JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJAD, VIZIANAGARAM
Syllabus for Pre-Ph.D Examination Civil Engineering

Pre-PhD Courses for CIVIL Engineering

Course-I			**Course-II**		
Structural Engineering			**Structural Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Theory of Elasticity and Plasticity	PH2401101	1	Pre-Stressed Concrete and steel structures	PH2401201
2	Advanced Structural Analysis	PH2401102	2	Advanced Concrete Technology	PH2401202
3	Earthquake Resistant Design of structures	PH2401103	3	Advanced Reinforced Concrete Design	PH2401203
Geotechnical Engineering			**Geotechnical Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Advanced Soil Mechanics	PH2401104	1	Soil Dynamics and Machine Foundations	PH2401204
2	Advanced Foundation Engineering	PH2401105	2	Soil-Structure Interaction	PH2401205
Transportation Engineering			**Transportation Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Pavement Analysis and Design	PH2401106	1	Highway Construction, Quality Control And Maintenance	PH2401206
2	Geometric Design of Highways	PH2401107	2	Pavement Materials	PH2401207
Water Resources Engineering			**Water Resources Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Advanced Fluid Mechanics	PH2401108	1	Open channel hydraulics and sediment transport	PH2401208
Environmental Engineering			**Environmental Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Urban drainage and Waste water treatment	PH2401109	1	Solid and Hazardous waste Management	PH2401209
2	Industrial waste water treatment	PH2401110	2	Air pollution and control technology	PH2401210
Remote Sensing & GIS			**Remote Sensing & GIS**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Digital Image Processing	PH2401111	1	Remote Sensing and Planning and Management	PH2401211
Course-I			**Course-II**		

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJAD, VIZIANAGARAM
Syllabus for Pre-Ph.D Examination Civil Engineering

General Civil Engineering			**General Civil Engineering**		
Sl.No.	**Subject**	**Subject Code**	**Sl. No.**	**Subject**	**Subject Code**
1	Probabilistic and statistical methods in Civil Engineering	PH2401112	1	Applications of Soft Computing Techniques	PH2401212

STRUCTURAL ENGINEERING

COURSE – I

(PH2401101)THEORY OF ELASTICITY AND PLASTICITY

UNIT-I

Introduction: Elasticity – Notation for Forces and Stresses – Components of Stresses – Components of Strain – Hooke's Law. Plane Stress and Plane Strain analysis – Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions.

UNIT-II

Two Dimensional Problems: in Rectangular Co-Ordinates – Solution by polynomials – Saint – Venant's Principle – Determination of Displacements – Bending of Simple beams – Application of Fourier Series for two dimensional problems for gravity Loading. Two Dimensional problems in Polar Co-ordinates General Equations in polar Co-ordinates –Stress Distribution Symmetrical about an axis – Pure bending of curved bars - Strain Components in Polar Co-ordinates – Displacements for Symmetrical stress Distributions – Circular discs- Stresses on plates with circular holes

UNIT-III

Three Dimensional Problems: Analysis of Stress and Strain in Three Dimension Principal Stress – Stress Ellipsoid and stress director surface – Determination of Principal stresses Maximum shear stresses – Homogeneous Deformation – Principle Axes of Strain. General Theorems: Differential equations of equilibrium – Conditions of Compatibility Determination of Displacement – Equations of Equilibrium in Terms of Displacements – Principle ofSuperposition – Uniqueness of Solution –Reciprocal theorem.

UNIT-IV

Torsion of Prismatic Bars:

Torsion of Prismatic Bars – Bars with Elliptical Cross Section – Other elementary Solution – Membrane Analogy – Torsion of Rectangular Bars – Solution of Torsional Problems by Energy method – use of soap Films in Solving Torsional problems – Hydro dynamical Analogies – Torsion of Bars.

UNIT-V

Theory of Plasticity: Introduction – Concepts and Assumptions – Yield criteria.

