JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY, MYSURU

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

M.TECH PROGRAMME IN
HEALTH SCIENCE & WATER ENGINEERING

SCHEME I TO IV SEMESTER: 2017-2018
&
SYLLABUS I TO IV SEMESTER: 2017-2018

DEPARTMENT OF ENVIRONMENTAL ENGINEERING

Scheme of Teaching and Examination for M.Tech (Health Science & Water Engineering)

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DEPARTMENT OF ENVIRONMENTAL ENGINEERING

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SEMESTER	CREDITS
I	28.0
II	28.0
III	18.0
IV	26.0
TOTAL	100.0

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Scheme of Teaching and Examination for M.Tech (Health Science & Water Engineering)

SEMESTER: I

Course Code	Course Title	Contact hours				Credits
		L	T	P	Total Hours	
EVH 110	Applied Anatomy and Physiology	4	0	2	6	5
EVH 120	Applied Microbiology and Public Health	4	0	2	6	5
EVH 130	Design of Water Treatment Processes and Distribution System	4	2	0	6	5
	Elective I (any one out of three)	4	2	0	6	5
	Elective II (any one out of three)	4	2	0	6	5
EVH 160	Seminar	-	-	-	-	1.5
EVH 170	Physico-chemical processes lab	-	-	3	3	1.5
Total		20	6	7	33	28

L: Lecture; T: Tutorial P: Practical

Elective - I

Sl. No.	Course Code	Course Title
1.	EVH 141	Human Resource Management in Health Care and Ethics
2.	EVH 142	Advanced Water Resources Engineering
3.	EVH 143	Transport Processes and Modeling

Elective - II

Sl. No.	Course Code	Course Title
1.	EVH 151	Occupational Safety and Health
2.	EVH 152	Advanced Computational Methods and Optimization
3.	EVH 153	Air & Noise Pollution and Control

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SEMESTER II

Course Code	Course Title	Contact hours				credits
		L	T	P	Total Hours	
EVH 210	Design of Wastewater Treatment Systems	4	2	0	6	5
EVH 220	Epidemiology and Risk Assessment	4	2	0	6	5
EVH 230	Principles of Biomedical Waste Management	3	2	2	7	5
	Elective III (any one out of three)	3	2	2	7	5
	Elective IV (any one out of three)	4	2	0	6	5
EVH 260	Seminar	-	-	-	-	1.5
EVH 270	Biological Wastewater Treatment Processes lab	-	-	3	3	1.5
Total		18	10	7	35	28

L: Lecture; T: Tutorial P: Practical

Elective III

Sl. No.	Course Code	Course Title
1.	EVH 241	Medical Statistics and Health Care Administration
2.	EVH 242	Operation and Maintenance of Environmental Facilities
3.	EVH 243	Design of Advanced Wastewater Treatment Processes

Elective IV

Sl. No.	Course Code	Course Title
1.	EVH 251	Water Recovery, Reuse and Recycle Technology
2.	EVH 252	GIS for Health Care Management
3.	EVH 253	Health Care Policy and Legislation

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SEMESTER III

Course Code	Course Title	Contact hours				Credits
		L	T	P	Total Hours	
EVH310T	Practical Training in Industry * / Exploration Research	-	-	-	-	4
EVH320P	Project Work (Phase-I)	-	-	-	-	14
Total		-	-	-	-	18

SEMESTER IV

Course Code	Course Title	Contact hours				Credits
		L	T	P	Total Hours	
EVH410P	Project Work (Phase-II)	-	-	-	-	26
Total		-	-	-	-	26

L: Lecture; T: Tutorial; P: Practical

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**APPLIED ANATOMY AND PHYSIOLOGY , EVH 110**
No. of Teaching Hours –	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course is unique as it encompasses medical knowledge dealing with anatomy and physiology of human body. Discusses the human cells, tissues, organs and topography for an engineering student. It also covers body functions of different systems. Deals with special sensory organs and their structure and functions. Course emphasizes on the pollutants' uptake, their magnification in some organs and their conversion aspects.

Course Outcomes (COs)

Student will be able to

CO1: Draw and identify the different parts of human body. Isolate different organ systems.

CO2: Discuss blood circulatory system, identify the common heart diseases. Clearly describe the respiratory system of human body and list the important diseases affecting lungs.

CO3: Explain the central nervous system and nuerological disorders. Illustrate joints and muscles of human body. List the diseases associated with human bone architecture.

CO4: Identify and explain the functions of different gland systems of human body. Describe the common endocrine diseases. Distinguish different components of human digestive system and explain their functions.

CO5: Identify both external and internal genital systems of human body. Explain their functional relationship and sex determination. Differentiate sensory organs of human body and illustrate their functions and associated diseases.

Course Content:

Introduction to human body: Cell - tissues – organs – systems, Postures, terms, division of the human body. Topography. Fate and transport of pollutants in human body.

Body Systems and their Functions: Blood and circulatory system - Heart blood vessels, Circulations. Common diseases of Heart & Blood vessels.

Respiratory system: Nose, Pharynx, larynx, Trachea, Tracheobroncheal tree, lungs, thoracic cavity, respiratory membrane, gaseous exchange,. Important diseases affecting lungs.

Central Nervous System: Nerves, Brain, Spinal Cord, Autonomic Nervous System. Neurological diseases.

Locomotor System: Joints and muscles, bone architecture

Endocrine glands: Pituitary, Thyroid, Parathyroid, adrenal, and Endocrine Pancreas. Names of the hormones and functions. Common endocrine disorders.

Digestive System: Mouth, Pharynx, Oesophagus, stomach, liver and pancreas, Small intestine, large intestine. Digestion, absorption, and motility functions.

Genito-urinary System: Urine forming organs-Kidneys, uterus, urinary bladder, prostate, urethra, Organs involved in the process of procreation, sex determination, external genital organs and internal genital organs.

Special sense organs: Skin, eyes, nose, ears & tongue

TEXT BOOKS

- Anne Waugh, Allison Grant, and Janet S. Ross, (2001), "Rossand Wilson – Anatomy and Physiology in Health and illness" – 9th Edition , Churchill Livingstone
- Jain A.K., (2002), " Human Anatomy & Physiology", Arya Publications

REFERENCES

- Anne B. Donnesberger, (2011), " A Laboratory Text Book of Anatomy and Physiology", Jones and Bartlett Publishers.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**APPLIED MICROBIOLOGY AND PUBLIC HEALTH EVH 120**
No. of Teaching Hours –	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course lays the foundation for applying microbiological knowledge in maintaining public health. It deals with microbial species identification, determination. It describes structural, morphological and functional aspects of microorganisms. The course covers microbial physiology including metabolism and its influencing parameters. The course provides the knowledge on public health, epidemic and endemic diseases and their control. It also helps student to gain knowledge on microbial immunology.

Course Outcomes (COs)

Student will be able to

CO1: Discuss prokaryotes and eukaryotes. Identify and characterize different microorganisms of medical importance

CO2: Perform different staining techniques to identify and enumerate different microbial species

CO3: Describe and draw structure and functional relationships of different microbial cells such as bacteria, fungi, algae and virus

CO4 : Calculate microbial nutrients requirement. Understand and prepare different culture media requirements for microbial species growth. Explain microbial growth curve and factors influencing it. List epidemic and endemic diseases and discuss the cause effect relationship.

C05: List and review methods of control of infectious diseases caused by microorganisms. Describe the function of immune system and its response.

