CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

M.Tech. in Civil Engg. with Specialization in Environmental & Water Resources Engineering

S. No.	Board of Study	Subject Code	Subject Name	Periods per week			Scheme of Examination Theory/Practical			Total Marks	Credits L+T+P/2
				L	T	P	ESE	CT	TA		
1	Civil Engg.	504111 (20)	Advanced Hydrology	3	1	-	100	20	20	140	4
2	Civil Engg.	504112 (20)	Advanced Hydraulics	3	1	-	100	20	20	140	4
3	Civil Engg.	504113 (20)	Water Pollution Mitigation & Management	3	1	-	100	20	20	140	4
4	Civil Engg.	504114 (20)	Computational & Soft Computing Techniques	3	1	-	100	20	20	140	4
5	**Refer Table-I**		**Elective-I**	3	1	-	100	20	20	140	4
6	Civil Engg.	504121 (20)	Water Resources Engg. Lab.	-	-	3	75	-	75	150	5
7	Civil Engg.	504122 (20)	Environmental Engg. Lab.	-	-	3	75	-	75	150	5
Total				**15**	**5**	**6**	**650**	**100**	**250**	**1000**	**30**

L: Lecture   T: Tutorial

P: Practical   ESE: End Semester Exam

CT: Class Test   TA: Teacher's Assessment

Table – I

List of Elective – I Subjects		
S.No.	Subject Code	Subject Name
1	504131 (20)	Hydropower Engineering
2	504132 (20)	Basics of Microbiology & Biotechnology
3	504133 (20)	Integrated Water Resources Management & Water Harvesting

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Semester: M.Tech -1   Branch: Civil Engg.
Subject: Advanced Hydrology   Code: 504111(20)
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

Pre-requisite: Basic knowledge of hydrology, open channel flow and river engineering.

Objectives: To understand hydrological processes and apply knowledge for analysis.

Unit I

The hydrologic processes: Precipitation, evaporation, ET, Infiltration, groundwater, and stream flow. Hydrologic measurements and networks

Unit II

Analysis of discrete and continuous hydrologic data: statistical including frequency analysis, correlation, and regression analysis and multivariate analysis, time series analysis and its applications.

Unit III

Hydrograph analysis: Unit hydrograph, Synthetic Unit Hydrograph and IUH.

Unit IV

Flood forecasting methods, flood protection and flood plain zoning. Real Time flood forecasting & warning system
Atmosphere Phenomenon, WMO standard , Introduction to climate change.

Unit V

Flood routing methods, Reservoir routing and Channel routing, Hydrologic routing and Hydraulic routing (Muskingum method).

Expected outcome: To apply the knowledge in the real field situations related to hydrological analysis and modelling

RECOMMENDED BOOKS:

1. Chow V T, Maidment David R. and Mays Larry W. "Applied Hydrology", McGraw Hill International editions, New Delhi, 1988.
2. Mutreja K.N. "Applied Hydrology" Tata McGraw-Hill Publishing company Ltd., New Delhi,1990.
3. Subramanya K, Engineering Hydrology, Third Edition - Tata McGraw-Hill Publishing company Ltd., New Delhi, 2015.
4. Singh Vijay. P, Elementary Hydrology Prentice Hall, INDIA,1992.
5. **Ojha C S P, Bhunya P and Berndtsson P, "Engineering Hydrology" Oxford University Press, Canada, 2008.**

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Advanced Hydraulics   Code: 504112 (20)
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

Pre-requisite: Basic knowledge of fluid mechanics and open channel flow

Objective: Analysis of different types of flow in open channel and Numerical analysis of open channel.

Unit I

Laminar and Turbulent boundary layers, BL on a flat plate, Karman's momentum integral equation, Karman - Pohlhausen's approximate equation, Flow under adverse pressure gradient, turbulent BL over smooth and rough surfaces, Analysis of BL control.

Unit II

Turbulent Flow: Reynolds Equations, Semi empirical theories of turbulence, Mixing length, vorticity transport, Karman's similarity theory flow in diverging channels.

Unit III

Gradually varied flow; Classifications and Computations of Free surface profiles, Hydraulics of Confluence of channels

Unit IV

Spatially varied flow; Supercritical flows and Oblique flows, Rapidly varied flow; Hydraulic jump;

Unit V

Continuity and Dynamic equations of Unsteady flow; Wave propagation and Surge; Method of Characteristics, Finite Difference Method

Expected outcome:

To apply knowledge in analysis of boundary layer flow, open channel flow and unsteady flow.