References:

1. Theory of Elasticity- Timoshenko & Goodier.
2. Theory of Elasticity – Sadhu Singh

(PH2401102)ADVANCED STRUCTURAL ANALYSIS

UNIT I

Analysis of Axially loaded bars, beams and portal frames by Rayleigh-Ritz method

UNIT II

Analysis of Axially loaded bars, beams and portal frames by Gelarkin's method

UNIT – III

Analysis of beams and plates by Finite Difference Method

UNIT – IV

Analysis of Statically determinate and Indeterminate beams, Frames and Trusses by Stiffness method

UNIT –V

Analysis of Statically determinate and Indeterminate beams, Frames and Trusses by Flexibility method

UNIT – VI

Approximate methods of analysis of Multi-storey frames

UNIT – VII

Influence lines for indeterminate beams, Arches and Trusses

UNIT VIII

Cables and suspension bridges.

REFERENCE :

1. Wang C. K., "Indeterminate Structural Analysis", McGraw-Hill, 2nd Edition, 2000.
2. Sinha, N. C. and Gayen, P. K., Advanced theory of structures, Dhanpat Rai & Sons, 4th Edition, 2002
1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co., 3rd edition, 2001
2. Hibbeler R.C, Structural Analysis, Macmillan Pub.Co., 2nd Edition, 2000
3. Au T and Christiano, P., Structural analysis, Prentice Hall, 1st Edition, 2002

(PH2401103)EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

UNIT-I

STRUCTURAL DYNAMICS: Introduction, Physical and Mathematical Modelling, Discrete and continuum modelling. Laws of Equilibrium, Newton's Law of Motion, D-Alembert's Principle, Principle of virtual displacement. Types of Dynamic Loading. Single Degree of Freedom System (SDOF), Undamped Free Vibrations, Damped Free Vibrations (concept only). Two Degrees of Freedom System (2DOF), Undamped Free Vibrations. Determination of Natural frequencies and Mode shapes.

UNIT-II

ENGINEERING SEISMOLOGY: Introduction,- Internal structure of earth, Chemical properties, Physical properties, Continental drift theory, Plate tectonics, Movement of plate Boundaries, Movement of Indian plate ,Faults, Types of faults, Elastic Rebound theory. Earthquakes, Earthquake terminology, Classification of Earthquakes, Causes and effects of Earthquakes, Earthquake waves, Quantification of Earthquakes, Intensity and Magnitude, Recording Earthquakes.

UNIT-III

EARTHQUAKE RESISTANT DESIGN: Reviews of latest I.S : 1893 (Part 1) provisions for buildings, General principles and design criteria, Assumptions, Design Acceleration spectrum, Horizontal seismic coefficient, Design acceleration, Seismic zones of India, Importance factor, Response reduction factor, Design lateral force, Design imposed loads for Earthquake force calculation, Seismic weight, Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method), Storey drift limitation.

UNIT-IV

BUILDING CONFIGURATIONS: Introduction, Regular and Irregular Buildings. Plan Irregularities, Torsion Irregularity, Re-entrant corners, Floor slabs having excessive cut-outs or openings, Out of plane offsets in Vertical Elements, Non-parallel Lateral Force system. Vertical Irregularities, Stiffness Irregularity (soft storey,) Mass Irregularity, Vertical Geometric Irregularity, In-plane discontinuity in Vertical Elements resisting lateral force, strength Irregularity (weak storey), Floating or stub columns, Irregular Modes of Oscillation in two Principle Plan Directions.

UNIT-V

DUCTILE DESIGN AND DETAILING: Review of Latest IS: 13920 provisions General specifications, Beams, Columns, Shear walls. Special confining reinforcement. Review of Latest IS: 4326 provisions, General principles, Special Construction features relating to separations of structures (above ground only).

REFERENCES

1. A.K. Jain “Dynamics of Structures with Mat Lab Applications” Pearson India Education Series Pvt.Ltd., Delhi, 2016

2. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design of Structures”, 5th Edition Prentice Hall of India, New Delhi, 2011.

3. S.K.Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, 1st Edition, 2012.

1. Chopra A.K., “Dynamics of Structures”, 5thEdition, Pearson Education, Indian Branch, Delhi, 2007.

2. Mario Paz, “Structural Dynamics - Theory and Computations”, 6thEdition, Pearson Education, 2005.

GEOTECHNICAL ENGINEERING

(PH2401104)ADVANCED SOIL MECHANICS

UNIT-I

Principles of Elasticity and Plasticity Concept of stress and strain – Principal stresses – Stress – strain relationships – Plane stress and plane strain – Mohr's diagram – Yield criteria – Theories of failure – Mohr – Coulomb failure condition.

