With effect from academic year 2021-2022

DEPARTMENT OF CIVIL ENGINEERING

Scheme of Instruction

and

Syllabus of

M.E. (CIVIL ENGG)

Water Resources Engineering

Full Time & PTPG

AICTE Model Curriculum

2021-22

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, TS, INDIA

INSTITUTE

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

• To achieve excellence in Teaching and Research
• To generate, disseminate and preserve knowledge
• To enable empowerment through knowledge and information
• Advancement of knowledge in Engineering, Science and Technology
• Promote learning in free thinking and innovative environment
• Cultivate skills, attitudes to promote knowledge creation
• Rendering socially relevant technical services to the community
•To impart new skills of technology development
• To inculcate entrepreneurial talents and technology appreciation programmes
• Technology transfer and incubation

DEPARTMENT

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of civil engineering profession and also contribute to the regional and country's developmental activities.

Mission

•To train the human resources with knowledge base in the field of Civil Engineering so that they can face the challenges of civil and infrastructural engineering problems to provide viable solutions.

•To integrate their understanding and attainable knowledge on the specializations for effective functioning in their profession and useful to the welfare and safety of mankind.

•To enhance the technical knowledge and research aptitude in the domains of various Civil Engineering specializations to serve the society in highly professional manner.

•To Produce highly competent and capable professionals and motivated young academicians to provide solutions to real life problems of Engineering and Technology and has apt for continuous learning and dedication towards societal issues.

Programme Educational Objectives (PEO):

1. Impart and enrich knowledge in the fields of Surface and Groundwater Engineering
2. Exposure to the state-of-art techniques / knowledge of modeling techniques in to be adopted for different Water Resources Engineering problems
3. Facilitate the policy makers and administrators to solve issues pertaining to regional Water Resources and Environmental Engineering
4. Provide continuing education as per the needs of practicing engineers and academician to enhance their technical knowledge

Programme Outcomes (PO):

PO-1	Acquaintance with the principles of water Resources Engineering
PO-2	Familiarity with the Planning, Design, and modeling techniques of Water Resources and Environmental Engineering Systems to solve real life problems
PO-3	Advocate the practicing Engineers and Academicians to enhance their technical knowledge so as to device effective policies
PO-4	Proficiency to carry out research /investigation for the sustainable development of water resources
PO-5	Capability to write and present a technical report /document independently
PO-6	Ability to exhibit professional, ethical and managerial skills.

DEPARTMENT OF CIVIL ENGINEERING, U.C.E., O.U
M. E. CIVIL (WATER RESOURCES ENGINEERING) AICTE Model

Type of course	Course Code	Course Name	Contact hours per week			Scheme of Examination		Credits
			L	T	P	CIE	SEE	
SEMESTER-I								
Core-I	CE201	Advanced Hydrology	3			30	70	3
Core-II	CE204	Free Surface Flows	3			30	70	3
Program Elective-I	CE214	Water Resources Systems Planning	3			30	70	3
	CE215	Models of Air and Water Quality						
	CE216	Stochastic Hydrology						
Program Elective-II	CE217	Geo-Spatial Applications to Water Resources Engineering	3			30	70	3
	CE218	Water Power Engineering						
	CE219	Environmental Impact Assessment						
Audit-I	AC031	English for Research Paper Writing	2	1		30	70	0
	AC131	Disaster Mitigation & Management						
	AC033	Sanskrit for Technical Knowledge						
	AC034	Value Education						
Lab-I	CE251	Water Resources Engineering Lab			3	50	-	1.5
Lab-II	CE252	Geographical Applications Lab			3	50	-	1.5
Mandatory Core	CE100	Research Methodology in Civil Engineering	3			30	70	3
TOTAL			**17**	**1**	**6**	**280**	**420**	**18**
SEMESTER-II								
Core-II	CE202	Advanced Fluid Mechanics	3			30	70	3
Core-III	CE203	Groundwater Engineering	3			30	70	3
Program Elective-III	CE211	Soft Computing Applications in Water Resources Engineering	3			30	70	3
	CE212	Environmental Hydrology						
	CE213	Sediment Transport						
Program Elective-IV	CE220	Integrated Watershed Management	3			30	70	3
	CE221	Applied Statistics in WRE						
	CE222	Ground Water Contamination						
Audit-II	AC035	Stress Management by Yoga	2	1		30	70	0
	AC036	Personality Development						
	AC037	Constitution of India						
	AC038	Pedagogy Studies						
MC	MC070	Mini Project			6	50		3
Lab-III	CE253	Computational Fluid dynamics Lab			3	50	-	1.5
Seminar	CE261	Seminar			3	50	-	1.5
TOTAL			**14**	**1**	**12**	**300**	**350**	**18**
SEMESTER-III								
Program Elective-V	CE223	Hydraulic Structures	3			30	70	0
	CE224	Irrigation and Drainage Engineering						
	CE 225	Impact of Climate Change in Water Resource Engineering						
Open Elective-1	OE 941	Business Analytics	3			30	70	3
	OE 942	Industrial Safety						
	OE 943	Operation Research						

	OE 944	Cost Management of Engineering Projects						
	OE 945	Composite Materials						
	OE 946	Waste to Energy						
	OE 947	Internet of Things						
	OE 948	Cyber Security						
Dissertation	CE281	Major Project Phase-I			20	100		10
TOTAL			**6**		**20**	**160**	**140**	**13**
SEMESTER-IV								
Dissertation	CE282	Major Project Phase-II			32		200	16
GRAND TOTAL								**68**

CIE : Continuous Internal Evaluation **SEE : Semester End Examination**

SEMESTER-I

CE201

ADVANCED HYDROLOGY

Instruction: 3 periods per wee *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

- Overview of meteorological and hydrologic factors.
- Rainfall-runoff analysis by different methods.
- Estimation of design flood, uncertainty, reliability and risk analysis.

Outcomes:

Students are expected to have gained knowledge of

1. Principles of physical processes in the context of hydrology, including the hydrological cycle in general.
2. Comprehensive understanding of issues pertaining to rainfall, runoff and hydrograph analysis.
3. Application techniques, such as flood frequency analysis, probabilistic methods to estimate design peak flows
4. Ability to formulate rainfall-runoff models and its correlation and goodness of fit.
5. Concepts on reliability, uncertainty and involved risks with an objective to optimize the benefits.

UNIT – I

*Evapotranspiration***:** Process of evaporation, factors affecting evaporation, measurement of evaporation, estimation of evaporation, evaporation reduction techniques,

Infiltration: Introduction, factors affecting infiltration, measurement of infiltration (ring infiltrometers only), Infiltration indices (ϕ, w, and w_{min}).

UNIT – II

Runoff **:** Process, factors affecting runoff, rational formula for relation between precipitation and runoff, hydrograph analysis, unit hydrograph, instantaneous unit hydrograph. Synthetic unit hydrograph and Nash model.

UNIT – III

Statistics in Hydrology: Random variables, probability of hydrologic events, probability (Gumbel, Log-Pearson type-III distribution) and statistical methods for flood frequency, trend analysis for hydrologic events.

UNIT – IV

*Regression Analysis***:** Identification of appropriate models, parameters estimation by the least square method, measures of goodness fit, uncertainity features of LS based model parameters, statistical Inferences of Regression Coefficients, confidence Interval. Multivariate linear regression and correlation.

UNIT – V

Reliability in Engineering: Brief theory of engineering reliability analysis – Definitions of Reliability and risk measures of reliability. Uncertainty in Engineering: Definition of uncertainty, types of Sources of uncertainty, analysis of errors, analysis of uncertainty.

Risk analysis and management: Classification of risks, sources of risk, estimation of risk.
Reservoir economics and optimization of benefits.

REFEREENCES

1. Ven Te Chow, '*Hand book of Applied Hydrology'* McGraw-Hill Book Company, New York., 1964
2. Subramanya, K. '*Hydrology for Engineers'*, Tata McGraw-Hill Publishing Company, New Delhi. (1984.
3. Raghnath, H. M. '*Hydrology'*, New Age International Pvt. Ltd., New Delhi. 1985
4. Gupta, R.S. '*Hydrology and Hydraulic systems*', Prentice Hall of India, New Delhi.1989
5. Yeou Koung Tung, Benchie Yen, Charles Staven Melching , '*Hydro systems Engineering Reliability Assessment and Risk Analysis*', McGraw-Hill Book Company, New Delhi. 2005.

CE204

FREE SURFACE FLOWS

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

- Introduction to the basic concepts of free surface flows
- Description of the equations of varied flows
- Basic concepts of Fluvial Hydraulics and design of stable channels

Outcomes:

1. Comprehensive understanding about the basic concepts of open channel flows
2. Acquaintance with the application of varied flow concept
3. Knack for the applications of principles and theory of non-prismatic channels
4. Knowledge of unsteady flows principles and its applications to water resources engineering problems
5. Propensity for the selection and design of appropriate stable channel approaches.

UNIT – I

Basic Concepts: Velocity and Pressure distribution, effect of slope on pressure distribution, energy and momentum principles, features of uniform flow, conveyance and section factor of a channel section, hydraulic exponent for uniform flow computation, flow computations in compound sections.

UNIT – II

Varied Flow: Application of specific energy and specific force concepts, Computation of flow profiles by Direct Integration and standard step method, profiles resulting from change in bed slope, jumps in non-rectangular channels, cross waves, design considerations for supercritical flow.

UNIT – III

Non Prismatic channels: Introduction, response to a disturbance, gradual change in boundary, flow at a corner, constrictions, super critical flow through constrictions, obstructions, flow between bridge piers, under flow gates, channel junctions.

UNIT – IV

Unsteady Flow: Continuity equation, momentum equation, uniformly progressive flow, positive and negative surges, SVF with increasing and decreasing discharges.

UNIT – V

Fluvial Hydraulics: Basic Characteristics of River Beds and Sediments, initiation of Motion, Regimes of Flow, Resistance to Flow in Alluvial Streams, Theories of Bed Load, Suspended and Total Load, Design of Stable Channels by different methods – Tractive Force, Simons, Blench, Minimum Energy.

