and concept of image processing

CO2: Explain the basic principles and components of GIS, Apply the knowledge of RS-GIS for various environmental problems

CO3: conduct activities on basics in remote sensing and GIS

Unit-I

Fundamentals Of Remote Sensing

Definition, Physics of Remote Sensing, Electromagnetic Radiation and its interactions with atmosphere, Spectral reflectance of earth features, Resolution spectral, spatial, Temporal and Radiometric.

Unit-II

Platforms and Sensors

Aerial Photographs, Active and passive sensors, Data products, various satellites in orbit and their sensors. Image Processing- Visual and digital image, Interpretation, Interpretation keys, Methodology, Training sets, Ground truth verification

Unit-III

Digital Image analysis, Image enhancement, Rectification, Classification methods, Users accuracy, producers accuracy and overall accuracy.

Unit-IV

Introduction To GIS

Data entry, storage and maintenances, Data output. Data analysis, Hardware and software.

Unit-V

Applications of Remote Sensing And GIS

Application of remotely sensed data for identifying solid waste disposal, forest fire mapping, EIA studies etc., Optimal routing of solid waste using GIS – Case Study, Environmental siting of industries and zoning atlas development, Remodeling of water distribution system using GIS, Environmental degradation assessment using RS and GIS.

Lab Component

Import and Image Registration (Image to Image, Image to Map), Image Subset / Clipping, band stacking and FCC, Spectral Signature of various land features, Image Classification from satellite data sets, Digitization, attribute assigning, Raster to Vector formats, Spatial Analysis.

REFERENCES:

1. Lillies and T.M. and Kiefer, R.W., " **Remote Sensing and Image Interpretation",** John Wiley and Sons, 1994.

2. Burrough, P.A. and McDonnell, R.A., **"Principles of Geographical Information Systems"**, Oxford University press, 1998

3. Lintz,J. and simonet, **" Remote sensing of Environment"**, Addison Wesley Publishing Company, 1994.

4. Mishra H.C., (1997), "**GIS Handbook**", GIS India, Shanthi Nivas, Hyderabad.

5. Syed R. Qasim, Edward M. Motley & Guang Zhu, **"Water Works Engineering: Planning, Design and Operation",** Eastern Economy Edition, PHI Learning Private Limited, New Delhi.

STATISTICS AND COMPUTATIONAL METHODS

Course Name	Statistics and computational methods	**Course Code**	18CVENPCSC	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-1-0	**CIE+SEE**	50+50

Course Objective: To enable the students apply Numerical techniques, basic optimization concept and statistics to various areas of environmental engineering like sampling and analysis, modelling etc.

Course Outcomes: On completion of this course, students are able to

CO1: Apply statistical techniques to examine data.

CO2: Solve engineering problems that involve constrained resource allocation.

CO3: Solve the governing equations of partial differential in nature applied to engineering problems.

UNIT-I

Statistics - Statistical methods, scope and limitations, population and sample, frequency distribution-measure of central tendency-measures of Dispersion-Mean, Median ,Mode, standard deviation, coefficient of variation, skewness and their applications. Frequency Distribution,Method of Least Squares and Regrssion, Multiple Regression .

UNIT-II

Probability – Concepts, Methods, Binomial, Poisson and Normal distribution.

UNIT-III

Statistical decisions: Hypothesis testing, significance levels Significance Tests.

UNIT-IV

Optimization – classification and importance in Environmental Studies, introduction to optimization without and with constraints, **Linear Programming –** different methods.

UNIT-V

Numerical Methods - Partial differential equations, Newton-Raphson method.

Introduction to Finite difference.