UNIT-II

Clay Mineralogy -Nature of soils – atomic bonds - Clay mineral structure – clay water relation – electrical effects – clay mineral identification – Soil fabric and structure Water flowin Soils Flow equation – Darcy's Law – General equation – mathematical analysis – solution by sketching – electrical analogy – numerical solution

UNIT-III

Transient Flow Effective stress - change in degree of saturation – change in void ratio – compressibility of pore water – compressibility of soil solids – rate of storage equation –transient flow condition – one dimensional consolidation – mathematical analysis – approximate numerical analysis.

UNIT-IV

Consolidation: Mechanism of consolidation – Primary consolidation – Stress history – Pre-consolidation pressure – Terzaghi's one-dimensional consolidation theory and equation – Solution by Fourier series and finite difference methods – Determination of coefficient of consolidation including Scott's method – U versus T relationship for deferent forms of initialexcess pore water pressure distribution – Degree of consolidation under time – dependent loading – secondary consolidation.

UNIT-V

Shear strength Principle of effective stress – Measurement of strength parameter – Strength tests based on drainage conditions – Skempton's pore pressure coefficients – Stress paths – Hvorslev' spacing parameters – Shear strength of cohesion-less sands – Strength and deformation behavior – Dilatancy – Critical. Void ratio Liquefaction – Shear strength of saturated cohesive soils – Triaxial testing – Normally and over consolidated clays – Partiallysaturated clays – Stress – state variables – Measurement of pore- water and pore – air pressure – Axis translation technique.

REFERENCES:

1. "Foundations of theoretical soil mechanics" by M.E. Harr., McGraw Hill Co.
2. "Fundamentals of soil behaviour " by J.K. Mitchell., John Wiley & Sons.
3. " Advanced soil mechanics" by Braja M. Das., Mc Graw Hill Co.,
4. "Introduction to Geotechnical engineering" by Holtz and Kovacs., Prentice Hall.
5. "Elements of soil mechanics" by G.N. Smith., B.S.P. Professional Books, Oxford,London

(PH2401105)ADVANCED FOUNDATION ENGINEERING

UNIT – I:

Foundations- estimating bearing capacity- Meyerhof's, Hansen's and I.S code methods- Effect of water table, eccentricity, and inclination of load on Bearing Capacity Elastic settlement –Effect of size of footing on settlement. Steinbrenner's method of calculating settlement

UNIT - II :

Allowable bearing pressure from penetration test data – Meyerhoff's and Teng's expressions. Consolidation settlement of footings - Combined footings and raft foundations, methods of analysis of raft, concept of floating raft, excavations.

UNIT - III

Deep foundations –Need. Types. Classification of piles. static equation – Single piles -– Critical depth concept. Pile capacity in clay and sand by the I.S. code method . Piles in layered soils. Piles with enlarged base in clays (under reamed piles). Piles for resisting uplift – straight shaft and under reamed piles in clays and sands – Dynamic formulae – Engineering News formula – Modified Hiley formula – Different types of pile load tests –initial and routine tests maintained load test, CRP test, pullout test, lateral load test and cyclic pile load test. Separation of skin friction and end bearing. – ultimate load from pile load tests.

UNIT – IV:

Pile groups – Efficiency of pile groups- Group capacity in clays– Minimum spacing of piles in a group – Negative skin friction of single piles and pile groups –Settlement of pile groups in clays – Equivalent raft approach – Settlement of pile groups in sands - Skempton's and Meyerhof's methods-

UNIT - V

Well foundations– Components of a well foundation–Procedure for construction and sinking of wells–Thickness of well steining for sinking under self weight - Grip length- Problems encountered in well sinking–Tilts and Shifts– Causes – Permissible tilts and shifts - Methods to rectify tilts and shifts – Forces acting on a well foundation –Allowable bearing pressure – Lateral stability of well foundations - Terzaghi's analysis

References:

1. Murthy, V.N. S. Advanced Foundation Engineering, CBS Publishers, New Delhi, 2007
2. Ranjan G. and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2002.
1. Gulhati, S. K. and Datta, M. Geotechnical Engineering, Tata McGraw Hill Education, 2005
2. Tomlinson, M. J. and Booman, R. Foundation Design and Construction, Prentice Hall Publishing, 2001.
3. Tomlinson, M. J. and Woodwrd, J. Pile Design and Construction Practice. CRS Press, 2015.
4. Kurien, N. P. Design of foundation systems: principles and practices. Alpha Science International, 2005.