Course Content:

Introduction : Scope and relevance of microbiology, Prokaryotes and Eukaryotes, Types of microorganisms

Microbiological Techniques : Pure culture, staining of microorganisms, enumeration of microorganisms and sterilization techniques

Structure, Function, Reproduction and characterization of Microorganisms Bacteria – morphology, ultra structure and reproduction.Virus – morphology. Classification, lytic and lysogenic cycles**,**Fungi – morphology, ultra structure and reproduction

Microbial Physiology : Microbial nutrition – common nutrient requirements and culture media, Microbial growth : Growth curve, Generation time, factors affecting growth, measurement of growth

Public Health and Medical Microbiology

Public Health Hygiene, Epidemic and Endemic Diseases and their control. Common microbial diseases and their control, bacterial – typhoid, tuberculosis, cholera, leprosy, syphilis and diarrhea. Viral – AIDS, Hepatitis, Ebola, SARS, MERS, Polio, Rabies,

Fungul – Candidiasis, mycoses Protozoa – Amoebiosis, Giardiasis, Cerebral Malaria, Helminthesis.

Immunology: Structure and function of immune system, Antigen & Antibody, Immunity, Infection, Immune response.

TEXT BOOKS

- Pelczar, Chan and Krieg, (1998), Microbioloogy, Tata McGraw Hill
- Stainer R.Y., Ingram J.L, Wheels M.L and Painter P.R., (1987), "General Microbiology", Prentice Hall of India Publishers

REFERENCES

- Gaudy and Gaudy (1980), "Microbiology for Environmental Scientists and Engineers", McGraw Hill.
- Chakraborthy P(2005), "Textbook of Microbiology", 2nd Edition, New Central Book Agency Pvt. Ltd.,
- Ananthnarayan and Paniker (2005), "Textbook of Microbiology", 7th edition, Orient Blackswan Pub.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**DESIGN OF WATER TREATMENT PROCESSES AND DISTRIBUTION SYSTEM EVH 130**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course covers the details of design considerations of various unit operations and processes of Water treatment facilities and distribution systems. High lights the importance of water quality requirements for health care facilities. Provides the laboratory exposure to analyze various water quality parameters and processes.

Course Objectives (COs)

Student will be able to

CO1: Explain the inter-relationship between water quality parameters and plant sizing, hydraulics and layout. Design intake structures.

CO2: Describe and design aeration, sedimentation, coagulation and flocculation processes. Explain settling equations. Tube settlers and pulsators.

CO3: Design filter units, filter backwash system. Discuss the chemistry and kinetics of disinfection. Understand and apply the knowledge of isotherms in adsorption process.

CO4: Design miscellaneous treatment processes such as softening, fluoridation / defluoridation. Explain the removal process for trace contaminants.

CO5: Develop a protocol for health care water requirements. Describe the norms and different rural water supply schemes. Explain need for industrial water quality requirements.

Course Content:

Design considerations for Plant sizing and layout, hydraulic flow diagram. Water sources characteristics and quality parameters .

Hydraulics of conduits - Intake structures – types, design, Rising main and water hammer analysis, pump design, water distribution systems – Hardy Cross and Newton Raphson's methods.

Aeration – principles and design of aeration systems – two film theory.

Sedimentation – types of settling and settling equations (Stoke's, Newton's, & Transition), design of settling tanks; Operational problems. Tube settlers and pulsators.

Coagulation and Flocculation – types of coagulants, coagulant aid, coagulation theory, optimum dose of coagulant, design of clariflocculator with flash mixers.

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

Disinfection - disinfectants, influencing factors, methods, byproducts and kinetics.

Adsorption – types, equilibrium kinetics and Isotherms and applications.

Miscellaneous treatment: Water Softening, Fluoridation / defluoridation processes, specific / trace organic contaminants – Arsenic (As), natural organic matter (NOM), dissolved organic matter (DOM), synthetic organic chemicals and Nitrate.

Health Care water quantity and quality requirements, Industrial and rural water supply systems.

Laboratory Component

- Analysis of physico-chemical and bacteriological water quality parameters.
- To conduct settling experiments, coagulant dose using Jar Test, disinfection kinetics.
- Filter head loss and rate of backwash calculations.
- Hands on experience of R MAIN, WATPLANT, LOOP & QUALOOP, DOWATTS

TEXT BOOKS

- Fair, G.M., Geyer J.C and Okun, (1969) "Water and Waste water Engineering" Vol II, John Wiley Publications.
- Weber W.J., (1975) "Physico - Chemical Processes for Water Quality Control".

REFERENCES

- AWWA, (1971), "Water Quality and Treatment McGraw Hill.
- CPHEEO Manual, (1991), "Water Supply and Treatment", GOI Publications.
- Peavy, H.S., Rowe and Tchobonoglous,G., (1985), "Environmental Engineering",McGraw Hill.
- APHA, 2005, Standard methods for examination of water and wastewater, 21st Edition.

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Subject Name & Code	**PHYSICO-CHEMICAL TREATMENT PROCESSES LAB , EVH 170**
No. of Teaching Hours –	**Credits : 0:0:1.5 L-T-P**
CIE Marks : 50	

Course Objective

The lab course provides an opportunity to collect and preserve water samples from different sources, conduct various tests on water quality parameters, perform experiments on selected lab scale treatment processes. It also enriches the student knowledge of determining coagulant dose, efficiency of settling basin, rate of adsorption and life of adsorbent. The lab course also exposes the student to various advanced instruments used in analysing toxic chemicals and trace organics in water and wastewater.

Course Outcomes (COs)

Student will be able to

CO1 : Acquaint with precision and accuracy of analytical data and to appreciate rounding off to a significant value in the context of water quality parameters. Apply various methods of sample preservation and conduct titrimetric and instrumental analyses on water samples

CO2: Carryout and determine treatment efficiency of various water treatment processes – aeration, jar test for optimum dose of coagulant and settling experiments, adsorption experiments with isotherms and break through curve

CO3: Plan and perform filtration experiments, understand the significance of break point chlorination and plot particle size distribution curve, determine Uniformity coefficient. Develop the skill ofanalyzing, interpreting and inferring the laboratory data

Experiments

- Titrimetric and Insturmental Analyses of Water Quality Paramters – Ground and Tap Water Samples
- Determination of Chlorine Demand for a given water sample and to plot the Break Point Chlorination Curve
- Determination of Optimum Coagulant Dose using Jar Test Apparatus for given water samples
- Conducting Settling Experiments and identify Type 1 and Type 2 settling and the determination of settling efficiency
- Performing Sieve Analysis for Filter Sand samples
- Carrying out experiments on Single and Multimedia Filters and Head Loss calculation
- Conducting Adsorption Experiments using Activated Carbon and plotting of Isotherms and Breakthrough Curve
- Demonstration of Advanced Instruments such as ICP, UV-VIS Spectrophotometer, HPLC

REFERENCES

- American Public Health Association, American Water Works Association, (1998), Standard Methods for Examination of Water and Wastewater, 20th edition, APHA.
- NEERI, Nagpur, “Water Quality Analysis Manual”.
- Bureau of Indian Standards (BIS) Codes

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Subject Name & Code	**HUMAN RESOURCE MANAGEMENT IN HEALTH CARE AND ETHICS (ELECTIVE I) EVH 141**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course transmits the knowledge of basics of management, management strategies to be adopted in a work place. Discusses health work place policy, code of practice in hiring health care workers. It also provides the detailed information regarding types, levels and functions of management. Describes the SWOT analysis and its imporatnace. It deals with personnel management and communication skills to be developed. It covers ethics in detail including professional, personal, medical and research ethics.