REFERENCES:

1. Rao. S.S.(1979) **Optimization: Theory & Applications Techniques**, Wiley Eastern Ltd New Delhi.

2. Taha H.A.,(2007), "**Optimization Research":An introduction**, Pear son Prentice Hall, 8th Edition

3. Shanthakumar M.S., **Numerical Methods and Analysis,** Tata McGrawhill Pubs.

4. Ross S.M.,(1987) "**Introduction to Probability and Statistics for Engineers and Scientists"**, John Wiley Publications.3rd Edition, Acedimic press

5. Stanton(1961) R.G –" **Numerical methods for science and engineers"**.Prentice Hall, Trade Edition

6. Kreyszig Erwin(2006),9th Edition" **Advanced Engineering Mathematics"**, Wiley Eastern Publications.

7. Berthouex P M.,and Brown L. C.(1994), "**Statistics for Environmental Engineers"**, Lishers publication, 2nd Edition

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

Course Name	Ecology And Environmental Impact Assessment	**Course Code**	18CVENPEEA	**SEE Duration**	03 Hrs
Credits	03	**L-T-P**	3-0-0	**CIE+SEE**	50+50

Course Objective: The overall objective of this course is to improve the application of ecological evaluation within EIAs. To provide Knowledge on principle of ecology and environmental impact assessment (EIA), history and law related to EIA, tools for evaluate impact on Physical, Biological, human use and quality of life focused with case studies.

Course Outcomes: On completion of this course, students are able to

CO1: Identify different Components of ecosystem and their interactions and interrelationships.

CO2: Outline the systematic process for environmental impact assessment along with different methodologies.

CO3: Identify and assess the impacts on environmental attributes from developmental projects, Explain importance of Public participation, EMP and DMP in EIA process.

Unit – I

Ecology - Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geo-chemical cycles, Ecological Pyramids.

Aquatic and Terrestrial Ecosystems - Diversity and dominance Indices, Ecosystem Models.

Unit – II

Climate change and biodiversity

Lake Ecosystem – trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication.

Unit – III

Environmental Impact Assessment – Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by-step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme.

Unit – IV

Frame work of Impact assessment, scope and contents of EIA, methodologies and techniques of EIA.

Attributes, Standards and Value functions, Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).

Unit – V

EIA Case Studies –Thermal Power Plant, Mining, Fertilizer, Construction Projects, Airport, Water and Wastewater Treatment Plants.

REFERENCES:

1. Kormondy, (1960), "**Concepts of Ecology**", Prentice Hall Publication, New Jersey.

2. Odum, (1961), "**Fundamentals of Ecology",** Adisson Co.

3. Krebs J.,(1985) "**Ecology - The Experimental Analysis of Distribution and Abundance**", I Edition, Harper International.

4. Hall C.A.S., and Day J.W.(1977), "**Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories**", John Willey.

5. Canter L., (1995), "**Environmental Impact Assessment**", McGraw Hill.

6. Jain R.K., Urban L.V., Stacey G.S., (1977), "**Environmental Impact Analysis – A New Dimension in Decision Making**", Van Nostrand Reinhold Co.

7. Clark B.C. Bisett and Tomlinson P, (1985), "**Perspective on Environmental Impact Assessment**", Allied Publishers.

8. Rau and Wooten, (1981), "**Environmental Impact Assessment Handbook**". McGraw Hill.

9. **Relevant Journals** :

e- sources:

1. http://eia.unu.edu/
2. http://envfor.nic.in/

TOXICOLOGY & ENVIRONMENTAL RISK ASSESSMENT

Course Name	Toxicology & Environmental Risk Assessment	**Course Code**	18CVENPETA	**SEE Duration**	03 Hrs
Credits	03	**L-T-P**	3-0-0	**CIE+SEE**	50+50

Course Objective:

This course introduces the principles; mechanistic and management about the environmental toxicology. This course describes various Risk assessment methods to analyse the effect of various toxic chemicals on environment and health.

Course Outcomes: On completion of this course, students are able to

CO1: Outline the methods and processes employed in environmental health and risk assessment, explain the key principles of environmental health risk characterization

CO2: Identify risk due to carcinogens and analyze various methods of risk assessment.

Unit – I

Introduction to toxicology – Significance, Applications, & Importance

Unit – II

Introduction to risk assessment – assessment methods,

Human exposure assessment, characterization of health risks. LD50 & LC50 concentrations

Unit – III

Toxicology – exposure, toxic effects, dose response relationships, carcinogens and non-carcinogens.

Unit – IV

Toxicology & Epidemiology, public health & Risk assessment, Epidemiology & its importance,

Hazard identification, exposure and toxicity assessment, Risk characterization, risk communication,

Unit – V

Ecological risk assessment – Monte Carlo methods, case studies.