TRANSPORTATION ENGINEERING

(PH2401106)PAVEMENT ANALYSIS AND DESIGN

UNIT-I

1. Pavement Types, Wheel Loads and Design Factors

Definition of Pavement Types, Comparison of Highway pavements, Wheel Loads, Tyre pressure, Contact pressure, Design Factors: Traffic and Loading, Environment, Materials, Failure criteria, Reliability.

UNIT-II

Stresses in Pavements-Layered System Concepts: One Layer System: Boussinesq Theory. Two Layer Theory: Burmister's Theory. Three Layer System. Stresses in Rigid Pavements. Relative Stiffness of Slabs, Modulus of Subgrade Reaction, Stresses due to Warping, Stresses due to Friction, Stresses due to Load, IRC Recommendations.

UNIT-III

Pavement Design IRC Method of Flexible Pavement Design, AASHTO Method of Flexible Pavement Design, IRC Method for Rigid Pavements, use of Geosynthatics in pavements.

UNIT-IV

Pavement Inventories Serviceability Concepts, Visual Rating, Pavement Serviceability Index, Roughness Measurements, Measurement of Distress Modes Cracking, Rutting, Rebound Deflection using Benkleman Beam Deflection Method, Load Man Concept, Skid Resistance Measurement.

UNIT-V

Pavement Evaluation Functional Pavement Performance Evaluation: AASHTO Method, Psycho Physical and Psycho Metric Scaling Techniques, Deduct Value Method. Structural Conditional Evaluation Technique: Benkelman Beam Deflection Method, Pavement Distress Rating Technique. Design of Overlays by Benkelmen Beam Deflection Methods as per IRC –81 - 1997 – pavements on problematic soils.

REFERENCES:

1. Yoder and Witzorack, "Principles of Pavement Design", John Willey and Sons.
2. Yang, H. Huang, "Pavement Analysis and Design", Prentice Hall Publication, Englewood Cliffs, New Jersy.
3. Sargious, M.A. Pavements and Surfacings for Highways and Airports – Applied science Publishers limited
4. Ralps Hass and Hudson, W.R. " Pavement Management System" Mc-Graw Hill Book Company.
5. IRC codes of practice.

(PH2401107)GEOMETRIC DESIGN OF HIGHWAYS

UNIT-I

Highway Cross Section Elements and Geometric Design Of Highways: FunctionalClassification of Highway System; Design Controls – Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design. Carriageway, Shoulders, Formation, Right of way; Kerbs, foot paths, Medians- design specifications; Pavement Surface characteristics – Skid Resistance, factors affecting Skid resistance, Measurement of Skid Resistance; Road Roughness, measurement of Road roughness; Camber, Objectives of Camber, design standards.

UNIT-II

Horizontal and Vertical Alignment: Objectives of horizontal curves; Super elevation – Need forSuper elevation; Method of computing super elevation; Minimum Radius of Curve; Methods of attainment of super elevation; Extra widening on Curves; Transition Curves – Objectives and Design. Gradients – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Combination of Vertical and Horizontal Curves – Grade Compensation; Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Importance of Sight Distances for Horizontal and Vertical Curves.

UNIT-III

Intersection Design: Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections – Channelisation, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept and Design, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

UNIT-IV

Traffic Signs and Road Markings : Types of Road Signs; Guidelines for the provision of RoadSigns; Cautionary Signs, Regulatory Signs, Information Signs – Design standards; Road markings – Objectives of Road Markings; Types of Road Markings; Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Markings. Highway Appurtenances – Delineators, Traffic Impact Attenuators, Safety Barriers.

UNIT-V

Miscellaneous Elements: Requirements of Pedestrians; Pedestrian facilities on Urban Roads;Cycle Tracks – Guidelines and Design standards; Bus bays – Types and Guide lines; Design of On-street and Off street Parking facilities – Guidelines for lay out Design.