Course Outcomes (COs)

Student will be able to

CO1: Define, classify and identify the functions of management. Perform SWOT analysis for a given situation.

CO2: Deal with different types of persons at a work place with managerial skills and style of management. Develop leadership qualities and establish good relationship between the employer and the employee. Practice time management

CO3: Develop good communication skills and eliminate barriers of communication, if any. Review health care policy and human resource relationship strategies. Implement good and cordial relationship amongst the health care workers and administrators.

CO4: Discuss the national and international codes of practice for health care workers employment. Describe the pros and cons of health care tourism. Differentiate ethics and ethical practices between individuals and human life.

CO5: Know the depth of medical ethics, family and society in medical ethics. Identify the responsibilities of individuals. Distinguish between professional and research ethics.

Course Content

Management Basics & Strategies

Management - definition, functions, classification, coordination, types and levels , TOWS matrix

Personnel Management

Motivation–importance and need, Moslow Theory, pre-requisites. Time and man management, Employee-employer relationship, leadership styles and situational model, leadership qualities.

Communication – elements and objectives, characteristics, barriers, (verbal & non verbal), downward & upward, factors and soft skills.

Health workplace policy and Planning

Human Resources for Health (Health workforce) - Doctors, Specialists, Super Specialists, Nurses, Paramedics, Health Workers

Global Code of Practice on the International Recruitment of Health personnel

Health Care tourism

Ethics

Ethics in general, Introduction to medical ethics-.Definitions & perceptions
Ethics of Individuals, Ethics of Human life
Family & society in Medical Ethics, Death & dying
Professional Ethics, Research Ethics
Hippocratic oath & declaration of Helsinki
Responsibilities of individuals

TEXT BOOKS

- Schermerhorn J.R., (2010), "Introduction to Management", Tenth Edition, International Student Version, John Wiley and Sons Inc., UK
- Francis C.M., (2004), "Medical Ethics", Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
- Joshi D.C., and Mamta Joshi, (2009), "Hospital Administration", 1st Ed., Jaypee Brothers Medical Publishers

REFERENCES

- World Medical Association, (2005), "Medical Ethics Manual"
- Joshi S.K. (2014), "Quality Management in Hospitals",2nd Revised Ed., Jaypee Brothers Medical Publishers
- Prabhakar G.V., (),"Short text book of Professional Medical Ethics"

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Subject Name & Code	**ADVANCED WATER RESOURCES ENGINEERING (ELECTIVE I) EVH 142**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course emphasizes computational aspects of advanced hydrology and provides scientific approach to several important applications in hydrologic engineering.

Course Outcomes (COs)

Student will be able to

CO1 : Recognize and explain the distribution, availability, significance, and multiple uses of water resources at regional, national, and global scale; apply techniques to measure components of hydrologic cycle.

CO2 : Explain watershed concepts, apply hydrograph theory in estimating overland runoff; analyse for low flow and explain various methods of measuring flow in a stream

CO3 : Apply statistical methods and tools for hydrologic data analysis

CO4 : Simulate hydrological response of a watershed using watershed models. Demonstrate the use of remote sensing and GIS in water resource management

CO5 : Model the groundwater flow in confined and unconfined aquifers under steady and unsteady state conditions

Course Content

Water Resources and issues – global, national, and regional and significance; National water policy, Riparian rights; Multiple uses of water resources, importance of hydro projects and its environmental problems.

Hydrologic principles: Hydrologic cycle, types, forms, precipitation and its measurement, infiltration

Hydrologic analysis: Watershed concepts, rainfall-runoff estimation, unit hydrograph theory, S-hydrograph, synthetic and instantaneous UH and their applications

Stream gauging: A-V method, end-depth method, chemical and radioactive method, weirs and flumes

Streamflow routing: lumped flow, distributed flow, kinematic wave model, Muskingum method, low flow analysis

Hydrologic statistics: statistical analysis of hydrologic data, parameter estimation – expected value, Frequency analysis, return period, probability distribution, concepts of probability weighted moments & L -moments., Markov process, confidence limits.

Hydrologic simulation models – steps in watershed modeling, major watershed models

Remote sensing and Geographical information systems in water resources engineering: assessment of ground water potential, flood control management, flood plain mapping, water logging and salt affected soil, soil moisture studies.

Ground Water: Basic equations of flow, occurrence and movement, flow into wells, steady state conditions, well hydraulics, losses, specific capacity and interference among wells. Unsteady flow into wells

TEXT BOOKS

- Raghunath H. M., (2006), "Hydrology: Principles, Analysis, and Design", Revised 2nd Edition, New Age International (P) Ltd.,
- Subramanya K (2008), "Engineering Hydrology", 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi

REFERENCES

- Jayarami Reddy P (2005), "A Text Book of Hydrology", Lakshmi Publications, New Delhi
- Ven Te Chow (1964), "Handbook of Applied Hydrology : A Compendium of Water Resources Technology", Vol 1, McGraw Hill
- Tim Davie, (2005), "Fundamentals of Hydrology, 2nd Edition, Routledge. Taylor and Francis Group, London, New York
- Todd D. K., and Mays L.W. (2005), "Groundwater Hydrology", Third Edition Wiley Eastern Publication, New Delhi

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Subject Name & Code	**TRANSPORT PROCESSES AND MODELLING (ELECTIVE I) EVH 143**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course emphasizes on various transport processes and illustration of mathematical models in simulation and prediction of pollutant concentration, and dispersion in surface and subsurface water bodies.

Course Outcomes (COs)

Student will be able to

C01: Know the simulation models for predicting fate and transport of pollutants with examples. Describe and differentiate the transport processes of advection and convection processes and derive related equations with analytical solutions.

C02: Apply mathematical models and predict pollutant (conservative and non-conservative) concentrations in lakes and rivers under steady-state conditions; solve simple numerical problems.

C03: Describe the concept of mixing zone in natural aquatic bodies and its influence on pollutant dispersion; prepare field monitoring protocol for measuring hydraulic as well water quality parameters.

C04: Compare stratified and completely-mixed lake systems; describe mathematical equations to compute pollutant distribution in lake and estuarine systems. Design outfall system for ocean disposal.

C05: Derive and apply 1-D groundwater model considering the influencing processes, field validation. Demonstrate the application of different prediction models for quality predictions and decision making.

Course Content

Modelling – Introduction, applications in environmental management.

Physical phenomena – advection, diffusion, dispersion, Fick's laws of diffusion, convective - diffusion equations for turbulent & shear flow regimes.

Steady-state water quality modelling - models for conservative and non-conservative substances.

1-D Oxygen balance models - Streeter-Phelps equation, critical point method. Calibration and verification of 1-D oxygen model. Error measures.

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

Mixing zones in rivers – types of outfalls and mixing regimes. Stream tube concept, Steady-state 2-D analysis. Parameter estimation - lateral mixing coefficient - critical point method, Case studies.

Dissolved oxygen models for lakes under completely mixed and stratified conditions.

Estuaries – Salinity distribution and its importance on flora and fauna.

Ocean - disposal of wastewater - siting and design of outfalls.

Ground water quality modelling concepts - formulation of 1-D and 2-D models with decay and retardation for instantaneous sources, plume delineation studies.