REFERENCES:

1. LaGrega M.D., Buckingham P.L. and Evans J.C.(1994), "**Hazardous Waste Management"-** McGraw Hill, New York

2. David G.M, and Haner N.B., "**An Applied Approach to Epidemiology and Toxicology for Engineers"** – Instructor's Resource Guide, US Department of Health Education and Welfare.

3. World Health Organization Report," **Recommended Health Based Limits in Occupational Exposure to Heavy Metals"**

4. Kamrin S. E., "**A text book on Primer on Toxicology Principles & Applications"** Lewis Publishers.

5. Kalos M.H., and Whitloc P.A.(1986), **Monte Carlo Methods**, Vol. 1, Basics, Wiley Publications.

6. Fan A.M & Chang L.W, (1996), "**Toxilogy & Risk Assessment- Principles , Methods & Applications",** Informa Health Care pubs.

7. Price F.T, Nancy Lane, Briq K.V, (2000), "**Environmental Toxiology & Risks Assessment – Recent Advancement in Environmental Fate & Transport ", ASTM International**

8. Landis W.G., Ming-Ho Yu, (2004), "**Introduction to Environmental Toxicology - Impacts of Chemicals upon Ecological Systems", CRC Press**

NON – POINT SOURCES OF POLLUTION AND MANAGEMENT

Course Name	Non – Point Sources Of Pollution And Management	Course Code	18CVENPENM	SEE Duration	03 Hrs
Credits	03	L-T-P	3-0-0	CIE+SEE	50+50

Course Objective:

To provide an understanding to protect the quality of water resources from the adverse effects of nonpoint source (NPS) water pollution.

Course Outcomes: On completion of this course, students are able to:

CO1: Utilize Simulation Models for tracing nonpoint source pollution.

CO2: Develop management solutions for nonpoint source pollution control, Select best management solutions for nonpoint source pollution control.

Unit – I

Introduction: Non-point Pollution, Problem, definitions, magnitude of Non-point Pollution, Non-point Pollution Control Laws, Waste Assimilative Capacity and Stream Standards pollution From the Atmosphere: Atmospheric Inputs – fall out, rainfall, Overland routing of the precipitation excess, interflow ground water flow.

Unit – II

Groundwater Pollution: Sources of Groundwater Contamination, Groundwater Movement. Pollution from impervious urban areas: Introduction Deposition and Accumulation of Pollutants on Impervious Surfaces Removal of Solids from street Surfaces, Porous Pavement.

Unit – III

Non point Pollution Simulation Models: Basic Concepts Brief Description available Nonpoint Pollution Simulation Models.

Unit – IV

Land use and non-point pollution: Effects, Comparative Assessment of Pollution Impact from land use, agricultural runoff, mining area runoff, Effect of hydrologic Modifications,

Management Practices of Non-point pollution control: Introduction, Source Control Measures Collection Control and Reduction of Delivery.

Unit – V

Planning for Nonpoint Pollution Control: Introduction, Water Quality Planning Process, Selection of Best Management Practices for Non-Point Source Pollution Control – detention ponds, exfiltration and infiltration trenches, vegetative swales.

REFERENCES:

1. Novotny V., and Chesters G., " Hand Book of Non-point Pollution, Sources and Management", Van Nostrand Reinhold Environmental Engineering Series, New York.
2. Pavoni J L, (Ed) "Hand Book of Water Quality Management Planning", Van Nostrand Reinhold, Environmental Engineering Series.New York
3. Pluarg, Pollution from Land Use Activities Reference Group Novotny V and Chesters G, "Hand Book of Non-point Pollution, Sources and Management", Van Nostrand Reinhold Company

ENVIRONMENTAL PLANNING AND MANAGEMENT

Course Name	Environmental Planning And Management	Course Code	18CVENPEEM	SEE Duration	03 Hrs
Credits	03	L-T-P	3-0-0	CIE+SEE	50+50

Course Objective: To enable understanding issues with respect to Environmental planning and Environmental management.

Course Outcomes: On completion of this course, students are able to

CO1: Outline issues related to environmental planning and sustainable development.

CO2: Identify various economic tools in evaluation of environmental aspects, Apply quality management principles in Environmental Auditing.

Unit – I

Environment and Sustainable Development - carrying capacity, relationship with quality of life, carrying capacity and resource utilization.