REFERENCES:

1. Ven Te Chow, *'Open Channel Hydraulics'*, McGraw-Hill Book Company, New York, 1959
2. French, R. H., *'Open Channel Hydraulics'*, McGraw-Hill Book Company, New York, 1986
3. Hanif Chaudhry, M., *'Open-Channel Flow'*, Prentice-Hall of India Pvt. Ltd., New Delhi, 1993
4. Subramanya, K., *'Flow Through Open Channels'*, Tata McGraw-Hill Publishing Company, New Delhi, 1986
5. Ranga Raju, K.G., *'Flow Through Open Channels'*, Tata McGraw-Hill Publishing Company, New Delhi, 1983
6. Henderson, F.M. *'Open Channel Flow'*, Mc Millan Publishing Company, New York, 1967
7. Bakhmeteff, B.A., 'Hydraulics of Open Channels', McGraw-Hill Book Company, New York, 1932
8. Garde and Ranga Raju, K. G. '*Mechanics of Sediment Transportation and Alluvial Stream Problems'*, Wilsey Eastern, New Delhi, 1980
9. Graf, W.H., *'Hydraulics of Sediment Transport'*, McGraw-Hill Book company, New York, 1971

CE214

WATER RESOURCES SYSTEMS PLANNING
(Program Elective – I)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- Introduction to various steps in water resources systems approach.
- Economic decision making in water resources.
- Identification of decision variables for linear and dynamic programming models and solution procedures for simple problems.

Course Outcomes:

1. Ability to understand water resources systems concepts their stages and procedures.
2. Application of Cash flow diagrams and solution to Water Resources problems based on economical aspects
3. Ability to formulate WRE problems by L.P. and D.P models and solving simple problems.
4. Ability to decide based on economic evaluation criteria for decision making of simple water Resources systems
5. Ability to formulate L.P models for water Resources systems problems.

UNIT – I

Introduction: Objectives of water resources development, plan formulation, planning models and solution procedures, basic steps involved in water resources systems approach, cash flow diagrams, annuities, discounting (Net Present Value, Internal Rate of Return, and Benefit Cost Ratio), and non-discounting techniques (urgency, payback, and average rate of return), cost comparison, determination of project benefits, economic and financial analysis of projects.

UNIT – II

Water Resources Planning: Concept of Water Resources Planning, Categories of Water Use, Stages and Flow Activities, Relationship among stages, Data Collection and Processing, Estimation of Future Water Demands for Irrigation, Municipal Use, Industrial and Hydropower, Planning for Operation.

UNIT – III

Optimization techniques: Linear programming (introduction, geometrical approach and interpretation, basic concepts of simplex method), Dynamic Programming (basic concepts, general approach to recursive optimization, formulation of multistate problems), application to water resources engineering problems.

UNIT – IV

Stochastic optimization: Introduction to stochastic linear and stochastic dynamic programming, two stage linear programming, linear programming with chance constraints.

Simulation: Basic concepts and application to water resources engineering problems.

UNIT – V

River basin planning models: Irrigation planning model, resource inputs of irrigation, crop diversification, costs of inputs, formulation of linear programming models for single reservoir, multi reservoir cases with single and multiple objectives.

REFERENCES

1. Loucks, D. P., Stedinger, J. R., and Douglas, A.H. '*Water Resources Planning and Analysis*', Prentice-Hall, New York. 1981
2. Kuiper Edward (1965), '*Water Resources Project Economics*', Butterworths and Company Ltd., London.
3. Jain, S.K. and Singh V.P. '*Water Resources Systems Planning and Management*', Elsevier Science, B.V., Amsterdam. 2003
4. Taha, H. A. '*Operations Research an introduction'*, Prentice-Hall of Indial, New Delhi. 1982
5. Pramod. A. Bhave "*Water Resources Systems*" Narora Publishing House, 22, Medical Association Road, Dharyagunj, New Delhi, 2011

CE215

MODELS OF AIR AND WATER QUALITY

(Program Elective – I)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Description of the concepts of water and air pollution
- Exposure to the principles of modeling and their application to water bodies
- An overview regarding reservoir sedimentation

Course Outcomes:

1. Capable of analyzing stream water and air quality issues.
2. Introduction of modeling techniques and standards
3. Capable to estimate the reservoir and lake sedimentation problems and understand various methods to control them.
4. Understanding of Air pollution effects and measures to controlling them.
5. Ability to model and propagation of pollution plume models.

UNIT – I

Introduction: Water pollutants and their sources Stream sampling – hydrological factors affecting the stream self – purification. Steady state conservative system, steady state with non-conservative pollutants.

UNIT – II

Stream pollution modeling concepts: Measurement of BOD – Streeter Phelp's equation – Effect of temperature on BOD, Kinetic reaction rate – Stream re-aeration. Analysis of DO Sag curve by Streeter – Phelps equation method, statistical method.

UNIT – III

Water Quality of Lakes and Reservoirs: Mass balance model, Phosphorus model, Thermal stratification, Eutrophication of lakes-Reservoir sedimentation: Determination of sediment yield, measurement of suspended load, Bed load estimation by empirical methods, control of sedimentation

UNIT – IV

Air Pollution: Sources and effects, scales of concentration, classification and properties of air pollutants effects of air pollution and air pollution standards, dispersion of air pollutants. Meteorological aspects of air pollution and atmospheric stability

UNIT -V

Plume behavior, modeling of air pollution: Gaussian plume model – determination of maximum ground level concentration due to elevated source pollutants. Limitations of Gaussian model, effective stack height concept and estimation of plume rise**.**

REFERENCES

1. Keily Gerard, '*Environmental Engineering'* McGraw-Hill International Publishers, London. 1998.
2. Fischer, H.B., E. John List, Robert C.Y. Koh, Jorg Imberger, and Norman H. Brooks , '*Mixing in Inland and Coastal Waters'* Academic Press Inc., New York. 1979.
3. Nelson Leonard Nemerow , '*Scientific Stream Pollution Analysis'* McGraw-Hill Publishers. 1974
4. Wurbs, R. A. and James, W.P, '*Water Resources Engineering',* Prentice-Hall of India, New Delhi. 2002
5. Graf, W.H. , '*Hydraulics of Sediment Transport',* McGraw-Hill Book company, New York, 1971
6. Yalin, M.S. , '*Mechanics of Sediment Transport*', Pergaman Press, Oxford. 1997

CE216

STOCHASTIC HYDROLOGY

(Program Elective – I)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Description of the concepts of deterministic and Stochastic hydrology
- Exposure to the principles of basic statistical hypothesis testing, KS test
- Concepts of linear regression and time series analysis

Course Outcomes:

1. Capable of finding parameters estimation, fitting of probability distributions, methods of moments.
2. Able to Perform frequency analysis of hydrologic extremes and uncertainty
3. Able to execute simple linear regression and multiple regression
4. Ability to accomplish Cluster analysis and modelling of hydrologic time series
5. Able to model Markov process and understanding of Copula in Hydrology.

UNIT- I

Deterministic and Stochastic Hydrology, review of concepts of probability, probability axioms, Random variables and their properties, probability distribution and probability density function, Discrete and continuous probability distributions used in hydrology, moments and expectations of distributions, Parameter estimation, method of moments, maximum likelihood method

UNIT-II

Hypothesis testing, goodness test of fit tests, Chi Square test and KS test, Analysis of hydrologic extremes, Frequency analysis of extreme events, extreme value distributions, analysis of floods, droughts and other natural hazards, Regional flood frequency analysis- Transformations, Modelling hydrologic uncertainty

UNIT –III

Correlation analysis and correlation coefficient, Simple linear regression, Multivariate regression analysis, Correlation coefficient and its significance in regional analysis, analysis of variance applications – rainfall-runoff analysis, rating curves.

UNIT IV

Data generation techniques, stream flow forecasting, First order Markov process, Markov chain, Multi-site time series model, cross-correlation, spatial and temporal disaggregation models.

UNIT V

Theory of copula and its use in hydrology, commonly used copula functions, selection of best fit copula, uses of copula.

REFERENCES

1. Haan T. C., Statistical Methods in Hydrology, East West Publishers, 1998
2. Kotteguda, N.T., and Resso, R., Statistics, Probability and Reliability for Civil and
3. Environmental Engineers, Blackwell Publishing, UK, 2008
4. Kotteguda, N.T., Stochastic Water Resources Technology, The Macmillan Press, New York, 1982
5. Rajib Maity, Statistical Methods in Hydrology and Hydroclimatology, Springer Nature Singapore Pte Ltd., 2018
6. NPTEL Course on Stochastic Hydrology, http://nptel.ac.in/syllabus/105108079/

CE217

GEOSPATIAL APPLICATIONS TO WATER RESOURCES ENGINEERING

(Program Elective - II)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Discuss the various spatial and non-spatial data types, and data base management techniques
- Develop the concepts and professional skills in utility of geospatial techniques
- Improve the working knowledge of geospatial techniques in field problems

Course Outcomes:

1. Understand the geospatial technology relating to the data acquiring and processing that is associated with geographic locations
2. Apply Geospatial techniques in the decision support systems useful for decision makers and community services.
3. Ability to solve the problems related to the natural resource management, environment, Urban planning and Infrastructure development, etc.
4. Able to generate the thematic maps using Geospatial techniques
5. Apply the concept of Geospatial Techniques to the Civil Engineering problems

UNIT –I

Introduction - Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems - Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT –II

Data Acquisition and Data Management - data types, spatial, non-spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty.

Data Processing - Geometric errors and corrections, types of systematic and non-systematic errors, radiometric errors and corrections, internal and external errors.

UNIT –III

Data Modeling - Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system.

GIS Analysis and Functions - Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non- spatial data.

UNIT –IV

Applications of GIS - Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing - General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

REFERENCES:

1. Burrough, P. A., and McDonnell R. A. *Principles of Geographical Information Systems.* Oxford University Press, New York, Pp.333. 1998
2. Choudhury S., Chakrabarti, D., and Choudhury S. *An Introduction to Geographic Information Technology.* I.K. International Publishing House (P) Ltd, New Delhi, Pp.276. 2009
3. Kang-tsung Chang. *Introduction to Geographical information Systems.* Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi, Pp.432. 2006
4. Lilysand T.M., and Kiefer R.W. *Remote Sensing and Image Interpretation*. John Wiley and Sons, Fourth Edition, New York, Pp.724. 2002
5. Sabins F.F. Jr. (1978). *Remote Sensing Principles and Interpretations.* W.H. Freeman and Company, San Francisco, Pp. 426. 1978
6. Tor Bernhardsen. *Geographical Information System.* Wiley India (P) Ltd., Third Edition, New Delhi, Pp. 428. 2002
7. Hoffman-Wellenhof, B, et al. *GPS Theory and Practice.* Fourth Edition, Springer Wein, New York. 1997.