REFERENCES:

1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna Publications
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.

WATER RESOURCES ENGINEERING

(PH2401108)ADVANCED FLUID MECHANICS

UNIT – I: Reynolds's Transport Theorem

Review of physical properties of fluids – intrinsic and extrinsic properties – measurement of pressure.Basic equations of motion -Continuity equation-Energy Equation-Momentum Equation-Applications

UNIT – II: Viscous Flow

Stress and Strain analysis- Classification of viscous flow-Viscosity measurements-Derivation of Navier –Stoke's equations -Exact Solutions of Navier –Stoke's equations-Laminar Flow through inclined pipes. Stationery Plates -One plate moving-Both plates moving ; Flow between two concentric rotating cylinders; Flow between two coaxial cylinders

UNIT-III: Turbulent Flow

Initiation of turbulent motion-Classification of turbulence-Reynold's stresses-Prandtls' mixing length theory-Measurement of turbulence, Continuity equation-Reynold's Navier-Stokes equations and Energy equation -Equation for dissipation rate of energy-Velocity distribution in case of flow through pipes using mixing length

UNIT-IV: Potential Flow

Uniform flow and their combinations-Source Flow-Sink Flow-Free Vortex Flow-Superimposed Flow - Concept of Doublet-Flow past Rankine Oval Shape-Flow past a circular cylinder (doublet in uniform flow)-Flow past a circular cylinder with circulation-Introduction to 3D sources and sinks

UNIT-V: Theory of Boundary Layer and Drag & Lift

Von Karman Momentum Integral equation - Prandtl Boundary layer equation-Blasius solution for laminar boundary layer flow-Hydrodynamically smooth and rough boundaries-Boundary Layer Separation-Methods of controlling Boundary Layer

Drag and lift-Types of drag-Streamlined and Bluff body-Terminal Velocity of a body- Drag on Sphere and Cylinder-Lift on a Circular cylinder-Drag & Lift on an airfoil

REFERENCES:

1. Fluid Mechanics including Fluid machines by Dr.A.K.Jain, Khanna Publishers.
2. Hydraulics and Fluid Mechanics including hydraulic machines", by Modi and Seth, Standard book house Publisher.
3. Fluid Mechanics and Hydraulic Machines by K Subramanya, Tata McGraw Hill Pvt. Ltd
1. Introduction to Fluid Mechanics and Machines by S.K. Som& G. Biswas, Tata McGraw Hill Pvt. Ltd.
2. Fluid Mechanics and Machinery by C S P OJHA, R BERNDTSSON AND P N CHANDRMOULI, Published by OXFORD, University Press.
3. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.

ENVIRONMENTAL ENGINEERING

(PH2401109)URBAN DRAINAGE AND WASTE WATER TREATMENT

UNIT I

Urban Hydrological Cycle, Effects of Urbanization on Catchment Hydrology, Need for Urban Drainage System, Planning Objectives, Interaction of Urban and Surrounding Areas.

Approaches to Urban Drainage, Urban Wastes and Urban Runoff Options for Waste Disposal, Separate and Combined System's, Open Channels and Closed Conduits, Wastewater and Storm water Reuse, Data Requirements, Master Drainage Plans.

UNIT II

Elements of Drainage System, Conveyance Elements, Appurtenances, Overflow Structures, Runoff Control, Pumping Stations. Design Parameters, Design Period, Catchment, Physical Parameters, Process Parameters, Rainfall, water Quality Parameters, Instrumentation for Data Collection. Hydraulic Design of Conveyance Elements, Sizing of Sewers and Drainage Channels, Design of Appurtenances, Layout of Road Drainage, Layout of Pumping Stations.

UNIT III

Operation and Maintenance of Urban Drainage Systems, Interaction of Urban Drainage and Solid Waste Management, Cleansing of Sewers and Drains, Repairs and Maintenance, Planning.

UNIT IV

Wastewater Treatment Technologies: Sedimentation, sedimentation with Coagulation, Filtration, Activated Sludge Process, trickling Filters. Tertiary Treatment Systems: Nitrogen removal, Phosphorous removal, biological phosphorus removal, advanced biological systems, aerobic ponds, facultative ponds, aerated ponds, anaerobic ponds, chemical oxidation.