Lab Component

- River Water Quality Prediction Models – STREAM, QUAL2KW, MIXING ZONE Models
- Data Analysis Models

- IA 2D PIT
- Prediction Models for estuary, lake and ocean using excel spreadsheet

TEXT BOOKS

- Thomann R.V., and Mueller J.A., (1987), "Principles of Water Quality Management and Control", Harper & Row Publications.
- Schnoor J.L., (1996) "Environmental Modelling – Fate and Transport of Pollutants in Water, Air and Soil", John Wiley and Sons.

REFERENCES

- Rich L.G., "Environmental Systems Engineering", McGraw Hill.
- Thomann R.V., (1980), "Systems Approach to Water Quality Management", McGraw Hill.
- Lee C.C., and Lin S.D., (1999), "Handbook of Environmental Engineering Calculations", McGraw Hill, New York.
- Metcalf and Eddy Inc., (1995), "Wastewater Engineering - Treatment and Reuse", 3RD Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

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Subject Name & Code	**OCCUPATIONAL SAFETY AND HEALTH** **(ELECTIVE II) EVH 151**
No. of Teaching Hours –	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

This course enables student to learn the basic principles of safety, OSH act and the national policy. It instills knowledge on cause - effect relationships of accidents at work places, need for economics & ergonomics, hazard identification and control aspects, fire prevention and control. Work place health related issues are also covered.

Course Outcomes (COs)

Student will be able to

CO1: Develop knowledge on safety principles, right-to-know laws and manage situation applying theories of accident at workplace

CO2: Develop skill of understanding the ergonomics and address specific problems with appropriate strategies

CO3: Identify and analyze the hazards using various techniques and prepare preventive plans. Also, discuss the hazards in selected industries and suggest remedial measures for their control

CO4: Describe the need for product safety and its importance and acquire knowledge on various aspects of fire - types, prevention, protection and control

CO5: Know the Biomedical Waste (Handling and Management) Rules and develop a protocol for biomedical waste collection, transport and disposal. Acquire in depth knowledge of Health and Safety Considerations at different work places with a thorough understanding of preventive and control techniques.

Course Content

Introduction to Occupational Health, Occupational Hazard and control Principles of Safety, National Safety Policy.Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know.

Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation, industrial safety – Man Vs. Machine, Facts and fact finding – safety psychology and education.

Ergonomics at work place, Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs.

Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations, Engineering versus management control, Hazard control measures,

Fire prevention and protection - Fire Triangle, Fire Development and its severity – Effect of Enclosures, Need for Early Detection of Fire, Classification of fire and Fire Extinguishers.

Electrical Safety, Product safety – Technical Requirements of Product safety. Safe handling of chemicals – safety procedures at Nuclear installations.

Health considerations at work place, types of diseases and their spread, Biomedical Waste (Handling and Management) Rules, 2012. Potential Hazards and their control in different sectors of Health care facilities like Hospitals, Health Care Units, and Pathology Labs. Health Emergency.

Personal Protective Equipment (PPE) – types and advantages.

Occupational Health and Safety considerations in water and wastewater treatment plants. Handling of chemical and safety measures in water and wastewater treatment plants and labs.

TEXT BOOKS

- Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
- Heinrich H.W., (2007), "Industrial Accident Prevention - A Scientific Approach", McGraw Book Co.

REFERENCES

- Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
- Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.
- Biomedical Waste (Handling and Management) Rules
- National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Pollution Control Handbook"
- Trevethick, R.A., ((1973), "Environmental and Industrial Health Hazards"- William Heinemann Medical Books Ltd., London.

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Subject Name & Code	**ADVANCED COMPUTATIONAL METHODS AND OPTIMIZATION (ELECTIVE II) EVH 152**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course introduces both numerical methods and analysis along with optimization and statistics. The student will be gaining knowledge of partial differential equations, their analytical solutions. Optimization deals with both problems with constraints and without constraints. The course lays the base for statistical methods and their applications for environmental data analysis and interpretation.

Course Outcomes (COs)

Student will be able to

CO1: Analyze the partial differential equations using Newton-Raphson and Finite Element methods and arrive at solutions.

CO2: Apply explicit and implicit methods to solve simple parabolic problems

CO3: Classify, analyze and solve simple to complex optimization problems with and without constraints.

CO4: Apply numerical search method for both linear and non-linear problems. Use interpolation methods for environmental data analysis and interpretation.

CO5: Describe and apply concepts of probability, central tendency and distribution. methods to characterize or analyze the environmental data**.** Formulate null hypothesis and apply regression analysis for a given set of data.

Course Content

Numerical Methods

Newton – Raphson method for solution of simultaneous equations, Numerical solutions of partial differential equations, finite difference, finite element method, explicit and implicit methods to solve simple parabolic differential equations.

Optimization

Classification of optimization problems. importance in Environmental Studies. Single and multivariable optimization without and with constraints. Linear programming – standard form of problems – pivotal reduction of equations. Single and two-phase simplex methods.

Numerical search methods for I – D, non-linear problems-Dichotomous. Fibonacci and Golden section methods. Quadratic and cubic interpolation methods. Solutions of linear programming problems.

Statistics and Probability

Frequency Distribution – Characteristics of Distributions: Central tendency and dispersion. Concepts of Probability – Binomial, Poisson and Normal distribution – applications, methods of least square and regression, multiple regression, Chi-squared test, F test, t-test. Analysis of Variance – Tolerance and control charts. Solutions of regression analysis problems.

TEXT BOOKS

- Rao, S.S., (1996), **"**Optimization: Theory and applications**"** - Wiley Eastern Ltd. Publications
- Shanthakumar M., (1987), "Computer Based Numerical Analysis", Khanna Pubvlishers
- Levin R I., (2008), "Statistics for Management", Pearson Education India

REFERENCES

- Anthony Ralston, and Philip Rabinowitz,(2001), "A First Course in Numerical Analysis" - Second Edition, Published by Dover Publications
- Desai, C.S., and John F Abel ,(1972), "Introduction to the Finite Element Method: Numerical Method for Engineering Analysis" -Van Nostrand Reinhold, New York
- Taha, H.A., (2008), "Operations Research – An Introduction, 8th edition, Pearson Education India

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**AIR & NOISE POLLUTION AND CONTROL (ELECTIVE II) EVH 153**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course covers the air pollution sources, classification, effects, and measurement of air pollutants, standards, importance of meteorology in air pollutant dispersion, fate and transport of air pollutants using various mathematical tools, as well as air and noise pollution control technologies and regulations.

Course Outcomes (COs)

Student will be able to

CO1: Understand the importance of composition and structure of atmosphere, sources, classification, effects of air pollutants, and measurement of air pollutants, air pollution standards and control regulations, carryout experiments on different monitoring tests for ambient air quality parameters.

CO2: Understand the basic concepts of various meteorological factors which influence the dispersion of air pollutants and to create windrose diagram.

CO3: Prediction of dispersion of air pollutants using different models and to evaluate the plume rise using various model equations and get a fair knowledge on stack sampling.

CO4: Understand and analyze the basic mechanisms involved, working principles and design aspects of various air pollution controlling equipment's through demonstration.

CO5: Know about sources, standards, measurement, effects and general controlling methods of noise pollution and also measurement and interpretation of light intensity for different applications.

Course Content

Introduction

Structure and composition of the atmosphere, sources and classification of air pollutants, air pollution episodes of environmental importance. Effects on human health, vegetation, animals, materials and monuments. Visibility problems.