CE218

WATER POWER ENGINEERING

(Program Elective - II)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- An overview of hydro power development
- Exposure to the principles involved in the design of surge tanks and penstocks
- Description regarding the concepts of speed and pressure regulation

Outcomes:

1. Aptitude to plan for hydro power development projects
2. Skills for the application of principles involved in the design of intakes and power house dimensioning
3. Ability to analyse and synthesize the pipe networks
4. Capacity to perform and apply the design principles of water hammer pressures, anchor blocks and surge tanks
5. Propensity for application of subject knowledge towards sustainable and economic development of human welfare

UNIT – I

General: Comparison with other methods of power generation, Site investigation and location of water power plant, Study of stream flow data for power estimation - Pondage and storage, and load prediction.

Development of power: Different types of layout, component parts of waterpower schemes.

UNIT – II

Water Conductor System: Intake – Various types, Hydraulics of Intakes, gates and their operations.

Powerhouse: General arrangements and criteria for fixing power house dimensions, including mechanical & electrical equipment details.

UNIT – III

Pipe networks : Analysis by Hardy Cross Method, and Newton Raphson Method, Joining and laying of pipes and pipe specials (Cast Iron, Ductile Iron, Pre stressed Concrete, and HDPE).

Penstocks and Pressure Shafts: Classification, Hydraulic design, Economical diameter of Steel Penstocks

UNIT – IV

Hydraulic transients and Surge Tanks: Introduction, effect of rapid valve closure, unsteady compressible flow, surge protection, and method of characteristics to water hammer. Water Hammer theory – Joukowsky's method, and Allieve's method.

UNIT – V

Anchor Blocks: Various types and design of simple anchor blocks, Design of simple surge tanks, and method of characteristics to the design of surge tanks.

Pressure Regulation: General features, auxiliary devices, automatic and remote control devices, governor improvement methods, performance characteristics and speed regulation of different turbines.

References:

1. Creager W. P., and Justin J..D. , *'Hydroelectric Hand Book'*, John Wiley and Sons Inc New York,1959
2. Barrows, H.K., *'Water Power Engineering'*, Tata McGraw-Hill Publishing Company, New Delhi, 1980
3. EI-Wakil, M.M., *'Power Plant Technology'*, McGraw-Hill Book Company, New York, 1984
4. Bhave, P.R., Gupta, R., *'Analysis of flow in water distribution networks'*, Narosa Publishing House, New Delhi, 2006
5. Modi, P.N., *'Irrigation, Water Resources and Water Power Engineering'*, Standard Book House, New Delhi, 1988

CE219

ENVIRONMENTAL IMPACT ASSESSMENT
(Program Elective - II)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

- Introduction of EIA concepts and methodologies.
- Importance of data collection of EIA assessment.
- Preparation of EIA reports and discussion about various environmental impact Laws pertaining to India.

Outcomes:

1. Knowledge to assess environmental Inventory and principles.
2. Understanding legislative acts to contribute towards clean environment
3. Applying the legislation acts of EIA in designs.
4. Understanding various characteristics of municipal solid waste.
5. Design of an efficient municipal solid waste management system

UNIT I

Enviornmental Impact Assessment: Definition, basic concepts and principles of EIA. Regulatory frame work in India. Enviornmental inventory, base line studies, over view of EIA studies.

UNIT II

Assessment and Methodologies: Physical, biological assessment, Socio economic and cultural enviornmental assessment, EIA methodologies–Adhoc, matrix, checklist approaches. Economic evaluation of impacts-cot benefits of EIA, Public participation in enviornmental decision making. Procedures for reviewing EIA analysis and statement.

UNIT III

Environmental Assessment: Introduction, process, Basic steps involved, Description of environmental setting – Base line data collection, possible impacts due to water resources projects. Impact prediction and assessment – methods of impact assessment, Matrix and check list method, Selection of proposed action. Preparation of environmental impact statement.

UNIT IV

Environmental Legislation and Regulations: Rationale, concerns, legislative data systems, safe drinking water act, clean water act, clean air act, noise control act, resource conservation and recovery act, comprehensive environmental response, compensation and liability act.

UNIT V

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal).

References:

1. Canter, L.W. '*Environmental Impact Assessment'*, McGraw-Hill Book Company, New York. 1996
2. Corbitt Robert A. *Standard Hand Book of Environmental Engineering'* McGraw-Hill Book Company, New York. 1999
3. Marriott '*Environmental Impact Assessment*: A Practical Guide', McGraw-Hill Book Company, New York. 2005

AC 031

ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE-I)

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 00

Objectives:

- *Understand that how to improve your writing skills and level of readability*
- *Learn about what to write in each section*
- *Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission*

Outcomes:

1. *Able to plan and prepare paragraphs, avoiding ambiguity*
2. *Writing of abstracts, paraphrasing and plagiarism*
3. *Providing of critical and thorough review of literature, discussions and conclusions*
4. *Able to exhibit key skills for writing titles, introduction, abstract.*
5. *Able to show key and necessary skills for paper writing, phrases, results.*

Unit I

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

Unit II

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

Unit III

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

Unit IV

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,

Unit V

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, *Writing for Science*, Yale University Press (available on Google Books), 2006.

2. Day R, *How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006.
3. Highman N *Handbook of Writing for the Mathematical Sciences*, SIAM. Highman'sbook. 1998
4. Adrian Wallwork English *for Writing Research Papers*, Springer New York Dordrecht Heidelberg London. 2011.

AC131

DISASTER MITIGATION & MANAGEMENT
(AUDIT COURSE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 00

Objectives:

- *Introduction of various types of disasters and its effect on structures.*
- *Learning of quality assurance and damage assessment of structures*
- *Educate different types of repair, strengthening, rehabilitation and retrofitting techniques.*
- *Awareness about flood characteristics and flood forecasting systems*
- *Description of Flood mitigation, adjustment, and regulation*

Outcomes:

1. *Understand the fundamentals of disaster and seismic performance of buildings*
2. *Able to assess various damages in structures and give assurance of quality of concrete*
3. *Decide the appropriate repair, strengthening, rehabilitation and technique required for a case study of building.*
4. *Applications of flood routing, flood forecasting and space time characteristics of rainfall.*
5. *Advanced understanding of flood plain adjustments and employment of appropriate technologies for flood mitigation.*

UNIT – I

Disaster: Classifications - Causes - Impacts including social, economical, political, environmental, health, psychosocial, etc.

Seismic performance of buildings: case studies of major earthquakes in the country, damage to buildings, damage patterns, performance of non-engineered buildings-Introduction to repair and rehabilitation of structures.

UNIT – II

Quality assurance for concrete – Strength, Durability and Thermal properties of concrete.

Damage Assessment**:** - Condition assessment and distress, Purpose of assessment, Rapid assessment - diagnostic techniques, Investigation of damage, , Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems, Procedure for evaluating damaged of structure.

UNIT III

Repair, Rehabilitation And Retrofitting Techniques : Repair materials, Common types of repairs – Repair in concrete structures – Repairs in under water structures – Guniting – Shot create –

Underpinning, Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake, Retrofitting techniques.

UNIT – IV

Introduction to Disasters: **Hazard, Vulnerability, Resilience, Risks.-Disaster- Different types of cold wave-heat wave- droughts- floods-Effect of climate change on Processes.**

Flood characteristics and forecasting: Measureable features of a flood (Elevation, discharge, volume, and duration), flood forecasting (unit hydrograph method, meteorological and snow data, and snow field air temperatures), operation of flood forecasting systems.

Space-time characteristics of rainfall: Policy criteria for design flood of a major and minor reservoir, spillways, diversion dams and barrages, design flood criteria for dams and other hydraulic structures (CWC recommendations).

UNIT - V

Flood Routing: Mathematics of flood routing, various methods of flood routing, Hydrologic and Hydraulic routing.

Flood mitigation: flood ways, channel improvement, evacuation and flood proofing, land management, flood plain management, estimating benefits of flood mitigation.

Flood plain adjustments and regulations: Results of controlling floods, alternatives to controlling floods, range of possible adjustments, practical range of choice, critical characteristics of flood hazards.

Suggested Reading:

1. Barry A. Richardson, "Defects and Deterioration in Buildings", E &FN Spon Press, London, 1991.
2. J. H. Bungey, "Testing of Concrete in Structures", Chapman and Hall,New York, 1989.
3. A.R. Santakumar, "Concrete Technology", Oxford University Press,New Delhi, 2006.
4. Pankaj Agarwal and Manish Shrihkande (2006). "Earthquake Resistance Design of Structures." Prentice Hall of India.
5. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
2. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
3. Chow, Ven Te 'Hand Book of Applied Hydrology', McGraw-Hill Publishers, New York. (1964),
4. Linsley, R. K. and Franzini A. W. 'Water Resource Engineering', McGraw-Hill Publishers, New York. 1992
5. Varshney, R. S. , 'Engineering Hydrology', Nem Chand Publishers, Roorkee.1979
6. Jaya Rami Reddy, P. , 'A. Text Book of Hydrology', Lakshmi Publishers, New Delhi.1987
7. Daniel H. Hoggan 'Computer Assisted Flood Plain Hydrology and Hydraulics', McGraw-Hill Publishers, New York.1989

AC 033

SANSKRIT FOR TECHNICAL KNOWLEDGE
(AUDIT COURSE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 0

Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Outcomes:

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

UNIT-I:

- Alphabets in Sanskrit.
- Past/Present/Future Tense.
- Simple Sentences.

UNIT-II:

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNIT-III:

- Technical concepts of Engineering-Electrical,
- Mechanical,
- Architecture,
- Mathematics

References:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

AC034

VALUE EDUCATION
(AUDIT COURSE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 0

Course Objectives:

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

Course Outcomes:

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

UNIT I:

- 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.

UNIT II:

- 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.

UNIT III:

- 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

UNIT IV:

- 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

References:

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

CE 100

RESEARCH METHODOLOGY IN CIVIL ENGG.

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- Learn the research types, methodology and formulation.
- Know the sources of literature, survey, review and quality journals.
- Understand the research design for collection of research data.
- Understand the research data analysis, writing of research report and grant proposal.

Course Outcomes:

1. Differentiate the research types and methodology.
2. Able to do literature survey using quality journals.
3. Able to collect research data.
4. Process research data to write research report for grant proposal.

UNIT – I

Scientific Research: Definition, Characteristics, Types, Need of research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Defining and formulating the research problem-Meaning of a research problem, Sources of research problems, Criteria of a good research problem, Importance of literature review in defining a problem, Errors in selecting a research problem, Scope and objectives of the research problem. Approaches of investigation of solutions for the research problem.