Texts/References Books:

1. Garde R. J, Turbulent flows, Wiley, 1994
2. Rouse H., Fluid Mechanics for Hydraulic Engineers , Dover Pub., New york, 1961
3. Schlisting H, Gersten K., Boundary layer theory,8th edition, Springer Publication,2000
4. Fox &Mc Donald, Introduction to Fluid Mechanics, , John Wiley 2013.
5. ChaudharyHanif M., Open Channel flow, Prantice-Hall of India Pvt. Ltd. New Delhi, 1993.
6. Chow V T, Open Channel Hydraulics, McGraw-Hill Book company, International editions,New Delhi,1973.
7. Subrmanya K, Flow in open channels, Second edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001
8. Srivastava Rajesh, Flow through open channels, Oxford University press, New Delhi, 2008.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Water Pollution Mitigation & Management   Code: 504113(20)
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

Unit-I Sources & Characteristics of Water Pollution

Water pollution-Sources & types of water pollution–Physical, chemical & biological–Effect of water pollution. Drinking water quality standards waste Water treatment–Primary, secondary, tertiary-

Unit-II Water Quality & Standards

Quality of surface waters, Water quality in flowing waters, Water quality in Impounded waters, Groundwater quality, Water quality standard Microbiological quality of drinking water, and d Chemical quality of drinking water

Unit-III Industrial Activity & Mitigation Measures

Role of water in different industries-Effluent discharge characteristics- Discharge Standards for Rivers and Streams-Role of stakeholders, Public NGOS, Government in Protection of Water bodies-Control Measures-Mitigation Measures for Industrial, Water Contamination due to industries.

Unit -IV Water Pollution Regulations

Administrative regulation under recent legislations in water pollution control. Water (Prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (Prevention & control of pollution) Rules 1975 Water (Prevention & control of pollution) Cess Act. 1977 as amended by Amendment Act 1991.

Unit-V Role of Regulatory Boards

Sustainable Development, Rain Water Harvesting-Methods-Water Pollution- Causes and Effects-Role of Regulatory bodies and Local bodies-CPCB-TWAD Board–CMWSSB etc-Case Studies related to Effective Water Management.

TEXT BOOK

1.Fair.G.M, "Water and Waste water engineering Vol.I&II".John Wiley and sons, Newyork. 2010.

REFERENCES

1.Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata McGrawhill publications, 2008.
2. Eckenfelder, W.W., ""Industrial Water Pollution Control", McGraw-Hill, 2009.
3. Arceivala.S.J, "Wastewater Treatment for Pollution Control", Tata McGraw-Hill, 2008.
4. "ArunaVenkat Environmental Law and Policy",PHI learning private limited New Delhi, 2011.
5. Water Management In India, "Concept Publishing Company", New Delhi.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Computational & Soft Computing Techniques   Code: 504114 (20)
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

OBJECTIVES:

- To educate the students to know about computing techniques
- Develop the different numerical technique and logic like ANN, Fuzzy
- To educate the students on aspects data management
- Develop the model Applications for monitoring and management of Environment

Unit I Computing Principles

Introduction to Computing techniques –Algorithms and Flowcharts, Numerical methods -Solution to ordinary and partial differential equation using Finite difference and Finite element method , Numerical integration and differentiation, Design of digital models for Environmental applications.

Unit II Artificial Intelligence

Knowledge based Expert system concepts -Principle of Artificial Neural Network (ANN) –Neural Network Structure –Neural Network Operations –ANN Algorithm -Application of ANN Model to Environmental field –Genetic Algorithms

Unit III Fuzzy Logic

Fuzzy sets, fuzzy numbers, fuzzy relations, fuzzy measures, fuzzy logic and the theory of uncertainty and information; applications of the theory to inference and control, clustering, and image processing - Network analysis models.

Unit IV Data Management

Data base structure -Data acquisition -Data warehouse -Data retrieval-Data format Attribute -RDBMS – Data analysis -Network data sharing -Statistical Analysis (SYSTAT) -Regression -factor analysis - Histogram-scatter diagram - Goodness of fit.

Unit V Environmental Modeling Using MATLAB

Introduction to MATLAB Software –Environmental modeling principles and MATLAB Applications –Pollutants transport, decay and degradation modeling using MATLAB. Case studies.

OUTCOMES:

- Ability to understand the computing techniques.
- Ability to apply the principle of soft computing for solving Environmental problems
- Ability to assess the Environmental Impacts using ANN and Fuzzy logic.
- Ability to employ modern advanced computing tools in environmental studies

REFERENCES:

1.Aliev R. A, and AlievRashad, "Soft Computing and its Applications", World Scientific Publications Co. Pte.Ltd. Singapore, 2014.