Meteorology

Wind circulation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth, Temperature Inversions, plume behaviour, Wind rose diagram, general characteristics of stack emissions, heat island effect.

Monitoring of particulate matter

Respirable, non-respirable and nano - particulate matter. Monitoring of gaseous pollutants – CO, CO_2, Hydrocarbons, SO_X and NO_X, photochemical oxidants. Monitoring equipment – stack sampling (Isokinetic sampling), ambient air sampler (HVAS), microbial air sampler, auto gas exhaust analyzer. Air Pollution Index.

Pollutants' dispersion models

Gaussian plume dispersion model - dispersion coefficient; point, line and volume sources, Pasquill and Gifford atmospheric stability classification. Prediction Models, Box model, plume rise and effective stack height calculations.

Air Pollution Control Equipment

Mechanisms, Control equipment for particulate matter – gravity settling chambers, centrifugal collectors, wet collectors, scrubbers, fabric filters, electrostatic precipitator (ESP), Design aspects, general control measures of air pollution.

Control Equipment for gaseous pollutants – adsorption, absorption, condensation and combustion.

Incinerators for Biomedical waste disposal – types and design.

Indoor Air Pollution

Indoor air quality – hospitals, health care facilities, residential and commercial establishments, effects and control. air changes per hour (ACH), IAQ Standards.

Noise Pollution

Sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations, control measures. Impacts of industrial noise on workers, aircraft noise on residential area, effects of highway noise on residential area.

Lab Component

Monitoring of ambient air quality parameters using H.V.A.S.
Measurement of indoor air quality using microbial air sampler
Vehicular exhaust analyzer for petrol and diesel vehicles.
Demonstration / Exercises on Air Pollution Control Devices - Bag Filter, Scrubber, Cyclone and ESP.
Measurement of intensity of sound and light

TEXT BOOKS

- Wark, K., Warner, C.F., and Davis, W.T., (1998), "Air Pollution"- Its Origin and Control"- Harper & Row Publishers, New York.
- Perkins, H.C ., (1980), "Air Pollution" - McGraw Hill.

REFERENCES

- Crawford, M., (1980)," Air Pollution Control Theory"- TATA McGraw Hill.
- Stern, A.C., Air Pollution, Vol I, II, III.
- Stern, A. C., (1977), "Air Pollution : The Effects of Air Pollution" – 3rd- Edition, Academic Press
- Environmental Engineering - A Design Approach - Sincero, A.P. andSincero, G.A. (1999), Prentice Hall of India, New Delhi.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**DESIGN OF WASTEWATER TREATMENT SYSTEMS EVH 210**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course emphasizes on design criteria, design equations, kinetics, hydraulic diagrams for the design of unit operations and processes for wastewater treatment. It also deals with biological sludge handling and treatment. Discusses the importance of rural sanitation systems and natural and constructed wetlands.

Course Outcomes (COs)

Student will be able to

CO1: Explain the need for wastewater treatment, categorize the wastewater based on characteristics, illustrate reactor types in wastewater treatment; explain the basic concept of mass balance; plan the treatment scheme through flow diagram and hydraulic profile.

CO2: Understand and apply the design principles and criteria in designing units such as screen, grit chamber, primary settling tank. Establish biokinetic constants in the engineering design of wastewater treatment processes.

CO3: Describe the design criteria and design the suspended and attached growth biological wastewater treatment systems like activated sludge process, trickling filter, UASB, RBC

CO4: Explain the need for sludge separation, conditioning and volume reduction. Design the facilities for treatment of biological sludge

CO5: Illustrate wastewater treatment systems for rural areas. Explain the applicability of natural systems for treatment of wastewater.

Course Content

Domestic Wastewater characteristics, flow fluctuations, types of reactors and mass balance approach.

Wastewater Treatment Flow Diagrams and Hydraulic Profile.

Design principles and design of unit operation systems - screen, equalization basin, grit chamber, primary settling tank.

Kinetics of biological wastewater treatment systems – biokinetic constants and their determination, batch and continuous system.

Design Criteria and design of unit processes – suspended and attached growth systems, conventional activated sludge process and its modifications.

Design principles of trickling filter, bio-towers and rotating biological contactors.

Biological Sludge separation, conditioning and volume reduction

Design of Sludge Processing units – secondary settling tank, slude thickeners and digesters– aerobic and anaerobic.

Wastewater treatment systems for small communities – septic tanks, soak pits, two-pit latrines, eco-toilet. Natural and constructed wetlands,

TEXT BOOKS

- Karia G.L., and Christian R.A., (2001), "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi.
- Metcalf and Eddy Inc., (2003), "Wastewater Engineering - Treatment and Reuse", 4thEdition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Quasim

REFERENCES

- Benefield R.D., and Randal C.W., (1980), “Biological Process Design for Wastewater Treatment”, Prentice Hall, Englewood Chiffs, New Jersey.
- Ronand L., and Droste, (1997),”Theory and Practice of Water and Wastewater Treatment”, John Wiley and Sons Inc.
- Gaudy, “Advanced Wastewater Treatment”.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**EPIDEMIOLOGY AND RISK ASSESSMENT EVH220**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The course is interdisciplinary bringing in the concepts of medical epidemiology and its relationship with the associated risks caused due to a variety of diseases and their control aspects. The course also reviews the local, district and national level Health Management system. It covers risk identification, characterization and communication. It deals with partitioning and portioning coefficients' determination for toxic and hazardous pollutants.

Course Outcomes (COs)

Student will be able to

CO1: Review and describe the history and scope of epidemiology. Discuss spatial and temporal studies in epidemiology, its interventions and experimental studies.

CO2: Classify and differentiate infectious diseases. Identify the epidemiological characteristics of each disease. Define and discuss morbidity and mortality as applied to epidemiological survey.

CO3: Carry out field investigation studies with respect to food and water contamination. Relate population and epidemiological information.

CO4: Perform data epidemiological data processing, analysis and interpretation. Plan for a detailed district health management system.

CO5: Identify, characterize and analyze risk and its impacts on human health and environment. Carry out exposure assessment to arrive at lethal concentrations and lethal dosages. Describe portioning and determine portioning coefficients.

Course Content

Epidemiology; the historical context; definition and scope of epidemiology; achievements in epidemiology; spatial and temporal studies in epidemiology; Cross Sectional Studies; Case control studies; cohort studies; intervention and experimental studies; Epidemiology: The foundation public health

Epidemiology of Infectious Disease: Classification of Infectious Diseases; Epidemiological Characteristics of Infectious Diseases; Surveillance of Infectious Diseases: Temporal Trends of Infectious Diseases; Recent Trends in Infectious Disease; Morbidity and Mortality in the India; Recent Worldwide Trends in Infections Disease Morbidity and mortality. Meta analysis.

Field investigations (biological and chemical parameters) related to food and water contamination.

District Health Management; District Population; Epidemiological Health Information; Reporting and Surveillance Systems; Data Processing and Analysis; Presenting Health Information; Communicating Health Information; Epidemiology and District Health Planning. Primary Health Centres.

GIS and Micro Computer Applications in Epidemiology

Risk Assessment: Definition of Risk and its importance. Risk Identification. Risk characterization. Risk communication. Ecological Health impact assessment. Exposure assessment. Health impact assessment, Health impact of various risk factors.

Sorption/ partitioning of organics, volatilization and structural / property activity relation.