Unit – II

Engineering Methodology in Planning and its Limitations – carrying capacity based short and long term regional planning.

Environmental Protection - Economic development and social welfare consideration in socio economic developmental policies and planning.

Unit – III

Total cost of development and environmental protection cost. Case studies on Regional carrying capacity.

Engineering Economics – Value Engineering, Time Value of Money, Cash Flows, Budgeting and Accounting.

Unit – IV

Environmental Economics: Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.

Unit – V

Environmental Audit – methods, procedure, reporting and case studies.

Total Quality Management in environmental management and protection – ISO 9000, 14000 and 18000 series of standards.

REFERENCES:

1. Lohani B.N (1984)., "**Environmental Quality Management**",South Asian Publishers, New Delhi

2. Chanlett, (1973)"**Environmental Protection**", McGraw Hill Publication, Newyork.

3. Danoy G.E., and Warner R.F., (1969), "**Planning and Design of Engineering Systems**",Unwin Hyman Publications.

4. MOEF, Government of India, "**Carrying Capacity Based Developmental Planning Studies for the National Capital Region"**, 1995-96.

5. NEERI, Nagpur, Annual Reports 1995 & 1996.

6. UNEP / UNDP – "**Environmental Sustainable Development**".

INDUSTRIAL WASTEWATER TREATMENT

Course Name	Industrial Wastewater Treatment	Course Code	18CVENPEIW	SEE Duration	03 Hrs
Credits	03	L-T-P	3-0-0	CIE+SEE	50+50

Course Objectives: To provide an understanding of the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use.

Course Outcomes: On completion of this course, students are able to

CO1: Outline the effects of industrial wastes on the treatment plants, water bodies, soil and explain surveying of industrial waste for pretreatment programme.

CO2: Explain wastewater treatment in specific industries and design treatment units.

Unit – I

Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.

Unit – II

Effluent standards and receiving water quality standards. Different aspects and choices of various disposal alternatives.

Industrial waste survey-Process flow charts, condition of waste stream. Material balance, Sampling – Grab, Composite and integrated samples. Continuous monitoring – pH, Conductivity, Biomonitoring.

Unit – III

Pretreatment of industrial wastewater – Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

Unit – IV

Wastewater treatment in specific industries and design of treatment units. Distillery, Sugar, Pulp and paper, Cement, Textile, Dairy, Fertilizer, Pesticides, Pharmaceutical.

Unit – V

Radio Active Wastes treatment- Low activity and high activity radiation, application of radio active techniques for wastewater treatment. **Bio-Remediation** of contaminated soils and industrial wastes.

Environmental Auditing: Introduction, Cost of Pollution, Environmental audit solutions, Financial and Managerial opportunities. Criminal and Regulatory liabilities.

REFERENCES:

1. Nemerow N.N., (1971) "**Liquid Waste of industry theories,** "Practices and Treatment. Addison Willey New York.

2. Azad N. S.,– "**Industrial Wastewater Management Hand Book"** McGraw Hill book Co.,
New York.

3. Ross R.D. (1968)– "**Industrial Waste Disposal"**, Reinhold Environmental Series – New York.

4. Dickinson(1974**)- Practical Waste Treatment and Disposal Applied Science publication**, London.

5. Mahajan (1984) –" **Pollution control in Process industries"**. TMH, New Delhi.

6. Eckenfelder(2000)- "**Industrial Water pollution Control"-** McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA

WASTE TO ENERGY

Course Name	Waste To Energy	**Course Code**	18CVENPESA	**SEE Duration**	03 Hrs
Credits	03	**L-T-P**	3-0-0	**CIE+SEE**	50+50

Course Objectives: To provide an understanding the different wastes as fuel and conversion devices to convert waste to energy.

Course Outcomes: On completion of this course, students are able to

CO1: Understand the different wastes as fuel and conversion devices to convert waste to energy.

CO2: Understand the existing technologies for the treatment of biomass and design the devices

CO3: Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.

Unit – I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digesters.

Unit – II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit – III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit – IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Course Name	Occupational Safety And Health Administration	Course Code	18CVENOESA	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objectives: To enable understanding issues with respect to Occupational safety and health at work place.