UNIT – II

Literature review-Source of literature, Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Research design – Basic Principles, Need of research design, Features of good design, Important concepts relating to research design.

Developing a research plan - Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs.

UNIT – III

Execution of the research - Necessary instrumentations, Various data collection methods in Civil Engineering. Data processing and data interpretation. Data presentation and illustration.

Types of the reports–Technical reports and thesis; Different steps in the preparation – Layout, structure and language of technical writing; Writing research papers; Developing a Research Proposal, Common formats of the research proposals;

Oral presentation–Planning, Preparation, Practice, Making a presentation, Importance of effective communication

UNIT – IV

Ethical issues - Research ethics, Plagiarism, Citation and acknowledgement

Patenting and development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for

grants of patents, Patenting under PCT Patent Rights. Problems encountered by researchers in India.

UNIT – V

Basics of statistics. Sampling and its types. Determination of sampling size. Sampling and non-sampling errors in statistics. Data: handling of data-significant figures & rounding. quality of data- precision & accuracy. Types of data.

Descriptive statistics: Summarization of Data- Measure of central tendency, Measure of central dispersion, Measure of symmetry.

Inferential statistics: Hypothesis of testing, Parametric (t-test & Analysis of variance) and Non-Parametric Tests. Univariate and Bivariate analysis; Correlational analysis.

Introduction to linear regression model and multi-linear regression models.

mathematical basis and introduction to SPSS

Suggested Reading:

1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, New Delhi, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, Chennai, 2011.
3. Ratan Khananabis and SuvasisSaha, "Research Methodology", Universities Press, Hyderabad, 2015.
4. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & Engineering students"
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
6. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008
8. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publishing Pvt. Ltd., New Delhi, 2004.
9. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
10. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.

CE251

WATER RESOURCES ENGINEERING LABORATORY

Instruction	*: 3 periods per week*
CIE	*: 50 marks*
Credits	*: 1.5*

Course Objectives:

- Conduct of Various Hydrological laboratory experiments in lab.
- Conduct of various Hydraulics experiment in laboratory set up.
- Introduction and writing programs in MATLAB Environment.

Course Outcomes:

1. Ability to perform experiments based on principles of Surface and Ground water Engineering
2. Ability to analyse, interpret and drawing inferences based on experimental data
3. Capability to present technical/lab report and able to write programs & Applications of certain softwares to water resources Engg

Water Resources Laboratory

1. Measurement of infiltration rate of a soil
2. Measurement of Rainfall and Runoff for simple storm in model Basin
3. Measurement of Rainfall and Runoff for complex storm in model Basin
4. Effect on Runoff due to impermeable land use due to complex storm in model Basin
5. Verification of Sediment flow in Catch Basin due to Rainfall and Runoff
6. Simulation of storm flow in Catch Basin and development of Unit Hydrograph
7. Study of Scour pattern and measurement around piers of different shapes
8. Verification of Drawdown curve experiment in Groundwater Model
9. Verification of Drawdown impact due to interference of wells in Groundwater Model

MATLAB Programs

10. Regression Analysis
11. Unit Hydrograph
12. Fitting of probability distributions to the Data
13. Flood routing by Muskinghum method
14. Water Distribution Network using EPANET software
15. Climate change applications using SDSM software

CE252

GEOGRAPHICAL INFORMATION LABORATORY

Instruction : 4 hours per week CIE: 50 Marks
Credits : 1.5

Course Objectives:

- Understands the concept of Geographical Information System
- Application of ArcGIS Software tools to Civil Engineering problems
- Preparation of Thematic maps using software tools

Course Outcome

1. Students are expected to have gained knowledge on ArcGIS software and its applications to Civil Engineering
2. Ability to develop the thematic maps using various tools of ArcGIS Software
3. Able to extract the geospatial data from the remotely sensed data

1. Georeferencing of toposheets
2. Digitization of Map/Toposheet
3. Creation of Boundary map
4. Extraction road network map
5. Creation drainage pattern Map
6. Generation Land use/Land cover map
7. Generation of Soil classification map
8. Developing Digital Elevation model
9. Preparation of slope map
10. Estimation of features and interpretation
11. Applications of GIS in Civil Engineering fields such as Water Resources, Transportation, Geotechnical and Infrastructural Engineering, Construction Engineering and Management.

SEMESTER - II

CE202

ADVANCED FLUID MECHANICS

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

- Introduction to the governing equations of fluid motion
- Knowledge about grid generation and boundary conditions
- Description of ideal fluid flow theory and its application in real life problems

Outcomes:

1. Acquaintance with application of Navier-Stokes equations
2. Comprehensive understanding regarding the concepts of boundary layer theory
3. Knowledge of turbulent boundary layer governing equations
4. Ability to analyse turbulence models for the solution of fluid flow problems
5. Application of ideal fluid flow theory concepts to water resources engineering problems

UNIT – I

Dynamics of Flow: Continuity equation, equations of motion, and Navier-Stokes equations, simple exact solutions to NS equations (steady laminar flow between parallel plates and in a circular tube of constant diameter).

UNIT – II

Boundary layer flows: Concept of boundary layer, Prandtl's boundary layer equations, Von Karnan-Pohlhausen integral momentum equation, Blasius solution for laminar boundary layer flow over a flat plate, boundary layer separation.

UNIT – III

Turbulent Boundary layer: Sources of turbulence, velocities, energies and continuity in turbulence, turbulent shear stresses, Reynolds equations for incompressible fluids, Prandtl's mixing length theory in shear flows, law of wall, velocity defect law, velocity distribution in turbulent flow through smooth and rough pipes.
Governing Equations: Classification of Partial Differential Equations (PDE), Reynolds Averaged Navier-Stokes equation

UNIT – IV

Classical turbulence models: Mixing length model, k-ε model, and Reynolds Stress equation model Solution procedure, Grid generation and grid independence, and Boundary conditions.
Computational Fluid Dynamics: Finite Volume formulation for diffusion equation, Convective-Diffusion equation, Solution algorithm for pressure velocity coupling in steady flows, staggered grid, SIMPLE & PISO algorithm

UNIT – V

Standard Patterns of flow: Source, sink, vortex pair, spiral vortex, flow past a half body, flow past a Rankine body, flow past a cylinder with and without circulation

REFERENCES:

1. Schlichting Herman and Klaus Gersten, *'Boundary Layer Theory'*, Springer (India) Pvt Ltd., New Delhi, 2007
2. Yunus A Cengel and John M Cimbala, *'Fluid mechanics: Fundamentals and Applications'*, Tata McGraw-Hill Publishing Company, New Delhi, 2008
3. Som, S. K. and Biswas, G., *'Fluid Mechanics and Fluid Machines'*, Tata McGraw-Hill Publishing Company, New Delhi, 1998
4. Vijay Gupta and Santosh K. Gupta, *'Fluid Mechanics and its applications'*, Wiley Eastern Ltd., New Delhi,1984
5. Versteeg, H and W. Malalasekra, *'An Introduction to Computational Fluid Dynamics: The Finite Volume Method',* Pearson Education Ltd, Essex, England, 2007
6. Anderson John D. Jr., *'Computational Fluid Dynamics – The basics with applications'*, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2012

CE203

GROUNDWATER ENGINEERING

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- A pathway to understand the basic physical principles of groundwater flow, differential equations, boundary condition and groundwater quality.
- Knowledge of various aspects of recharge of groundwater.
- Exposure to use the numerical solutions to solve problems with complex realistic situations.

Course Outcomes:

1. Knowledge of groundwater hydrology and hydraulics of the movement of water in aquifers to manage groundwater resources.
2. Comprehensive understanding of the issues pertaining to unsteady radial flows in aquifers.
3. Analyze the results obtained from geophysical methods and use them to identify the zones for feasibility of groundwater recharge.
4. Ability to deal with more realistic situations to solve problems pertaining to groundwater quality.
5. Conduct simulation studies for future state of groundwater systems, optimal protection and rehabilitation strategies

UNIT-I

Introduction: Ground water in hydrologic cycle, Distribution of subsurface water, ground water potential, occurrence of groundwater in hydro geologic formations, components of groundwater studies, Darcy's law and its validity.Governing equations of groundwater flow in aquifers: 3-D Ground water flow equations in Cartesian and polar coordinates, equations for steady radial flow into a well in case of confined and unconfined aquifers, equations for effect of uniform recharge in a fully penetrating unconfined aquifer, well flow near aquifer boundaries.

UNIT-II

Equations for unsteady radial flow into a well in case of confined aquifer, determination of Storage coefficient and Transmissibility (S and T) by Theis's graphical method, Cooper-Jacob's and Chow's method. Image well theory, partial penetration of wells, multiple well systems.

UNIT-III

Artificial recharge of aquifers: Introduction, current trends in artificial recharge, spreading methods, injection wells, technical feasibility and economic viability. -Geophysical methods in groundwater Exploration: surface geophysical methods: electrical resistivity method, seismic method, magnetic method, determination of aquifer thickness.

UNIT-IV

Quality of groundwater and seawater intrusion in coastal aquifers: Dissolved constituents in groundwater and their effects, fluctuations in groundwater, mechanism of salt water intrusion, Ghyben-Herzberg relation, slope and shape of the interface, prevention and control of seawater intrusion, case studies involving sea water intrusion.

UNIT-V

Models in ground water analysis: Major applications of ground water models, sand models, viscous fluid models, membrane models, thermal models, electric-Analog models, numerical modeling of ground water systems.

REFERENCES

1. Ven-Te-Chow, '*Hand book of Applied Hydrology'*, McGraw-Hill Book Company, New York. 1964
2. Todd, D.K. '*Groundwater Hydrology'*, John Wiley and Sons, New York. 1980
3. Karanth, K. R. '*Groundwater Assessment, development and Management'*, Tata Mc Graw – Hill publishing company New Delhi. 1987
4. Raghunath H.M, '*Ground water'* Wiley Eastern Ltd, New Delhi. 1982
5. Wang Herbert. F. and Anderson Mary. P.(), '*Introduction to groundwater modeling; FDM and FEM'*, Academic Press, New York. 1995
6. Rastogi, A.K. '*Numerical Groundwater Hydrology'*, Penram International publishing (India) Pvt Ltd. 2007.

CE211

SOFT COMPUTING APPLICATIONS IN WATER RESOURCES ENGINEERING
(Program Elective - III)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Introduction of Soft computing concepts and terminology.
- Method of Solution and simple problem solving for Goal Programming problems.
- Various terminology and simple numerical problems for Neural Networks, Genetic Algorithm and Fuzzy based systems.