UNIT V

Wetlands: Introduction, definition, classification, delineation, Identification methods, Importance of wetlands, Human impacts, wetland protection, mitigation. Wetland Management: Designed ecosystem, water recycling, soil filters, Constructed wetlands

REFERENCES:

1. Industrial Wastewater Treatment, M.N. Rao, A.K. Dutta Oxford and IBH Publishing House, 1987.
2. Waste Water Treatment and Disposal by Metcalf Eddy & Co., Mc. Graw Hill Co., 1993
3. Water and wastewater Treatment by Hammer and Hammer: Prentice-Hall 1998
4. Hall, M.J. (1984), "Urban Hydrology ", Elsevier Applied Science Publishers.
5. Geiger, W.F., Marsalek, J. Zudima and Rawls, G. J. (1987 "Manual on Drainage in Urban Areas", 2 Volumes, UNESCO, Paris.
6. Geiger, W.F. and Jayakumar, K.V. (Ed.) (1996) "Lecture Notes of the V
7. International Course on Urban Drainage in Developing Countries", Regional Engineering College, Warangal

(PH2401110)INDUSTRIAL WASTEWATER MANAGEMENT

UNIT-I

Sources and types of industrial wastewater – Environmental impacts – Regulatory requirements – generation rates – characterization – Toxicity and Bioassay tests. Prevention vs Control of Industrial Pollution– Source reduction techniques – Waste Audit- Evaluation of pollution prevention options.

UNIT-II

Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal –adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation– Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – MembraneTechnologies – Nutrient removal.

UNIT-III

Individual and Common Effluent Treatment Plants – Zero effluent discharge systems - Wastewater reuse – Disposal of effluent on land – Quantification, characteristics and disposal of Sludge.

UNIT-IV

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing.

UNIT-V

Petrochemical -Pharmaceuticals – Sugar and Distilleries – Food Processing – fertilizers –Thermal Power Plants and Industrial Estates, ISO 14000:2003 – Waste Audit.

REFERENCES:

1. Eckenfelder, W.W., *Industrial Water Pollution Control*, McGraw-Hill, 1999.
2. Arceivala, S.J., *Wastewater Treatment for Pollution Control*, McGraw-Hill, 1998.
3. Frank Woodard, *Industrial waste treatment Handbook*, Butterworth Heinemann, New Delhi, 2001.

M. Tech. (Environmental Engineering)

4. Department of Civil Engineering, National Institute of Technology, Tiruchirappalli – 620015

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS

(PH2401111)DIGITAL IMAGE PROCESSING

UNIT I: Sensor, Satellite Data, and Data Model: Satellite systems, Data acquisition & storage - Data formats - Data products.-Image display system. Sensor model-Resolutions - Pixel characters - Image formation. The histogram and its significance- ENTROPY and its significance - Univariate & multivariate Image statistics – Spatial Statistics.

UNIT II: Geometric Preprocessing: Over view of Image Processing, Geometric distortion, Image registration, resampling, orthorectification – Image Mosaic.

UNIT III: Image Enhancements: Image characteristics- Spectral signatures .contrast enhancements- Image domain filtering. first order, second order ,directional filters , linear and non linear filters, Spatial enhancement, Multiband enhancements, ratioing, indices and Principal component analysis , Point, local and regional operators - Fourier transform-Fourier domain filtering, Ideal, Butterworth and Gaussian filters; scale-space transform, wavelet transform.

UNIT IV: Information Extraction: Classification algorithms: Non- parametric, parametric, Feature extraction, Un Supervised, training sets-Supervised methods and algorithms. Accuracy Assessment: Sources of Classification Error, Interpretation of the Error Matrix. Measurement of Classification Accuracy

UNIT V: Image Analyses : Pattern recognition, boundary detection and representation, textural and contextual Analysis.