TEXT BOOKS

- Vaughan. J.P. , and Morrow, R.H., (1989) – "Manual of Epidemiology for District Health Management". – WHO, Publication.
- Kenrad.E. Nelson, Carolyn Master Williams, Neil M.H. Graham, (2001), "Infectious Disease Epidemiology - Theory and Practice" - ASPEN Publication, Maryland-
- Lagrega M.D., Buckingham P.L., and Evans J.C., (1994), "Hazardous waste Management", McGraw Hill International Edition

REFERENCES

- Beaglehole, R., Bonita, R., and Kjellstrom, T., (1993), "Basic Epidemiology", WHO publication.
- Barker and Hall, (1991) " Practical Epidemiology" - Churchill Livingstone, Edinburgh.
- Sawyer, C.N., Mcarty, P.L., and Park, G.F., (2003), "Chemistry for Environmental Engineering and Science" – V Edition, Tata McGraw Hill Publications
- Wentz C.A.,(1995),"Hazardous Waste Management", McGraw Hill International Edition

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**PRINCIPLES OF BIOMEDICAL WASTE MANAGEMENT EVH 230**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Objective

The student will have a thorough knowledge of biomedical waste sources, types, and characteristics and alsothe difference in handling and processing technique compared to any other waste management. The course provides complete theoretical and practical aspects on biomedical waste treatment and best management practices.

Course Outcomes (COs)

Student will be able to

CO1: Able to categorize the waste based on the Biomedical Waste (Management and Handling) Rules and different sources. And also to explain present scenario of waste management and the impact of its mismanagement.

CO2: Will be in a position to carryout survey on various aspects of biomedical wastes at different point of generation. And also to enumerate various handling and processing techniques on all the categories of wastes.

CO3: Capable of demonstrating specific treatment methods for biomedical wastes and also identifying best equipment for incineration and containments of wastes.

CO4: Proficient enough to train and carryout awareness programmes among the waste handlers at various stages there by helping to safeguard the health.

CO5: Develops the standard procedures for handling and disposal of biomedical wastes generated at various stages. And can also model the waste flow to maintain the standards with assistance of engineering design.

Course Content

Biomedical Waste Scenario: Health Care Facilities, Global, National and State;, Impact of improper management of Biomedical waste

Categories : BMW (Management and Handling) Rules, Waste categorization and collection, disposal.Types, Generation, Quantification, Segregation and Disinfection of Biomedical waste within the hospital, Methods of Disposal, Training and Awareness.

Waste handling within the Facility : suitable receptacles for each waste, Colour Coding, Containers, labelling - international biohazard symbol, corrosive, explosive, radioactive, chemical, cytotoxic.

Handling and Treatment of Various Categories of Waste, Standard procedures

Infectious Waste: Types, Sharps, precaution, handling and proper system of sharp collection and disposal, containers and destroyers.

Liquid Waste: Segregation and Management of liquid waste, Disposal methods, Mercury Spill, Pharmaceutical liquid waste, Photographic liquid waste. Solidification of liquid waste.

Non-infectious Waste: Need for Segregation of Non-infectious Waste from infectious Waste, Precautions for treatment.

Radioactive Waste: Types , Precautions to be adopted in handling radioactive materials in Hospitals, waste containment methods.

Best Management Practices : Orthonova Case study, Holy Family Hospital Case Study, Bangalore armed force Hospital study.Social Responsibilities of Healthcare personnel for Safe Waste Management.Rag pickers role and Municipality Participation.

TEXT BOOKS

- Lowbury EJL, Aylife GAJ, Geddes AM, Williams J D, "Control of hospital infection", (Ed) First edition, 1975, Chapman and Hall Ltd.
- Landrum, V.J.,(1991) "Medical Waste Management and disposal" – Noyes Data Corporation, Newyork
- Stricoff Scott R., and Walters B. Dougals, (1995)"Laboratory Health and Safety" 2nd edition , - John Wiley and Sons Inc.

REFERENCES

- Basavanthappa, BT (2008), "Community Health Nursing", Second Edition, 2008, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi
- Anantpreet Singh and Sukhjit Kaur (2012), "Biomedical Waste Disposal" First Edition 2012, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi
- Srishti Survey Report on medical waste disposal practice in healthcare unit, 1998 &1999.
- Srishti Fact Sheets on medical waste incineration, mercury, sharps handling and disposal and plastic in healthcare.
- WHO. Lagboratory Biosafety Manual 2nd Edition, 1993 World Health Organisation, AITBS Publishers and Distributors.
- WHO. Managing Medical Waste in Developing Countries, 1994 world Health organization, Geneva.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**BIOLOGICAL TREATMENT PROCESSES LAB EVH 270**
No. of Teaching Hours –	**Credits : 0:0:1.5 L-T-P**
CIE Marks : 50	

Course Objective

The lab course provides an opportunity to collect and preserve domestic wastewater samples as well as industrial effluents, conduct various tests on wastewater characteristics, perform experiments on selected lab scale treatment processes. It also enriches the student knowledge of determining bio kinetic constants for aerobic treatment process. The lab course also exposes the student to carryout analysis on biological sludge developed during the biological treatment of wastewater

Course Outcomes (COs)

Student will be able to

CO1 : Acquaint with the planning of domestic wastewater and industrial wastewater collection, transportation and preservation of samples. Perform standard tests for qualitative analysis and quantification of organic load. Conduct continuous CBOD and NBOD test.

CO2: Design and use the experimental set up to determine bio kinetic constants of biological waste treatment process. Characterize bio sludge through standard procedure to identify significant parameters.

CO3: Plan and perform aerobic and anaerobic bench scale treatment processes on both domestic wastewater and industrial effluent. Use constructed wetland (bench scale) system as polishing unit. Develop the skill of analyzing, interpreting and inferring the laboratory data.

EXPERIMENTS

- Domestic and Industrial Wastewater analysis for different parameters
- Determination of CBOD and NBOD of both domestic and industrial wastewater using BOD apparatus
- Determination of Bio kinetic Constants - F/M, Θ, Θ_c ,K_d, Y, q, μ,
- Analysis of Biological Sludge – MLSS, MLVSS, SVI
- Aerobic process of treating domestic wastewater
- Anaerobic process of treating domestic wastewater
- Polishing unit – constructed wetland

REFERENCES

- American Public Health Association, American Water Works Association, (1998), Standard Methods for Examination of Water and Wastewater, 20th edition, APHA.
- Adams and Eckenfelder Jr. W.W. (1974), "Environmental, Process Design Techniques for Industrial Waste Treatment", Nashville (USA), 1974.
- Benefield, L.D., and Randall, C.W., (1980), "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood, Chiffs, N.J.
- CPHEEO Manual (2014),"Wastewater Collection, Treatment and Disposal", Ministry of Urban Development, Government of India, New Delhi.
- Metcalf and Eddy, (2003), "Wastewater Engineering, Treatment and Reuse", 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**MEDICAL STATISTICS AND HEALTH CARE ADMINISTRATION (ELECTIVE III) EVH 241**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course encompasses both medical statistics and health care administration. It discusses basic statistical data analysis methods. Introduces parametric and non parametric tests on the medical data. Describes correlation and regression analysis. It also deals with survival analysis, sensitivity and specificity of medical data. It lays foundation on health care investments, health care administration. It explains the pros and cons of telemedicine and health care tourism. It provides knowledge on managing health care services during emergencies and disasters.