Course Outcomes:

1. Ability to understand soft computing concepts, methods and technical terms
2. Formulation of mathematical model using Goal programming and able solve simple problems
3. Understanding the terminology and flow diagrams of NN model.
4. Understanding the Fuzzy Logic Concepts, terminology of Genetic Algorithm.
5. Ability to formulate problems using Fuzzy Logic and Genetic Algorithms.

UNIT – I *Goal Programming:* Introduction, Concept of Goal Programming, Single Goal Models, Multiple Goal models, Multiple goals with priorities, Multiple goals with priorities and weights, Formulation of Goal programming, Methodology and solution of Goal programming by Simplex method for simple problems, Formulation of Goal Programming for Simple water resources problems.

UNIT – II

Multi Objective Optimization: Introduction, Plan generation, Weightage method, Constraint method, Methods of Estimation of weights by Weightage method, Constraint method, formulation of Multi-Objective problem by Goal Programming method, application of simple water resources multi-Objective problems.

UNIT –III

Neural Net works: Fundamental concepts, Biological Neural networks, Basic Models in Neural networks, Comparison of Biological Neuron and artificial neuron, terminology of Neural networks. Supervised learning networks and calculation of error. Back propagation networks (algorithm and architectures).

UNIT – IV

Fuzzy sets: Introduction to fuzzy sets and classical sets, fuzzy set operations and properties. Fuzzy relations, fuzzy membership functions, Fuzzy logic, fuzzy quantifiers and fuzzy

inferences. fuzzy rule based methods and defuzzification methods. Application of fuzzy methods in water resources.

UNIT – V *Genetic Algorithms:* Fundamentals of genetic algorithms, basic concepts, binary coding, fitness function, Reproduction, (Roulette wheel selection, Tournament selection). Cross over and mutation operations, convergence of algorithm. Simple applications in water resources.

REFERENCES

1. Raja Sekharan S. and Vijaya Laxmi Pai G. A. , '*Neural Networks, Fuzzy Logic, and Genetic Algorithm'*, Prentice-Hall of India, New Delhi. 2003
2. Jang J.S.R. , C.H. Tsai Sun, and Eiji Mizutsani, '*Neuro-Fuzzy and Soft Computing', Pearson Education,* New Delhi. 2004
3. Ashok. D. Belegundu and Chandraputala T.R., '*Optimization concepts and Applications in Engineering*', Pearson Education, New Delhi. 2002
4. Vedula S. and. Mujumdar P.P. '*Water resources Systems'*, McGraw-Hill Publishing Company, New Delhi. 2005
5. Srinivasa Raju K. and Nagesh Kumar D. '*Multi-Criterian Analysis in Engineering & Management*', Prentice-Hall of India, New Delhi. 2010
6. John Yen and Reza Langari, '*Fuzzy Logic: Intelligence Control Information', Pearson Education,* New Delhi. 1999.

CE212

ENVIRONMENTAL HYDRAULICS

(Program Elective – III)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives

- Introduction to basic principles of Fluid Mechanics
- Exposure to hydraulic pipes, their design philosophy
- familiarity of advection and dispersion equations and Mass transfer in gas-liquid and liquid -liquid system

Outcomes

1. Ability to apply concepts of Fluid mechanics in various fields of water resources.
2. Application of hydraulics principles in the design of pipes.
3. Modelling mixing processes and applying of advection and dispersion equations.
4. Understanding of mixing and density stratified flows
5. Ability to analyse Mass transfer in gas-liquid and liquid -liquid systems

UNIT I

Introduction and scope, review of basic principles of engineering fluid mechanics, continuity, momentum, and energy equations, steady flow through pipes- hydraulic gradient and total energy line, basics of open channel flow; Ground water, well hydraulics, well design and constructions,

UNIT II

Basic equations for fluid flow analyses including Reynolds transport theorem- Parallel, compound and equivalent pipes, head losses in pipes, design of pressurized conduits- General design requirements – Methods of analyses – Control of water hammer in long distance transmission. – Introduction to optimization of water distribution system.

UNIT III

Various forms of mixing in the environment, modeling of the mixing process. advection dispersion equation, Various forms of advection dispersion eq. and its solution.

UNIT IV

Models for rivers and streams - Completely mixed and incompletely mixed systems. BOD and oxygen saturation, Streeter-Phelps equation, point and distributed sources- Special cases of mixing, density stratified flow, tide, etc.

UNIT V

Mass transfer in gas-liquid and liquid -liquid system with special emphasis on aeration, Project presentation

REFERENCES:

1. Roberson, J.A., Cassidy, J.J., Chaudhry, M.H. "*Hydraulic Engineering*", 2nd Edition, Wiley. 1998
2. Chadwick, A., Morfett, J., Borthwick, M. "*Hydraulics in Civil and Environmental Engineering"*, 5th Edition, CRC Press. 2004
3. Lee, C. C., Lin, S.D. "*Handbook of Environmental Engineering Calculations*", McGraw Hill. 2007

CE213

SEDIMENT TRANSPORT
(Program Elective – III)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives

- Introduce the sediment and fluvial Hydraulics concepts
- Discussion of sediment transport mechanism and regimes of flow
- Introduction of Alluvial streams, reservoir siltation, sediment control and bank protection.

Outcomes

1. Knowledge of properties of sediments and sediment problems
2. Ability to understand sediment transport mechanism
3. Ability to collect the sediment using sediment samplers and design of stable channels
4. Analysis of various stages of streams including stream characteristics
5. Assessment of scour and ability to plan sediment controlling methods and protection.

UNIT–I

Introduction: Sediment and Fluvial Hydraulics –nature of sediment problem- origin and formulation of sediment – fundamental properties of individual sedimentary particles-bulk property of sediments.

UNIT–II

Sediment Transport: Incipient motion of sediment particles- regimes of flow, resistance to flow and velocity distribution in alluvial stream-bed load transport suspended load transport-total load transport

UNIT-III

Sediment samplers and sampling, bed load sampling—suspended load sampling - Design of Stable channels: variables in channel design, design of channels by permissible velocity method and tractive force method

UNIT IV

Alluvial streams: Introduction, various stages of streams, stream slope, stages of streams, stream slope, shapes of streams, bed level variations in alluvial streams, continuity equation for sediment, stream bed changes during flood

UNIT V

Sediment Control: Silting of reservoirs, local scour , sediment control in canals, Methods actions, in controlling methods , objections of river training, and bank protection .

REFERENCES

1. Graf, W.H. " *Hydraulics of Sediment Transport* " Mc Graw Hill Company, New York, 1971
2. Garde RJ and Ranga Raju KG, *Mechanics of Sediment transportation and alluvial stream peoblems*, Wiley Easterns Ltd, New Delhi, 1995.
3. Yalin MS, *Mechanics of Sediment transport*, Pergaman Press, Oxford, 1997.

CE220

INTEGRATED WATERSHED MANAGEMENT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

The course is designed to:

- Introduce the concept of watershed management practices globally.
- Acquaint with various features and issues of watershed management.
- Create awareness about current status and importance of watershed management.

Course Outcomes:

1. Understanding the fundamentals of watershed Management practices.
2. Ability to apply integrated watershed principles and asses the geomorphological characteristics of a watershed.
3. Ability to model soil erosion, applying soil erosion control measures in a watershed and suggesting suitable methods for rain water harvesting structures.
4. Adopting appropriate techniques applicable in urban water sensitive designs.
5. Ability to solve problems related to environmental, socio-economical, water governance for sustainable watershed management.

UNIT-I:

Fundamentals of Watershed: Definition and concept of watershed development,objectives of watershed management; need for watershed planning in India. Socio-economic aspects of watershed management, impacts of changing demography and land use & land cover on watersheds management. Case studies on "on-site and Off-site" impacts of watershed development.

Status of Water Resources in India: National and regional attributes of annual rainfall, evaporation rates, groundwater recharge, and surface runoff. Indian river basins and their water resources. Storage of surface water versus river discharge. Per capita availability of freshwater resources in India. Dark Zones and water crisis. Inter-linking of rivers, Ecological flow in the rivers. Water disputes in India.

UNIT-II:

Integrated watershed management: Basics ofIntegrated watershed management; multidisciplinary approach for watershed management, Integrated watershed management programme in India.

Characteristics of Watershed: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT-III:

Dynamics of Soil Erosion: Types and formation of soils.Types of soil erosion, factors affecting erosion, effects of ploughing on soil erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, various universal soil loss equations.

Measures to Control Soil Erosion: Need and importance of soil conservation. Contour techniques, furrowing trenching, building terracing, gully control, rock fill dams, brushwood dams, gabions, check dams, afforestation and agro-forestry.

Rain Water Harvesting: Importance and need; rainwater harvesting techniques-catchment harvesting, harvesting structures, farm ponds and percolation tanks, soil moisture conservation, artificial recharge.

UNIT-IV

Urban Watershed Management: Urbanization and water requirement, per-capita availability of water in Indian cities, source of water and consumption patterns. Urbanization impacts on water balances. Municipal Sewage generation, recycling and re-use of grey water in global and Indian cities.

Water Sensitive Urban Design: Water-stress in cities, urban floods, urban storm-water drainage network, urban rainwater harvesting-systems and planning. Dessign constructions and applications green storm water Infrastructure such as rain-gardens, pervious concrete and green roofs. Low Impact developments, Best management practices. Climate change impacts on urban urbanizations, climate resilient water sensitive urban designs and urban flood modeling.

UNIT-V

Sustainable Watershed Management: Concept of sustainability and sustainable developments; Need of water conservation. Indigenous practices in watershed management. Need of social awareness. Importance of people's participation in water conservation measures and watershed management.

*Water Quality:*Concept, Characterization and assessment, water quality issues in surface and groundwater bodies, monitoring and analysis protocol. Status of water quality in Indian rivers and lakes. Approaches to minimize the impacts of anthropogenic contaminates on water resources. Socio-economic and environmental cost of water quality degradation.