REFERENCES:

1. John R.Jenson, .Introductory Digital Image Processing., Prentice Hall Series, 1996. 2. John A. Richards, Springer-Verlag, .Remote Sensing Digital Image Analysis. 1999. 3. Lillisand T.M and R.W.Kiefer (2004) 4th edition. Remote sensing and image interpretation, John Wiley & Sons, New York. 4. Rafael C.Gonzalez, .Digital Image Processing (2nd Edition)., Prentice Hall, 2002. 5. Remote sensing models and methods for Image processing. Schowengerdt 2nd edition. 6. Remote Sensing: The Quantitative Approach, edited by Swain, P.H.and Davis, S.M. Mc Graw Hills.

David L. Verbyla .Satellite Remote sensing of Natural Resource Management., Lewis publishers, Florida. 2. Anil K. Jain .Fundamentals of Digital Image Processing. Prentice Hall Publications, USA. 3. Image Analysis, Classification and change Detection in Remote Sensing . Mortan J.Century Taylor and Francis, 2007

GENERAL CIVIL ENGINEERING

(PH2401112)PROBABILISTIC AND STATISTICAL METHODS IN CIVIL ENGINEERING

UNIT-1

Deterministic and Stochastic processes, Probability axioms, Continuous and discrete distributions commonly used.

UNIT-2

Moments and expectations of distributions, Parameter estimation, Introduction to Frequency Analysis, Frequency Analysis and Probability, Annual Duration Series and Partial Duration Series.

UNIT-3

Simple linear regression and multi variate linear regression, evaluation of regression, hypothesis testing

UNIT-4

Characteristics of time series data, components of time series data, autocorrelation and spectral analysis, data generation technique

UNIT-5

Principles of time series modeling, Autoregressive models (AR), Autoregressive Moving Average models, Thomas-Fiering model, calibration and validation.

REFERENCES:

1. SC Gupta, VK Kapoor, Fundamentals of Mathematical Statistics, S Chand and Sons
2. Kotteguda, N.T., and Resso, R., Statistics, Probability and Reliability for Civil and Environmental Engineers, McGraw Hill Companies Inc., New York, 1998.
3. Haan T. C., Statistical Methods in Hydrology, East West Publishers, 1998.
4. Kotteguda, N.T., Stochastic Water Resources Technology, The Macmillan Press, New York, 1982.
5. McCuen, R.H., Hydrologic Analysis and Design, Prentice Hall Inc. N York, 2005
6. Mauro Naghettini, Fundamental of Statistical Hydrology, Springer

STRUCTURAL ENGINEERING

COURSE – II

(PH2401201)PRESTRESSED CONCRETE AND STEEL STRUCTURES

UNIT-I

INTRODUCTION: Development of prestressed concrete –Advantages and Disadvantages of PSC over RCC General principles of pre-stressing-pre tensioning and post tensioning – Materials used in PSC-high strength concrete –High tension steel- Different types /methods/systems of prestressing. **Losses of prestress**: Estimation of the loss of prestress due to various causes like elastic shortening of concrete ,creep of concrete, shrinkage of concrete, relaxation of steel, slip in anchorage, friction etc.

UNIT-II

a) **Flexure:** Analysis of sections for flexure in accordance with elastic theory-Allowable stresses-Design criteria as per I.S code of practice –Elastic design of Beams (rectangular, I and T sections) for Flexure –Introduction to partial prestressing.

b) **Shear, bond, Bearing and Anchorage:** shear in PSC beams –Principal stresses – Conventional elastic design for shear-transfer of prestress in pretensioned memberstransmission length –Bond stresses-bearing at anchorage –Anchorage zonestresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

UNIT-III

a) **Deflections:** Introduction-Factors influencing deflections-short term and long termtime deflections of uncracked and cracked members.

b) **Composite Construction:** Types of composite construction-stress distribution in composite sections analysis of stresses-Differential shrinkage-Design of simple composite sections.

UNIT-IV

Statistically indeterminate structures: Introduction –advantages and disadvantages of continuity –Layouts for continuous beams-primary and secondary moments –Elastic analysis of continuous beams-Linear transformation-Concordant cable profile-Design of continuous beams.

UNIT-V

a) **Circular prestressing**: Introduction –Circumferential prestressing Design ofPrestressed concrete tanks –vertical prestressing in tanks-Dome prestressing.

b) Introduction to pre-stressed of steel structures.