Course Outcomes: On completion of this course, students are able to

CO1: Outline the issues related to health and safety through various Acts, Identify health problems in different types of industries

CO2: Apply types of accident causation models and Hazard Analysis.

CO3: Identify different classes of fire with suitable fire extinguishing system.

Unit – I

Introduction, Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws, **Indian Acts** – Labour Act, Factories Act, OSHA

Unit – II

Accident – Causation, investigation methods and different models.

Ergonomics – need, Task Analysis, Preventing Ergonomic Hazards, Ergonomics Programme.

Unit – III

Occupational Hazard and Control - Hazard Analysis, Human Error and Fault Tree Analysis, Emergency Response. Hazards and their control in different manufacturing and processing industries.

Unit – IV

Fire Prevention and Protection - types of Fire, Fire Development and its Severity, Effect, Extinguishing Fire, Electrical Safety, Product Safety.

Unit – V

Occupational Health - Health and Safety Considerations, Personal Protective Equipment.

Health problems in different types of industries – construction, textile, steel and food processing, pharmaceutical, occupational Health and Safety considerations in Wastewater Treatment Plants.

REFERENCES:

1. Goetsch D.L., (1999),"**Occupational Safety and Health for Technologists**", Engineers and Managers", Prentice Hall.

2. Heinrich H.W.(1959),**"Industrial Accident Prevention",** McGraw Hill Publication , Newyork.

3. Colling D.A.(1990),"**Industrial Safety Management and Technology**", Prentice Hall, New Jersey.

4. Della D.E., and Giustina, (1996), "**Safety and Environmental Management**", Van Nostrand Reinhold International Thomson Publishing Inc.

5. CPHEEO, (1999) **Manual on Sewerage and Sewage Treatment,** Ministry of Urban Development, GOI, New Delhi.

6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "**Industrial Safety and Pollution Control Handbook**"

e- sources: https://www.osha.gov/

TRANSPORT PROCESSES AND MODELLING OF AQUATIC SYSTEMS

Course Name	Transport Processes And Modeling Of Aquatic Systems	**Course Code**	18CVENPETM	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-1-0	**CIE+SEE**	50+50

Course Objective: To learn the principles of pollution transport, and estimation of extent of contamination by steady state 1-D modeling in aquatic system like streams, lakes, estuaries and ground-water.

Course Outcomes: On completion of this course, students are able to :

CO1: Identify importance and basics of Modelling; different types of outlets, characteristics of zones, ocean disposal and guide lines, single port and multiport system.

CO2: Develop governing equations for transport of conservative and non-conservative contaminant in a aquatic system DO models, phosphorous model, fate transport through ground water.

CO3: Predict and investigate contaminant extent in aquatic systems.

UNIT-I

Modelling – Introduction, applications in environmental management. **Physical phenomena** – advection, diffusion, dispersion, Fick's laws of diffusion and convective - diffusion equations for turbulent & shear flow regimes.

UNIT-II

Steady-state water quality 47odeling – models for conservative and non-conservative substances.

Data collection and analysis – specialized water quality surveys, estimation of decay and reaeration rates.

UNIT-III

1-D Oxygen balance models - Streeter-Phelps equation, critical point method.

Calibration and verification of 1-D oxygen model. Error measures.

UNIT-IV

Mixing zones in rivers – types of outfalls and mixing regimes. Steady-state 2-D analysis. Field study methodology. Parameter estimation – lateral mixing co-efficient - critical point method – simple numerical problems. Dissolved oxygen models for lakes under completely mixed and stratified conditions.

UNIT-V

Eutrophication models - simplified nutrient loading models for rivers and lakes.

Ocean disposal of wastewater - Siting and design of outfalls.

Ground water pollution : 1D contaminant transport in porous medium –Governing equation and solution

REFERENCES:

1. Rich L.G., **"Environmental Systems Engineering",** McGraw Hill.

2. Thomann R.V., and Mueller J.A., (1987), **"Principles of Water Quality Management and Control"**, Harper & Row Publications.

3. Schnoor J.L., **"Environmental Modelling – Fate and Transport of Pollutants in Water, Air and Soil**", John Wiley and Sons.