References:

1. Das, M. M. and Saikia,M.D. *"Watershed Management"*, PHI Learning Pvt. Ltd, India, 2013
2. Gonenc, I. E., Wolflin, J. P., & Russo, R. C. (Eds.). *Sustainable Watershed Management*. CRC Press. 2014
3. Jain, S. K., Agarwal, P. K., & Singh, V. P. *Hydrology and water resources of India (Vol. 57)*. Springer Science & Business Media. 2007
4. Krenkel, P. *Water quality management*. Elsevier. 2012
5. Larry W.Mays. "*Integrated Urban Water Management: Arid and Semi-Arid Regions*". CRC Press, Taylor & Francis Group, Netherlands. 2009
6. Majumdar D.K. *"Irrigation and Water Management."* Prentice-Hall of India, New Delhi. 2000
7. Morgan, R. P. C. *"Soil erosion and conservation."* John Wiley & Sons. 2009

CE221

APPLIED STATISTICS IN WATER RESOURCES ENGINEERING
(Program Elective –IV)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

- Introduction to frequency distribution and sampling
- Concepts of regression and correlation
- Knowledge about sampling distributions and tests of significance

Outcomes

1. Ability to compute central tendencies and sampling applications
2. Fitting of Probability distribution to data, computations of the mathematical expectation and moment generating function.
3. Applications Regression techniques in water resources engineering field.
4. Ability to compute various parameters in multivariate data.
5. Applications of tests of statistical significance especially in Hydrological studies

UNIT-I

Introduction : Frequency Distribution - Measures of central tendency-measures of dispersion - Standard error - Skewness - kurtosis-moments - definitions and applications, Karl Pearson's, Bowley's , Kelly 's , moment's methods - sampling- simple random sampling - stratified sampling - systematic sampling- sample size determination , and applications in Water Resources Engineering.

UNIT-II

Probability : axioms of probability - addition theorem on probability - conditional probability- independent events and multiplication theorem on probability - Baye's theorem - Random variables- discrete and Continuous random variables - probability distribution and density functions- Mathematical expectation - Moment generating function

Statistical Distribution: Binomial, Poisson , Normal distributions and fitting of these distribution -exponential distribution - gamma distribution - uniform distribution - chi-square distribution ,and applications in Water Resource Engineering

UNIT-III

Regression and Correlation: Simple , multiple, total ,partial linear and non-linear regressions-regression coefficients-regression equations - correlation - multiple correlation - multiple correlation coefficients - Standard error of estimate –curvilinear regression -analysis of variance - and applications in Water Resources Engineering.

UNIT-IV

Multivariate Data Distributions: Types of data - Base vectors and matrices - simple estimation of Centroid , standard deviation ,dispersion ,variance and covariance - correlation matrices - Principal component analysis and Time series analysis .

UNIT-V

Exact Sampling Distributions and Tests of Significance : Chi-square distribution - student's t- distribution and F - distribution,-sampling and non-sampling errors - sampling fluctuations .sampling distribution of a statistic- standard error a statistic - Estimation theory - point estimation - interval estimation- confidence limits for population parameter - confidence interval of the mean - Testing hypothesis - Large sample and small sample tests - Tests of significance of

single mean - difference between two means , difference between two variances -test of significance for single proportion (small samples and large samples) t-test, chi -square test - F-test , applications in Water Resources Engineering.

REFERENCES:

1. Snedecor, G.W., and W.G. Cochran , '*Statistical Methods'*, East West Press, NewDelhi. 1994
2. Alfredo, H.S. and Tang Wah , '*Probability Concepts in Engineering Planning and Design: Vol-I (Basic Principles),* John Wiley & Sons, New York. 1975
3. Simpson and Kafks , '*Basic Statistics'*, Oxford IBH, Calcutta. 1969
4. V. Sundarpandian *Probability, Statistics, Queuing theory* , PHI Publishers 2011
5. G.Shankar Rao *Probability and Statistics for Science and Engineering*, University Press. 2011
6. SC Gupta and VK Gupta *Fundamentals of Mathematical Statistics* Sultan Chand & Sons Publishers, 2014
7. Daniel Wilks (2006) statistical methods in the atmospheric sciences Academic Press Elsevier publishers
8. D.R. Helsel and R.M. Hirsch (2002) Statistical Methods in Water Resources, USGS Science for a changing world. Publication available at: http://water.usgs.gov/pubs/twri/twri4a3/
9. Hwei P. Hsu (1996)Theory and Problems of Probability, Random Variables, and Random Processes, Schaum Series

CE 222

GROUNDWATER CONTAMINATION: TRANSPORT AND REMEDIATION
(Program Elective –IV)

Instruction: 3 periods per week *Duration of Semester End Examination: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Introduction to the concepts of contaminant transport.
- Description of the NAPL impacts in source areas and plumes by modeling approaches.
- Illustration of the various evaluation schemes and emerging remediation techniques.

Course Outcomes:

1. Comprehend the fundamentals of groundwater contamination and transport.
2. Knowledge of various sources and contaminants pertaining to groundwater contamination.
3. Ability to critically review and interpret transport processes and mechanisms to solve problems of groundwater flow and solute transport
4. Understand the contaminant transport in unsaturated zones and decide the appropriate remediation methods and treat them effectively.
5. Application of knowledge to solve problems of contaminant transport by modeling techniques

UNIT I *Introduction to groundwater contamination***:** Hydrologic cycle, groundwater hydrology, groundwater contamination and transport, evolution of groundwater information, groundwater remediation, and groundwater movement, general flow equations and well mechanisms.

UNIT II

Sources and types of groundwater contamination: Introduction, under ground storage tanks, landfills, surface impoundments, waste disposal of injection wells, radioactive contaminants, classification of organic compounds, inorganic compounds in ground water. Non aqueous phase liquids (NAPL'S): types, general processes, transport, fate of NAPL'S in subsurface.

UNIT III

Contaminant transport mechanisms: Introduction, advection process, diffusion and dispersion process, mass transport equation, governing flow and transport equations, analytical methods, tests for dispersivity.

UNIT IV

Flow and transport in the unsaturated zone: Capillary action, governing equations for unsaturated flow, transport process in unsaturated zone and its governing equations-

Remediation alternatives: introduction to remediation method and alternatives, containment methods for source control, hydraulic controls and pump and treat systems, bio-remediation, soil vapor extraction systems, emerging remediation technologies.

UNIT V

Numerical modeling of contaminant transport: Introduction, numerical methods, finite difference methods(FDM), finite element methods (FEM), methods of characteristics, numerical flow models, contaminant transport models, applying numerical model to field sites.

REFERENCES

1. Philip. B. Bedient, Hanadis. Rifai ,and Charles. J. Newell '*Groundwater Contamination: Transport and Remediation*', Prentice-Hall, New Jersey. (1999),
2. Lakshmi.N.Reddi, Hilary, I.Inyang '*Geo-Environmental Engineering: Principles and Applications',* CRC Press, Florida. 2000
3. Zheng Zheng Chunmiao and Gordon. D. Bennett '*Applied Contaminant Transport Modeling (Theory and Practice)'*, John Wiley and Sons, New York. 1995
4. Wang Herbert. F., and Anderson Mary.P. *'Introduction to Groundwater Modelling Finite Difference and Finite Element Methods',* Academic Press, San Diego, 1995.

AC 035

STRESS MANAGEMENT BY YOGA
(AUDIT COURSE-II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 00

Objectives:

- *Creating awareness about different types of stress and the role of yoga in the management of stress.*
- *Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).*
- *Prevention of stress related health problems by yoga practice.*

Outcomes: *Students will be able to*

1. *To understand yoga and its benefits.*
2. *Enhance Physical strength and flexibility.*
3. *Learn to relax and focus.*
4. *Relieve physical and mental tension through Asanas*
5. *Improve work performance and efficiency.*

UNIT-I

Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT–II

Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT-III

Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT-IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT).

Suggested Reading:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Online Resources:

https://onlinecourses.nptel.ac.in/noc16_ge04/preview

https://freevideolectures.com/course/3539/indian-philosophy/11

AC 036

PERSONALITY DEVELOPMENT THROUGH LIFE ENHANCEMENT SKILLS (AUDIT COURSE-II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 00

Objectives :

- *To learn to achieve the highest goal happily*
- *To become a person with stable mind, pleasing personality and determination*
- *To awaken wisdom in students*

Outcomes: *Upon completing this course, students will be able to:*

1. *Develop their personality and achieve their highest goal of life.*
2. *Lead the nation and mankind to peace and prosperity.*
3. *To practice emotional self regulation.*
4. *Develop a positive approach to work and duties.*
5. *Develop a versatile personality.*

UNIT-I

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavad Geetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of basic knowledge - Shrimad Bhagawad Geeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 – Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Reading:

1.. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Web resource:

1. NTPEL:http://nptel.ac.in/downloads/109104115/

AC 037

CONSTITUTION OF INDIA
(AUDIT COURSE-II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 00

Objectives:

- *The history of Indian Constitution and its role in the Indian democracy.*
- *Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
- *Have knowledge of the various Organs of Governance and Local Administration.*

Outcomes: *Upon completing this course, students will be able to:*

1. *Understand the making of the Indian Constitution and its features.*
2. *Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.*
3. *Have an insight into various Organs of Governance - composition and functions.*
4. *Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.*
5. *Understand Electoral Process, special provisions.*

UNIT-I

History of making of the Indian constitutions: History, Drafting Committee (Composition & Working). **Philosophy of the Indian Constitution**: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance": Parliament: Composition, Qualifications, Powers and Functions, Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions.

UNIT-IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, ayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

AC038

PEDAGOGY STUDIES

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 0

Course Objectives:

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

Course Outcomes:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in Developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I

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.

UNIT-II

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

UNIT-III

- 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.

UNIT-IV

- Professional development: alignment with classroom practices and followup support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

UNIT-V

- 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. ww.pratham.org/images/resource%20working%20paper%202.pdf.

MC070

MINI PROJECT

Instruction: 6 periods per week
CIE: 50 marks
Credits: 1.5

Course Outcomes:

At the end of the course, the student will be able to:

1. Identify WR engineering problems by reviewing available latest literature.
2. Study different techniques and analyze complex WR systems.
3. Provide appropriate solutions for the identified problem.

Syllabus Contents:

Mini Project will have mid semester presentation and end semester presentation. Mid semester Presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

CE254

SEMINAR

Instruction: 3 periods per week
CIE: 50 marks
Credits: 2

Course Objectives:

- Problem definition
- Literature survey, familiarity with research journals
- Broad knowledge of the available techniques to solve the problem
- Technical writing skills
- Presentation skills

Course Outcomes:

At the end of the course, the student will be able to:

1. Identify appropriate topic and understand its relevance.
2. Update literature on technical articles of selected topic and develop comprehension.
3. Prepare a technical report and Deliver presentation on specified technical topic

The objective of the seminar is to prepare the student for a systematic and independent study of the state of art topics in his/her specialization. Seminar topics may be chosen by the students with the advice of the faculty members. Students are exposed to the following aspects:

Each student is required to submit a technical write-up, presentation of their study (about 20 minutes) followed by a discussion.