Course Outcomes (COs)

Student will be able to

CO1: Apply descriptive statistics for any set of data including medical data. Understand the confidence intervals and p values.

CO2: Perform parametric and non-parametric tests on the data. Differentiate between risk ratio and odds ratio.

CO3: Carry out correlation and regression analysis and explain Cox regression model. Describe sensitivity, specificity and predictive values.

CO4: Justify health care administration need and health care investments. Explain the the associated problems with health care investments. Manage quality in health care facilities.

CO5: Review pros and cons of telemedicine and medical tourism. Discuss the role of health care insurance and reimbursement. Apply the knowledge to manage health services at the time of emergencies and disasters. Discuss the legal frame work for health care administration.

Course Content

Statistics

Descriptive Statistics –Mean, Median, Mode, Standard Deviation, percentages

Statistics of Confidence testing – confidence intervals, p values

Statistics of differences- t tests and parametric tests, chi-squared, Mann-whitney and other non-parametric tests, risk ratio, odds ratio

Correlation and regression, Survival analysis, life tables, Koplan Meier Plots, Cox Regression model

Sensitivity, specificity and predictive value

Level of agreement and Kappa

Health Care Administration

Health care, effective media communication, health care financing, quality in health care

Telemedicine and Medical tourism

Role of health insurance

Managing Health services during emergencies and disasters

Medico legal aspects.

TEXT BOOKS

- Sundar Ram K.R., (2014), "Medical Statistics – Principles and Practice", 2nd Edition, Wolter Kluwer Publishing
- Goyal R.C., and Sharma D.K., (2013), Hospital Administration and Human Resource Management", PHI Publishing

REFERENCES

- Michael Harris and Taylor G, (2003), "Medical Statistics Made Easy", Martin During, London and New York
- Joshi D.C., and Mamta Joshi, (2009), "Hospital Administration", 1st Edition, Jaypee Brothers Medical Publishers.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**OPERATION AND MAITENANCE OF ENVIRONMENTAL FACILITIES (ELECTIVE III) EVH 242**
No. of Teaching Hours –	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course encompasses the aspects of operation and maintenance of Environmental facilities. It highlights the operational problems and suggests the control, preventive and corrective measures.

Course Outcomes (COs)

Student will be able to

CO1: Know the need, types, basic principles, organizational structure, work planning and scheduling and cost estimates of O&M

CO2: Explain the importance of drawings, plans, record keeping. Recognize the need for operational manual and SOP. Discuss the advantages and limitations of SCADA based control systems

CO3: Identify and list the operational problems in water treatment and supply facilities. Apply preventive and corrective maintenance measures

CO4: Describe the operational problems in wastewater collection and treatment facilities. Enumerate the remedial measures. Explain the problems and control measures in Industrial wastewater treatment facilities

CO5 : Identify and discuss the troubles in air pollution control systems and suggest the preventive and control measures**.**

Course Content

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

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

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

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

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

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

TEXT BOOKS

- Hammer M.J., and Hammer Jr. M.J., (2008), "Water and Wastewater Technology", Prentice Hall of India Pvt. Ltd., New Delhi.
- Metcalf and Eddy Inc., (2003), "Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

REFERENCES

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

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**DESIGN OF ADVANCED WASTEWATER TREATMENT PROCESSES (ELECTIVEIII) EVH 243**
No. of Teaching Hours –	**Credits : 3:1:1 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course covers in depth the advanced and hybrid wastewater treatment systems for the removal of nutrients, toxic organics, inorganic and trace contaminants, as well as sludge handling and disposal practices. It allows the student to understand design criteria and design the various advanced wastewater treatment processes.

Course Outcomes (COs)

Student will be able to

CO1: Acquire knowledge of residual pollutants in the effluent of conventionally treated wastewater and their removal by various advanced processes

CO2: Describe different combinations of hybrid reactor systems and to design them for a given situation

CO3: Apply the knowledge of nutrients removal using advanced wastewater treatment processes design

CO4: Familiarize with the handling and disposal methods of both biological and chemical sludge from wastewater treatment facilities and comprehend the knowledge on recent advanced technologies. Apply design principles in designing the facilities

CO5: Discuss the need for application of environmental biotechnology for wastewater treatment. Differentiate in-situ and ex-situ bioremediation processes. Design Membrane bioreactors using design principles. Review the option of using wastewater for other purposes.

Course Content

Advanced Wastewater Treatment Systems

Residuals in treated wastewater and their removal

Gas Stripping, DAF, Advanced Oxidation, Electro dialysis, Ion Exchange & Adsorption, Micro and Ultra Filtration

Hybrid Wastewater Treatment Systems

Need for upgrading treatment plants, Possible Combinations of Physico chemical and Biological Processes.

Electrochemical coagulation, UASB and Anaerobic filters, multistage anaerobic filters

Nutrients' Removal from Wastewaters

Nitrification and denitrification, physicochemical and biological phosphorus removal, SBR.

Sludge

Chemical Sludge – Sources and generation, types, characterization, recovery of metals, and alternate uses

Biological sludge – Sources and generation, characterization, utilization possibilities compost

Recent Trends

Environmental Biotechnology - genetically engineered microorganisms for wastewater treatment, bio remediation, bio sensors, membrane bio reactors (MBR), power generation from wastewater.

TEXT BOOKS

- Metcalf & Eddy Inc, (2003), "Wastewater Engineering, Treatment and reuse"- 4th Edition, Tata McGraw Hill Publishers Co. Ltd, New Delhi
- Karia, G.L., and Christian, R.A., (2006) "Wastewater Treatment: Concepts And Design Approach "– Prentice – Hall of India

REFERENCES

- Syed R. Qasim, (1999), " Wastewater treatment plants: planning, design, and operation" - 2nd edition, CRC Press LLC
- Moo-Young M., Anderson W.A., Chakrabarty A.M., (2007), "Environmental Biotechnology – Principles and Applications," Kluwer Academic Publishers.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**WATER RECLAMATION, REUSE AND RECYCLE TECHNOLOGY (ELECTIVE IV) EVH 251**
No. of Teaching Hours –	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course emphasizes on reuse applications of reclaimed water for agricultural, landscape, industrial, potable and non-potable domestic purposes, potential issues and their management options.

The student will be able to

CO1 : Recognize and explain the need and rationale for water reclamation and reuse, analyse the health and environmental concerns related to reclaimed water reuse, relate water borne diseases with the possible reclaimed water reuse application

CO2: Explain available tertiary treatment technologies for reuse applications, identify the potential contaminants and suggest state-of-the-art techniques for their qualitative and quantitative measurement, assess market opportunities and conduct economic analysis.

CO3 : Compute the impacts of reclaimed water on agricultural and landscape applications and work out its feasibility. Recognize the need for reuse policy and discuss reclaimed water quality issues.

CO4 : Identify the sectors that serve as beneficiaries for reclaimed water; evaluate the water quality issues and suggest the management options for industrial applications of reclaimed water

CO5 : Identify the most appropriate technology for using the reclaimed water for artificial ground water recharge. Examine the direct and indirect use of reclaimed water for potable purposes.

Course Content

Introduction: Need and prospects, water reclamation and reuse.

Water Reuse Innovation and Public Policy: Water management and system and reclamation innovation, water reuse and public policy. Quality Issues and its management.

Water – Reuse Systems: Health and environmental concerns in water reuse – water borne diseases; Factors influencing pathogen inactivation; Endocrine disruptors and Pharmaceutically active chemicals.