4. Thomann R.V., (1980), **"Systems Approach to Water Quality Management"**, McGraw Hill.

5. Lee C.C., and Lin S.D., (1999), **"Handbook of Environmental Engineering Calculations"**, McGraw Hill, New York.

OPERATION & MAINTENANCE OF ENVIRONMENTAL FACILITIES

Course Name	Operation & Maintenance Of Environmental Facilities	**Course Code**	18CVENPEOM	**SEE Duration**	03 Hrs
Credits	04	**L-T-P**	3-1-0	**CIE+SEE**	50+50

CO1: Know the need, types, basic principles, organizational structure, work planning and scheduling and cost estimates of O&M and explain the importance of drawings, plans, record keeping, need for operational manual and SOP.

CO2: Identify and list the operational problems in water treatment and supply facilities, wastewater collection and treatment facilities and apply preventive and corrective maintenance measures

CO3 Identify and discuss the troubles in air pollution control systems and suggest the preventive and control measures

Unit-I

Importance of Operation & Maintenance- Basic Principles, Objectives, Requirements, Corrective and Preventive Maintenance.

Operation & Maintenance Planning - Organizational Structure, Work Planning, Preparation and Scheduling, Cost Estimates.

Unit-II

Data Base of Facilities for O&M – Detailed Plans, Drawings, Operation Manuals, Record keeping, standard operating procedure and Computer Applications in O&M and SCADA.

Unit-III

O&M of Water Treatment and Supply and Facilities- Operational Problems and Corrective Measures in Different Units of Treatment. Water Distribution Network

Unit-IV

O&M of Wastewater Collection and Treatment Facilities- Operational Problems and Corrective Measures in Different Units of Treatment, sewer network system. O & M of Industrial wastewater systems.

Unit-V

O&M of Air Pollution Control Facilities- Operational Problems and Corrective Measures in Different Units of Treatment.

TEXT BOOKS

1. Hammer M.J., and Hammer Jr. M.J., (2008), ”Water and Wastewater Technology”,

Prentice Hall of India Pvt. Ltd., New Delhi.

2. Metcalf and Eddy Inc., (2003), "Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

REFERENCES

1. Training Manual on O&M for Municipal Staff, Asian Development Bank Project, Government of Karnataka.
2. CPHEEO Manual., (1991) "Water Supply & Treatment", GOI Publication.
3. CPHEEO Manual., (1995) on Sewerage & Sewerage Treatment, GOI Publication,.
4. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial
5. Safety and Pollution Control Handbook"

ENVIRONMENTAL BIOTECHNOLOGY

Course Name	Environmental Biotechnology	Course Code	18CVENPEEB	SEE Duration	03 Hrs
Credits	04	L-T-P	3-1-0	CIE+SEE	50+50

Course Objective: The objective of the course is to provide a comprehensive and historical overview of hazardous waste management, drawing from both scientific and engineering principles.

Course Outcomes: On completion of this course, students are able to:

CO1: Understand and explain the methods and techniques for analysis of environmental samples

CO2: Apply the technologies for bioremediation of soil, water and air.

Unit – I

Introduction to environmental biotechnology, cell genetic material, Nucleic acid-based methods of analysis- Extraction of nucleic acids from environmental samples, Polymerase chain reaction- Steps of PCR, design of primers, PCR detection of specific and universal genes, RT-PCR, real-time PCR, Recombinant DNA techniques- Cloning, metagenomics, sequence analysis, comparative genomics.

Unit – II

Bacterial genetic recombination, recombinant DNA technology, applications in environmental engineering.

Unit – III

Bioremediation for soil environment- Biotechnologies for ex-situ and in-situ remediation of soil, phytoremediation technology for soil decontamination.

Unit – IV

Bioremediation for water environment- ex-situ decontamination of groundwater, in-situ Bioremediation of groundwater, landfill leachate, Industrial wastewater Bio treatment technologies, Bio treatment of surface waters. Bio treatment of metals- microbial transformation of metals, Biological treatment technologies for metals remediation, Bioleaching and Biobenificiation, Bioaccumulation, oxidation/reduction processes, biological methylation.

Unit – V

Bioremediation for air environment- atmospheric environment for microorganisms, microbial degradation of contaminants in gas phase, Biological filtration processes for decontamination of air stream, Bioscrubbers.