2.Chepra S. C. and Canele R. P., "Numerical Methods forEngineers", McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020. 6th Edition 2014.
3. Data-Driven Modeling: Using MATLAB in Water Resources and Environmental Engineering, Springer; 2014 edition.
4. Kotteguda, N.T., and Renzo Resso, Statistics, "Probability and Reliability for Civil and Environmental Engineers", McGraw Hill Companies Inc., New York, 2008.
5. Mathews J. H. and FinkK.D. , "Numerical methods using MATLAB", Pearson Education 2010.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Hydro Power Engineering
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

Pre-requisite: Basic knowledge of hydrology, fluid mechanics, and open channel hydraulics.

Objectives: To gain the knowledge of hydropower, thermal power and to analyse its potential at different sites.

Unit I

Planning of hydropower development, Hydropower potential.   Operation of power plants for peak and base load, Characteristics of power market, Integration of various types of plants, Augmentation of power plants, Pump storage plants, Small hydro power.

Unit II

Design of hydropower installation components – intake structures, water conductor systems, tunnels, surge-tanks, penstocks, valves and anchor-blocks hydro mechanical parts.

Unit III

Turbines and their foundations, Turbines and their performances Introduction to structural and geotechnical aspects of powerhouse design, Types of powerhouse – Underground, Semi-Underground.

Unit IV

Gates, stilling basins, spillways., hydropower plants efficiencies, power distribution.

Unit V

Reservoir operation for hydropower generation in a multipurpose projects, Basin scale hydropower generation in a multipurpose projects, Basin scale hydropower development, Mathematical models for reservoir sizing and opera

Expected outcome: To apply the knowledge in the area of hydropower and thermal engineering.

Texts/Reference Books:

1. M.M. Dandekar and K.N. Sharma, Water Power Engg.,Vikas Publishing House, New Delhi.
2. R.S. Varshney, Hydropower Structures, Nem Chand and Bros., Roorkee.
3. A.K.Keshari,Water power Engineering,new age publishers,New Delhi.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Basics of Microbiology & Biotechnology   Code: 504132 (20)
Total Theory Period: 40   Total Tutorial Period: 12
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

UNIT I

Basic concepts– Spontaneous generation, Germ theory of diseases, Cell theory. Contributions of Antonie van leuwenhoek, Joseph Lister, Robert Koch, Louis Pasteur, Edward Jenner, John Tyndall, Sergei N. Winogradsky, Selman A waksman, Alexander Flemming, Paul Erlich, Fannie Hesse, Elie Metchnikoff, Kary Mullis.

UNIT II

Sterilisation and disinfection- Definitions, Principles.Methods of sterilization- Physical methods (Heat, Filteration), Radiation and Chemical methods.Control of sterilization and Testing of sterility.

UNIT III

Microscopy – Principles, Light microscope, Phase Contrast, Dark field, Bright field, Fluorescent, Interference microscope (Stereo microscope), Confocal, Inverted microscope, and Electron microscope (TEM and SEM). Measurement of Microorganisms- Micrometry. Staining- Simple, Gram staining, Negative staining, Capsule staining, Spore staining, Flagellar staining, Nuclear staining and Acid fast staining.

UNIT IV

Microbiological media, composition and types: selective and differential media Growth curve and growth kinetics. Influence of environemental factors for microbial growth. Nutritional groups of bacteria: overview Estimation of Microbes- Direct Microscopic count, Turbidometric assay, TVC- Indirect Method- CO_2 liberation- Protein estimation- Development of pure culture methods. Cellultra structure: Peptidoglycan structure and synthesis. Cytoplasmic matrix and components: Inclusion bodies. Maintenance and Preservation of cultures

UNIT V

Taxonomy– Principle and its types (Classical approach– Numerical, Chemical, Serological and Genetic). Bacterial taxonomy – Bergey's manual of Systematic Bacteriology (Eubacteria and Archaebacterium).

REFERENCES

- Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.
- Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology McGraw Hill Book R. Krieg, 1986 Company
- Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986 The Microbial world, 5th edition. Eagle Works Cliffs N.J. Prentica Hall.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Integrated Water Resources Management   Code: 504133(20)
         & Water Harvesting   Total Tutorial Period: 12
Total Theory Period: 40
Total Marks in End Semester Exam: 100
Minimum of class test to be conducted: 02

OBJECTIVES:

Students will be introduced to the role of disciplines of ecology and socio-economic play in Management of water resources.

Unit-I Context for Iwrm

Water as a global issue: key challenges and needs –Definition of IWRM within the broader context of development –Complexity of the IWRM process –Examining the key elements of IWRM process.