Wastewater Reclaim Technologies: Treatment process reliability, advanced wastewater reclamation processes and their combination, Water Harvesting.

Public acceptance of water reuse, implementation hurdles, advanced facilities for analysis of reclaimed water quality, market assessment, economic and financial analysis.

Reuse Applications

Agriculture and Landscape irrigation

Agronomic and water quality considerations, salinity, sodicity, specific ion toxicity, leaching and irrigation requirement, hydraulic loading rate, drainage system, estimation of water needs

Industrial Water Reuse: Water quality issues and their management options – corrosion, scaling, biological fouling; Cooling tower, makeup and blow down water; boiler system using reclaimed water; Water pinch analysis.

Ground Water Recharge with Reclaimed Water: Rationale, Ground water recharge methods, water recharge guidelines

Potable Reuse – Indirect and direct.

TEXT BOOKS

- Metcalf & Eddy Inc, (2003)," Wastewater Engineering, Treatment and reuse"- 4th Edition, Tata McGraw Hill Publishers Co. Ltd, New Delhi
- Takashi Asano, Franklin L. Burton, Harold L. Leverenz, RyujiroTsuchihashi, George Tchobanoglous,(2007) "Water Reuse – Issues, Technologies, and Application", McGraw Hill Company, Copyright by Metcalf & Eddy, Inc.

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**GIS FOR HEALTH CARE MANAGEMENT (ELECTIVE IV) EVH 252**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course lays the foundation for concepts of Geographical Information System, coordinates and projection, data models, spatial data input and editing, database management, as well as the applications of GIS in health care business, emergency response, tele-health. It also introduces the basics of Remote Sensing including sensors, platforms and orbits and satellite images.

Course Outcomes (COs)

Student will be able to

CO1: Recognize the importance and need of GIS in environmental management; explain the concepts of co-ordinates and projection system and examine their relevance. Review Remote Sensing basics.

CO2: Differentiate between raster and vector data models and suggest suitability of these data types to represent various geographic features, determine data input method, identify the errors and suggest methods of editing the data to remove the errors.

CO3: Perform raster and vector overlay analysis, spatial interpolation, explain network analysis.

CO4: Explain database structure models, formulate database management system to represent healthcare related data; Discuss web GIS.

CO5: Formulate programs to carry out projects for visualizing and analyzing health-related data. Apply the GIS to various health care management in epidemiology, healthcare business, tele-health service delivery, emergency response, correlation analysis, etc.

Introduction

Origin and importance of GIS; scale; coordinate and projection systems

Basics of remote sensing: EMR spectrum; Energy sources and radiation laws, Energy interactions with atmosphere and Earth's surface features; Spectral reflectance curves, airborne and space borne sensors, passive and active remote sensing, Platforms and orbits; Satellite system parameters, spectral, radiometric, spatial, and temporal resolutions of satellites;

Data Models and Structures

Spatial data models – Raster, vector; spatial and attribute data.

Spatial Data Input and Editing

Encoding methods of data input: keyboard, manual digitizing, scanning and automatic digitizing methods. Electronic data transfer, GPS, Data Editing: spatial and attribute data accuracy, concept of topology.

Spatial Analysis

Raster and Vector overlay analysis; Spatial interpolation; Buffering and Neighborhood function, Networks;

Spatial Database Management System

Data storage, database structure models, database management system, E-R model.

Introduction to Web GIS

Applications of GIS in healthcare administration, management and policy

Mapping, Measuring, Monitoring and Modeling - in GIS application in epidemiology, in health risk mapping, network analysis – optimum route mapping, GIS at health facilities/industries – pharmacy, health clinics, hospitals, health facility survey, site location decisions

Decision Making Support System, GIS for healthcare business, emergency response service coordination, rural health-service analysis, tele-health service delivery coordination, patient care and room management, marketing strategies

TEXT BOOKS

- Burrough, P. A., McDonnell, R. A., Lloyd, C. D. (2015), "Principles of Geographical Information Systems", 3rdEdition, Oxford University Press,
- Michael N. DeMers (2008) " Fundamentals of Geographical Information Systems", 4th Edition, John Wiley and Sons. Inc

REFERENCES

- Anji Reddy (2008) " Text Book of Remote sensing and Geographical Information systems", 3rd Edition, B. S. Publications, Hyderabad
- Longley, P. A., Goodchild, M. F., Maguire, D. J., and Rhind, D. W., (2005) Geographical Information Systems: Principles, Techniques, Management and Applications, 2nd Edition, John Wiley & Sons, 2005.
- Elmasri, Ramez; NavatheShamkant. B. Fundamentals of Database Systems, (2007), 5th Edition, Pearson Education, Inc.,
- GIS in Hospital and Healthcare Emergency Management,(2010), Edited by Ric Skinner, GISP, CRC Press, Taylor & Francis Group,
- Romley, Ellen K., McLafferty Sara L. (2012), "GIS and Public Health", The Guilford Press

Department of Environmental Engineering, SJCE, Mysuru

Subject Name & Code	**HEALTH CARE POLICY AND LEGISLATION (ELECTIVE IV) EVH 253**
No. of Teaching Hours –	**Credits : 4:1:0 L-T-P**
CIE Marks : 50	**SEE Marks : 100**

Course Objective

The course deals in detail the need for health care policy and public health. It provides details on the role and responsibilities of organizations involved in health care. It reviews Indian Rules and Regulations, discusses various health related acts and rules. The course also highlights the health insurance products and policies along with legal issues for health insurance claims.

Course Outcomes (COs)

Student will be able to

CO1: Discuss the need and basic aspects of public health. Describe the essentials of health care policies, roles and responsibilities of organizations involved.

CO2: Explain the importance of Indian Acts related to health. Identify different laws and describe the salient features of pharmacy act, drug act, biomedical rules and human organs transplantation act

CO3: Review the salient features of Maternity benefit act, Medical Termination of Pregnancy act

CO4: Explain and understand the salient features of PNDT and Mental Health acts

CO5: Review the health care policy of India, Identify and discuss different health care products and policies. Identify the legal issues related to health care policy claims

Course Content

Health Policy – need and essentials, importance of public health, organizations and agencies in Health Care Policy

Indian Laws and Regulations related to Health

Pharmacy Act 1948, Drug and Cosmetic Act 1940, The transplantation of human organs Act and Rules, Biomedical Waste (Management and Handling) Rules

Maternity Benefit Act and Rules, Acts in Disability

The Medical Termination of Pregnancy Act and Rules

The Prenatal Diagnostic Techniques (PNDT) Act and Rules

Mental Health Act (1987), Food Act

Indian Health Care Policy – Medical / Health Insurance Policy

Review of Health care in India, Basics of Health Insurance, IRDA Health Regulations 2013, Health Insurance Products and Policies

Legal Issues – Health Insurance claims

TEXT BOOKS

- Gangolli L.V., Ravi Duggal and Abhya Shukla, "Review of Health Care in India", Centre for Enquiry into Health and Allied Themes, Mumbai
- Gupta L.P., (2014), "Health Insurance for Rich and Poor in India", (2014), 1st Edition

REFERENCES

- Tietelbaum J.B., Wilkensky S.E.,(2012), "Essentials of Health Policy and Law", 2nd Edition, Jones and Barlett Learning
- Gosfield A.G., (2015),"Health Law Handbook" Health Law Series, Clark Boardman Callaghan