Books & References:

1.Environmental Biotechnology: Principles and Applications (1sted.), BE Rittmann and PL McCarty, McGraw-Hill Publishing Co., 2001.

2.Environmental Biotechnology, B Bhattacharya and R Banerjee, OUP, 2008.

3.Microbiology (2nded) - LM Prescott, JP Harley, and DA Klein, Wm. C.
Brown Publishers, Dubuque, Iowa, 1993.

Major Project – Phase I

Course Name	Major Project – Phase I	Course Code	18CVENPWP1
Credits	18	CIE+SEE	50+50

AUDIT COURSE - I

IV SEMESTER

INTERNSHIP/INDUSTRIAL TRAINING

Course Name	Internship/Industrial training	Course Code	18CVENPCIN
Credits	08	CIE+SEE	50+50

Course Outcomes: On completion of this course, students are able to

CO 1: Comprehend the organization structure and management processes involved in the organization.

CO 2: Explain the state of the art technologies / processes/ materials implemented in the organization.

CO 3: Demonstrate writing and Communication skills effectively.

Major Project Phase-II

Course Name	Major Project	Course Code	18CVENPWP2
Credits	12	CIE + SEE	50+50

Course Outcomes: On completion of this course, students are able to

CO 1: Identify a current problem through literature/field/case studies and define the background objectives and methodology for solving the same.

CO 2: Design and develop a technology/process to address the problem

CO 3: Implement, analyze and evaluate the technology/process developed.

CO 4: Demonstrate writing and communication skills effectively

AUDIT COURSE - II

SEMINAR

Course Name		Seminar	**Course Code**	18CVENPCSR	
Credits	02	**L-T-P**	**0-0-2**	**CIE+SEE**	50+50

Course Outcomes: On completion of this course, students are able to:

CO1: Collect, assimilate, analyze and interpret the technical information/data pertaining to the recent environmental engineering related topics through literature survey.

CO 2: Demonstrate writing and Communication skills effectively.

AUDIT COURSES

DISASTER MANAGEMENT

Course Name	Disaster Management	Course Code	18CVENNCDM	SEE Duration	
Credits	00	L-T-P	2Units	CIE+SEE	

Course Outcomes: On completion of this course, students are able to:

CO1: learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO2: critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO3: develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO4 critically understand the strengths and weaknesses of disaster management approaches,

planning and programming in different countries, particularly their home country or the countries they work in

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions of Disasters and Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.

Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

PEDAGOGY STUDIES

Course Name	Pedagogy Studies	Course Code	18CVENNCPS	SEE Duration	
Credits	00	L-T-P	2Units	CIE+SEE	

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Outcomes: On completion of this course, Students will be able to:

CO1: Understand what pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

CO2: understand what is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3: understand how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions.

Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices.

Methodology for the in depth stage: quality assessment of included studies.

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices.

Pedagogic theory and pedagogical approaches.

Teachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up,support,Peer support

Support from the head teacher and the community.

Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Research gaps and future directions

Research design, Contexts, Pedagogy , Teacher education , Curriculum and assessment, Dissemination and research impact.

SUGGESTED READING

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

VALUE EDUCATION

Course Name	Value Education	Course Code	18CVENNCVE	SEE Duration	
Credits	00	L-T-P	2Units	CIE+SEE	

Course Objectives

Students will be able to:

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course Outcomes:

CO1: Knowledge of self-development

CO2: Learn the importance of Human values

CO3: Developing the overall personality

- Values and self-development –Social values and individual attitudes.
- Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles. Value judgements

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration.
- Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature ,Discipline

- Personality and Behavior Development - Soul and Scientific attitude.
- Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.

- Association and Cooperation.
- Doing best for saving nature
- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality,Nonviolence ,Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

ENGLISH FOR RESEARCH PAPER WRITING

Course Name	English for Research Paper Writing	Course Code	18CVENNCEW	SEE Duration	
Credits	00	L-T-P	2Units	CIE+SEE	

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Course Outcomes: On completion of this course, Students will be able to:

CO1: Write paragraphs avoiding ambiguity and vagueness

CO2: Understand the key skills are needed when writing a Title, Abstract, Introduction, Review of the Literature, Methods, Results and Discussion with Conclusions.

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction,

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's Book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011