Unit-II Water Economics

Economic view of water issues: economic characteristics of water good and services–Non-market monetary valuation methods –Water economic instruments, policy options for water conservation and sustainable use –Case studies. Pricing: distinction between values and charges –Private sector involvement in water resources management: PPP objectives, PPP options, PPP processes, PPP experiences through case studies –Links between PPP and IWRM.

Unit III Water Supply & Health within the Iwrm Consideration

Links between water and human health: options to include water management interventions for health – Health protection and promotion in the context of IWRM –Health impact assessment of water resources development.

Unit IV Agriculture in the Concept of Iwrm

Water for food production: „blue‟ versus „green‟ water debate –Virtual water trade for achieving global water security –Irrigation efficiencies, irrigation methods and current water pricing.

Unit V Water Legal and Regulatory Settings

Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non-navigable uses of international water courses –Development of IWRM in line with legal and regulatory framework.

OUTCOMES:

The students will gain knowledge about economic aspects of water and also broad understanding of the complexities of dealing with water resources problems.

REFERENCES:

1. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.

2. Technical Advisory Committee, Poverty Reduction and IWRM, Technical Advisory Committee Background paper no: 8. Global water partnership, Stockholm, Sweden, 2003.
3. Technical Advisory Committee, Regulation and Private Participation in Water and Sanitation section, Technical Advisory Committee Background paper No:1. Global water partnership, Stockholm, Sweden, 1998.
4. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Water Resources Engg. Lab.   Code: 504121 (20)
Total Marks in End Semester Exam: 75

Course Objective:

1. To compare the result of analytical models introduced in lecture to the actual behavior of real fluid flows
2. To discuss and practice standard measurement techniques of fluid mechanics and their applications
3. To work on small design projects

List of Experiment:

1. To determine the hydrostatic forces on immersed body.
2. To determine the energy losses in pipes.
3. To calculate the cavitation Number.
4. To determine the coefficient of discharge of Orifice meter &Venturimeter
5. Determination of minor losses due to sudden expansion and contraction in a pipe flow
6. To determine the surface profile and total distribution of a forced & free vortex.
7. To study laminar to turbulent flow and determine lower critical Reynolds number.
8. To estimate the discharge of an ogee spillway.
9. To determine the co-efficient of discharge of a weir.
10. To study centrifugal pump in series and parallel.
11. To study velocity distribution in pipe and to compute the discharge by integrating velocity profile.
12. To find out the co-efficient of evaporation using pan-evaporimeter.
13. To determine the depth of rainfall using rain-gauge.
14. To study the characteristics of Reciprocating Pump for variable speeds.
15. Study the characteristics of Francis turbine.

Course Outcome:

Students who successfully complete this course will have demonstrated, the ability to:
1. Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.
2. Produce a working model through hands-on experience in fluid mechanics design and explain its operation in terms of what was learned in the course.

Manuals/Text Book/Reference Book:

1. Fluid Mechanics and Machinery Laboratory-Student reference manual (online) by P.SundaraKumar,M.Tech (PhD)
2. Experiments in Fluid Mechanics: by Singh Sarbjit , PHI Learning Pvt.Ltd.- 2012
3. Fluid mechanics with engineering applications by E.JohnFinnemore and Joseph B.Franzini (10[th]Edition)
4. A textbook of fluid mechanics and Hydraulic machines by Dr.R.K. Bansal-Laxmi Publications

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Semester: M.Tech - 1   Branch: Civil Engg.
Subject: Environmental Engg. Lab.   Code: 504122 (20)
Total Marks in End Semester Exam: 75

OBJECTIVES:

To familiarise with the physico chemical characterisation of water and wastewater.

LIST OF EXPERIMENTS:

1. Measurement of pH, Electrical conductivity and Turbidity of water samples
2. Determination of Chlorides in water.
3. Determination of Iron and Fluoride in water
4. Determination of Acidity and Alkalinity of water.
5. Determination of Sulphate in water.
6. Determination of hardness of water
7. Determination of nitrate & TKN in water (demo)
8. Determination of residual chlorine of water
9. Determination of total dissolved solids
10. Determination of optimum coagulant dosage
11. Determination of Ammonia Nitrogen in wastewater.
12. Coagulation and Precipitation process for treating waste water
13. Determination of suspended, volatile, fixed and settle able solids in wastewater.
14. B.O.D. test
15. C.O.D. test
16. Determination of Calcium, Potassium and Sodium.
17. Heavy metals determination -Chromium, Lead and Zinc. (Demonstration only)

OUTCOMES:

The students completing the course will have the ability to use the techniques, skills and modern instruments to determine the quality of water and wastewater.

REFERENCE:

1. Standards Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989.