At least two faculty members will be associated with the seminar presentation to evaluate and award marks.

CE253

COMPUTATIONAL FLUID DYNAMICS LABORATORY

Instruction: 3 periods per week *CIE: 50 marks*
Credits: 1.5

Course Objectives:

- Introduction to the basic concepts of CFD
- Explanation to importance of various turbulence models
- Evaluation of flow properties from simulation analysis

Course Outcomes:

1. Knowledge on the basic concepts of simulation analysis and geometry creation
2. Ability to spawn appropriate mesh and boundary conditions to WRE case studies
3. Acquaintance with various turbulence models and their evaluation

LIST OF EXPERIMENTS

1. Creation of geometry for various cases
2. Mesh generation and assigning of boundary conditions for uncomplicated cases
3. Verification of application of different turbulence models for simple cases
4. Evaluation of flow characteristics from simulation analysis
5. Simulation of head over the crest in a rectangular notch
6. Flow simulation in a pipe bend for varying angles and diameters
7. Appraisal of flow behavior around an aerofoil
8. Plotting of various contours and vectors for flow over an Ogee weir
9. Analysis of flow for sudden change in the pipe diameters
10. Comparison of simulation results with available physical modeling analysis.

REFERENCES

1. Anderson John D. Jr., '*Computational Fluid Dynamics – The basics with applications'*, Mc-Graw Hill Education (India) Pvt. Ltd., New Delhi, 2012
2. Versteeg H. K., and Malalsekera W, '*An Introduction to Computational Fluid Dynamics – Finite Volume Method',* Preason Education Ltd., 2007.
3. Chung T. J., '*Computational Fluid Dynamics'*, Cambridge University Press, Cambridge, U.K, 2002.

SEMESTER-III

CE223

HYDRAULIC STRUCTURES
(Program Elective- V)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- Description of the design aspects of different types spillways
- Knowledge regarding the design of energy dissipation arrangements
- Awareness about urban storm drainage and concepts of dam safety

Outcomes:

1. Skills for the application of principles involved in the design of spillways
2. Aptitude to plan with latest improvements in the design of hydraulic structures
3. Application of principles of design to different types energy dissipation arrangements
4. Propensity to plan and apply the design principles of urban storm-water drainage systems for the sustainable development of the society
5. Knack for the application of principles and concepts of dam safety guidelines

UNIT–I

Introduction – Functions of Spillways, Design flood, Hydraulic design steps for Side Channel spillway, Chute Spillway, and Shaft Spillway

UNIT–II

Roller Compacted Concrete (RCC) dams, Hydraulic design steps for Stepped spillway, and air regulated siphon spillway.

Hydraulic design steps for Labyrinth weir and Duck bill spillway

UNIT – III

Energy Dissipaters – Factors governing the design, design criteria of energy dissipaters as per U.S.B.R. Cavitation and air entrainment in spillway as per BIS 2804-1989

UNIT – IV

Urban drainage: Quantity of storm water, design of storm water drainage system, SCS curve technique, design of culverts for submerged and partly submerged flow situations, airport drainage.

UNIT–V

Dam safety – Principles and concepts for new dams and existing dams, hazard classification of dams, spillway capacity criteria, safety of existing embankment dams and appurtenant structures.

REFERENCES:

1. Water Resources Technical Publication, *'Design of Small Dams (USBR)'* , Oxford and IBH Publication Company, New Delhi, 1974
2. Vischer D.L. & W.H. Hager , *'Dam Hydraulics'* , Wiely International Edition., New York , 1998
3. Novak P., A.I.B. Moffat, R. Nalluri & R. Narayanan, *'Hydraulic Structures'*, Unwin Publishers, London, 1990
4. Larry-W-Mays, *'Water Resources Engineering'*, John Wiley & Sons, Singapore, 2006
5. John E. Gribbin, *'Hydraulics and Hydrology for Stormwater Management'*, Delmar Publishers, New York, 1997
6. Creager W.P., Joel D. Justin and Julion Hinds, *'Engineering for Dams'* Volume I,II & III, John Wiley and Sons Inc, New York, 1961

CE224

IRRIGATION & DRAINAGE ENGINEERING
(Program Elective V)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- Introduction to concepts and behavior of soil-water-plant relationship
- Exposure to various water application techniques and their design principles
- Awareness relating to the drainage equations and its applications

Outcomes:

1. Comprehensive understanding about soil-water plant relationships
2. Knowledge of different methods of Evapotranspiration
3. Skill for the choice and design of suitable water application method
4. Perceptive awareness regarding principles of drainage for sub surface flows
5. Application of principles of drainage for various flow scenarios for the sustainable development of the society

UNIT–I

Soil Agronomy – Soil moisture retention and movement, soil moisture tension, soil moisture stress, soil moisture constants (saturation capacity, field capacity, permanent witting point and available water), Measurement of soil moisture (Gravimetric, tensiometer, pressure membrane, electrical resistance and Neutron moisture meter methods), Soil-water-plant relationships, soil – water relationships, Soil – Crop relationships and fertility of soil.

UNIT–II

Estimation of evapotranspiration from direct and indirect/climatological data using Blanney–Criddle, Thronthwaite, Penmann, Modified Penman Method, Hargreaves radiation methods.

UNIT-III

Water Application methods – Details and design specifications for Border, Check basin, Furrow,sprinkler, and drip methods of applications of water. Irrigation requirements: gross, net, and frequency of application, Irrigation efficiencies.

UNIT-IV

Basics of Groundwater flow- Dupuit-Forchheimer's assumptions, water table subjected to recharge or capillary rise, steady flow towards a well, steady state drainage equations (Hooghoudt, and Ernst), unsteady state drainage equations (Glover-Dumm).

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UNIT-V

Drainage criteria- Water table indices for drainage design, steady state versus unsteady state drainage equations, critical duration, storage capacity, and drainage design.
Drain spacings: principles of Hooghoudt, and Ernst equations.

REFERENCES:

1. Ritzema, H.P., *'Drainage Principles and Applications'*, International Institute for Land Reclamation and Improvement, Publication no.16 (second edition), Netherlands, 1994 (www.ilri.nl)
2. Beers Van W.F.J., *'Computing Drain Spacings'*, International Institute for Land Reclamation and Improvement, Bulletin no.15, Netherlands 1976 (www.ilri.nl)
3. Michael, A.M., *'Irrigation Theory & Practice',* Vikas Publishing House, New Delhi, 1978

CE225

IMPACTS OF CLIMATE CHANGE IN WATER RESOURCES ENGINEERING

(Program Elective - V)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

- Introduction to basic concepts of General Circulation Models and their importance.
- Features of Indian summer monsoon rainfall (ISMR) and their characteristics
- Downscaling principles of statistical downscaling and dynamical downscaling.

Course Outcomes:

1. Understanding of various components of Climate System .
2. Comprehensive Understanding of Hydrological cycle, water balance, distribution of precipitation
3. Ability to comprehend the monsoon wind patterns, ISMR characteristics, floods and droughts.
4. Analysis and synthesis on the causes of climate change on hydrology using General Circulation Models (GCMs)
5. Modeling of climate variables using various downscaling approaches and Applications of Hydrologic models

UNIT–I

Climate System- Weather and Climate- Overview of earth-atmosphere- vertical structure of atmosphere- Radiation and Temperature- Temperature variation- vertical variation in Air temperature- temperature extremes

UNIT–II

Hydrological cycle- Introduction- Global water balance- cycling of water on land- simple water balance- climate variables affecting precipitation- forms and types of precipitation.

UNIT – III

Monsoon- wind patterns in India- Global wind circulation- clouds- Types of clouds-Indian summer monsoon Rainfall (ISMR) - characteristics- climate variability- Floods- droughts- drought Indicators - climate extremes.

UNIT – IV

Causes of climate change - Modeling of climate change-General circulation models (GCMs) –IPCC scenarios - IPCC Assessment Report (AR5) - Physical Science basis.

UNIT–V

Bias correction methods -Downscaling – Types of downscaling- Dynamical downscaling- Regional Climate Models - statistical downscaling - Types of statistical downscaling -

climate predictors - data reduction techniques -principal component analysis- step wise regression- Lasso- - Kernel Regression - SDSM software - Hydrology models - Introduction on Soil and water assessment tool SWAT and VIC (variable Infiltration capacity models)

REFERENCES

1. Bonon G B - *Ecological climatology*- Cambridge University Press Edition- II - ISBN-1107268869, 2008
2. RL Wilby, SP charles, E Zoritaa, B Timbal, P WHetton, LO Mearns - *Guide lines for use of climate science from Statistical Modeling models*. 2004
3. *Physical science basis of AR 5 report of IPCC - working group I contribution to Assessment Report*- https://ipcc.ch/report/ar5/wg1/ 2013
4. *Soil and Water Assessment Tool SWAT- user Manual Report (2005) http://swat.tamu.edu/media/1294/swatuserman.pdf* 2005
5. *VIC model Macro scale Hydrologic Model- http://www.hydro.washington.edu/Lettenmaier/Models/VIC/index.shtml*
6. Rasmus E Benestad, Inger Hanson Baver, Delinag Chen (2008) *Empirical Downscaling* World Scientific Publishing Co. Ltd. 2008.
7. Haan T. C., Statistical Methods in Hydrology, East West Publishers, 1998
8. K Srinivasa Raju and Nagesh Kumar (2018) Impact of climate change on water resources , Springer publications.
9. Karamouz M , S Nazif , M Falahi (2002) Hydrology and Hydroclimatology Principles and Applications, CRC Press, Taylor and Francis Group.

OE 941

BUSINESS ANALYTICS
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- *Understanding the basic concepts of business analytics and applications*
- *Study various business analytics methods including predictive, prescriptive and prescriptive analytics*
- *Prepare the students to model business data using various data mining, decision making methods*

Outcomes: *Upon completing this course, students will be able to:*

1. *To understand the basic concepts of business analytics*
2. *Identify the application of business analytics and use tools to analyze business data*
3. *Become familiar with various metrics, measures used in business analytics*
4. *Illustrate various descriptive, predictive and prescriptive methods and techniques*
5. *Model the business data using various business analytical methods and techniques*

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Suggested Reading:

1. Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015
3. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

OE942

INDUSTRIAL SAFETY
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1. *Causes for industrial accidents and preventive steps to be taken.*
2. *Fundamental concepts of Maintenance Engineering.*
3. *About wear and corrosion along with preventive steps to be taken*
4. *The basic concepts and importance of fault tracing.*
5. *The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry*

Course Outcomes:

1. *Identify the causes for industrial accidents and suggest preventive measures.*
2. *Identify the basic tools and requirements of different maintenance procedures.*
3. *Apply different techniques to reduce and prevent Wear and corrosion in Industry.*
4. *Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.*
5. *Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc*

UNIT-I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT–II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT–III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT–V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Suggested Reading:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication
3. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
4. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

OE 943

OPERATION RESEARCH
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- *Introduce the concepts of optimization techniques*
- *Formulation of LPP models*
- *Basic concepts of Non-linear programming, Dynamic programming, Game theory are introduced.*

Outcomes:

1. *Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*
2. *Students should able to apply the concept of non-linear programming*
3. *Students should able to carry out sensitivity analysis*
4. *Student should able to model the real world problem and simulate it.*
5. *Student should able to apply graph theory, competitive models, and game theory simulations.*

UNIT I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV

Scheduling and sequencing - single server and multiple server models deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Suggested Reading::

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010.

OE 944

COST MANAGEMENT OF ENGINEERING PROJECTS
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- Introduce the concepts of cost management, inventory valuation , decision making
- Fundamentals of cost overruns, project execution and technical activities
- Introduce the concepts of Quantitative techniques for cost management, Linear Programming, PERT/CPM

Outcomes:

1. Understanding of strategic cost management process, control of cost and decision making based on the cost of the project.
2. Ability to appreciative detailed engineering activities of the project and execution of projects
3. Preparation of project report and network diagram
4. Able to plan Cost Behavior , Profit Planning , Enterprise Resource Planning, Total Quality Management.
5. Applications of various quantitative techniques for cost management

UNIT I

Introduction and Overview of the Strategic Cost Management Process-Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System- Inventory valuation- Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning- Project execution as conglomeration of technical and non- technical activities- Detailed Engineering activities.

UNIT III

Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems- Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector-Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints- Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control;

Flexible Budgets- Performance budgets- Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM,- Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Suggested Reading :

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OE 945

COMPOSITE MATERIALS
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- *Study the concepts of composite construction.*
- *Learn analysis and designs of composite beams, floors, columns and trusses as per the recommendations of IS codes of practice.*
- *Apply the concepts for design of multi-storey composite buildings.*
- *Scope of analysis is restricted to skeletal structures subjected to prescribed dynamic loads.*

Outcomes:

1. *Understand the fundamentals of composite construction, and analysis and designs of composite beams.*
2. *Analyse and design the composite floors*
3. *Select suitable materials for composite columns,*
4. *Analyse composite trusses and understand connection details.*
5. *Analyse and design the multi-storey composite buildings*

UNIT-I

Introduction of composite constructions: Benefits of composite construction - Introduction to IS - BS and Euro codal provisions.

Composite beams: Elastic behaviour of composite beams - No and full interaction cases - Shear connectors - Ultimate load behaviour - Serviceability limits - Effective breadth of flange - Interaction between shear and moment - Basic design consideration and design of composite beams.

UNIT-II

Composite floors: Structural elements - Profiled sheet decking - Bending resistance - Shear resistance - Serviceability criterion - Analysis for internal forces and moments - Design of composite floors.

UNIT-III

Composite columns: Materials - Concrete filled circular tubular sections - Non-dimensional slenderness - Local buckling of steel sections - Effective elastic flexural stiffness - Resistance of members to axial compressions - Composite column design - Fire resistance.

UNIT-IV

Composite trusses: Design of truss - Configuration - Truss members - Analysis and design of composite trusses and connection details.

UNIT-V

Design of multi-storey composite buildings: Design basis - Load calculations - Design of composite slabs with profile decks - Composite beam design - Design for compression members - Vertical cross bracings - Design of foundation.

Suggested Reading:

1. R.P. Johnson, "Composite Structures of Steel and Concrete - Beams, Slabs, Columns and Frames in Buildings", Blackwell Publishing, Malden, USA, 2004.
2. "INSDAG Teaching Resources for Structural Steel Design", Vol-2, Institute for Steel Development and Growth Publishers, Calcutta, India.
3. "INSDAG Handbook on Composite Construction – Multi-Storey Buildings", Institute for Steel Development and Growth Publishers, Calcutta, India.
4. "INSDAG Design of Composite Truss for Building", Institute for Steel Development and Growth Publishers, Calcutta, India.
5. "INSDAG Handbook on Composite Construction – Bridges and Flyovers", Institute for Steel Development and Growth Publishers, Calcutta, India.
6. IS: 11384-1985, "Code of Practice for Composite Construction in Structural Steel and Concrete", Bureau of Indian Standards, New Delhi, 1985.

OE 946

WASTE TO ENERGY
(OPEN ELECTIVE)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

- *To know the various forms of waste*
- *To understand the processes of Biomass Pyrolysis.*
- *To learn the technique of Biomass Combustion*.

Outcomes: *Upon completing this course, students will be able to:*

1. *Understand the concept of conservation of waste.*
2. *Identify the different forms of wastage.*
3. *Chose the best way for conservation to produce energy from waste.*
4. *Explore the ways and means of combustion of biomass.*
5. *Develop a healthy environment for the mankind.*

UNIT-I:

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

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.

Suggested Reading:

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.

OE947

INTERNET OF THINGS
(Open Elective)

Instruction: 3periods per week Duration of SEE: 3 hours
CIE: 30 marks SEE: 70 marks
Credits: 3

Course Objectives:

- To understand the concepts of Internet of Things and able to build IoT applications
- To learn the programming and use of Arduino and Raspberry Pi boards.
- To know about data handling and analytics in SDN.

Course Outcomes:

After Completion of the course Student will be able to:

1. Known basic protocols in sensor networks.
2. Program and configure Arduino boards for various designs.
3. Python programming and interfacing for Raspberry Pi.
4. Design IoT applications in different domains.

UNIT – I

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT – II

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino,

UNIT – III

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

UNIT - IV

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics,

UNIT - V

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

Suggested Readings:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by PethuruRaj and Anupama C. Raman (CRC Press).
2. “Make sensors”: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media, 2014.
3. "Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti Vijay Madisetti,
4. ArshdeepBahga, “Internet of Things: A Hands-On Approach”
5. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
6. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

OE948

CYBER SECURITY

(Open Elective)

Instruction: 3periods per week
Duration of SEE: 3 hours
CIE: 30 marks
SEE: 70 marks
Credits: 3

Course Objectives

- Learn the various threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and IT laws and policies

Course Outcomes:

After completion of this course, the students shall be able to:

1. Understand the various network threats.
2. Analyze the forensic tools for evidence collection.
3. Apply the firewalls for threat analysis.

UNIT-I

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNIT-II

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis.

UNIT-III

Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation, email investigation, email tracking, IP tracking, email recovery, searc and seizure of computer systems, password cracking.

UNIT-IV

Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts, Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences, social media analysis, data retrival, Email analysis from mobile phones.

UNIT-V

Ethics, Policies and IT Act Basics of Law and Technology, Introduction to Indian Laws, Scope and Jurisprudence, Digital Signatures, E Commerce-an Introduction, possible crime scenarios, law coverage, data interchange, mobile communication development, smart card and expert systems Indian Laws, Information Technology Act 2000, Indian Evidence Act, India Technology Amendment Act 2008, Indian Penal Code , Computer Security Act 1987, National Information Infrastructure Protection Act 1996, Fraud Act 1997, Children Online Protection Act 1998, Computer Fraud and Abuse Act 2001, Intellectual Property, IP Theft, Copyright, Trademark, Privacy and Censorship, Introduction to Cyber Ethics, rights over intellectual property, Corporate IT Policy Formulations, Compliance Auditing.

Suggested Readings

1. Charles P. Fleeger, "*Security in Computing*", Prentice Hall, New Delhi, 2009.
2. BehrouzA.Forouzan, "*Cryptography & Network Security*", Tata McGraw Hill, India, New Delhi, 2009.
3. William Stallings, "*Cryptography and Network Security*", Prentice Hall, New Delhi, 2006.
4. Chalie Kaufman, Radia Perlman, Mike Speciner, "*Network Security: Private Communication in a Public Network*", Pearson Education, New Delhi, 2004.
5. Neal Krawetz, "*Introduction to Network Security*", Thomson Learning, Boston, 2007.
6. Bruce Schneier, "*Applied Cryptography*", John Wiley & Sons, New York, 2004.

CE281

MAJOR PROJECT PHASE-I

Instruction: 6 periods per week *CIE: 100 marks*
Credits: 10

Course Objectives:

- Identification of the research problem
- Discussion of literature survey.

Course Outcomes:

1. Identification of the objectives of the Research Problem.
2. Ability to obtain the latest literature in chosen area of research & establishment of the scope of work.
3. Development of the methodology for the chosen research problem and perform basic theoretical /experiment studies.

Each student will be attached to a faculty member/guide for project. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design analysis / Experimental related to his/her specialization. The work will be monitored regularly by the guide. At the end of the semester student will write the report on the work done and submit to the guide. Student has to present his/her work before two faculty members (one guide and other to be appointed by chairman BOS) on a fixed day during last week of the semester in which project is offered. The sessional marks will be awarded jointly by these examiners based on the report, presentation and viva voice

SEMESTER-IV

CE282

MAJOR PROJECT PHASE-II

Instruction: 32 Periods per week *SEE: Viva Voice*
Marks: 200 *Credits:16*

Course Objectives:

- Identification of the research problem
- Discussion of literature survey.

Course Outcomes:

At the end of the course, students are able to

1. Expand the defined Research Problem for the dissertation work.
2. Conduct of Laboratory/analytical/ software studies
3. Analysis of Data, development of models, offer solutions to the research problem and provide conclusions of the work.

The student will carry out the project under allotted supervisor, which may be development of Software / Hardware / Simulation studies / Design analysis / Experimental related to his/her specialization. The work will be monitored regularly by the guide. At the end of the semester student will write the report on the work done and submit to the guide. Student has to present his/her work before two faculty members (one guide and other to be appointed by chairman BOS) on a fixed day during last week of the semester in which project is offered. The final marks will be allotted based on the report, presentation and viva voce conducted by the external examiner whose name is suggested by Chairman BOS.