REFERENCE BOOKS:

1. Prestressed Concrete by Lin
2. Prestressed Concrete by S.Krishnam raju
3. Research materials on prestressing steel structur

(PH2401202)ADVANCED CONCRETE TECHNOLOGY

UNIT-I

Materials- Cement, Aggregates, mixing water soundness of aggregate- Fresh and hardened concrete: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- effect of admixtures on fresh and hardened concretes- Natural admixtures. Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests

UNIT-II

Repair and rehabilitation of structural elements: Analysis, strategy and design- Material requirement- Material selection- Surface preparation- Reinforcing steel cleaning, repair and protection- Bonding repair materials to existing concrete- placement methods-

UNIT-III

Strengthening and stabilization- Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening Crack stabilization

UNIT-IV

Fiber-reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes. Light weight concrete- Introduction- properties of light weight concrete- No fines concrete- design of light weight concrete

UNIT-V

Fly ash concrete- Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes. High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes.

REFERENCE:

1. Concrete technology- Neville & Brooks
2. Special Structural concrete- Rafat Siddique
3. Concrete repair and maintenance illustrated- Peter H Emmons

(PH2401203)ADVANCED REINFORCED CONCRETE DESIGN

UNIT-I

Introduction: History of Reinforced Concrete (RC), advantages of RC, load paths, introductions to different structural systems used in modern concrete construction. Stress-Strain Behaviour of concrete and steel under Compression and Tension, Behaviour of concrete under multi-axial stress, High strength concrete, lightweight concrete, Failure theories for concrete under Combined stress state, Tension-stiffening of Concrete, Effects of creep, shrinkage and temperature on material and structural behaviour.

UNIT-II

Behaviour under Pure Axial Loads: Basic Laws of Mechanics, Load displacement behaviour of RC members under pure axial compression and tension, Role of concrete and steel in compression and tension; differences in Behaviour of high strength and normal strength concrete.

Behaviour and Design under Flexure: Analysis at ultimate; Moment-curvature and load-deflection relationships, Effect of reinforcement ratios and concrete strength on moment-curvature Behaviour; Flexural design aspects using IS Code,

UNIT III

Analysis and Design for Shear: Relationship between flexure and shear, Effect of shear span to depth ratio, Definition of nominal shear, critical sections for shear, concept of Mohr circle; different failure modes in shear; Internal resisting mechanisms under shear

Analysis and Design for Torsion: Behaviour of reinforced concrete members subjected to Torsion, Design methods of Torsion, Difference between equilibrium and compatibility torsion; concepts behind the derivation of code equations; concept of equivalent shear and bending; design examples, Design for combined loading (Torsion + Bending + Shear)

UNIT-IV

Columns: Concept of effective length; short columns vs slender column, Effect of confinement, Derivation of axial compression and bending interaction curves, Design of slender columns; Design for biaxial bending

Serviceability Checks: Difference between short-term and long-term deflections; estimation of deflections, estimation of crack widths and shrinkage cracks, vibrations and fatigue

UNIT-V

Analysis and Design of Two-way Slabs: Difference between one way and two-way slabs; limitations of code coefficient method; direct design method; equivalent frame method; Yield line analysis of slabs, Design of two-way slabs with a commercial package and comparing results from direct Design and equivalent frame methods

Special Topics Part 1: Design of Shear Walls, Design of Curved beams, Moment redistribution in continuous beams; bond and development length, curtailment of reinforcing steel

REFERENCES:

- S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, 3rd Edition, 2009, Tata Mcgraw Hill

- Krishnam Raju, N. "Design of Reinforced Concrete Structures", 2 nd Edition, CBS Publishers and Distributors, New Delhi, 2007.
- Varghese P.C. "Advanced Reinforced Concrete Design", 2 ndEdition, Prentice - Hall of India, , 2008.
- Purushothaman P, "Reinforced Concrete Structural Elements", 3rd Edition, Tata Mc Graw- Hill Publishing Co, 2004.
- J. Wight and J.G. MacGregor, Reinforced Concrete - Mechanics & Design, 6th Edition, Prentice-Hall, 2011
- A Nilson, D Darwin, C Dolan Design of Concrete Structures, McGraw-Hill Education; 14 edition (16 August 2009), 816 pages.

Codes and Standards:

- 1. IS 456: 2000 — Plain and reinforced concrete – Code of practice (fourth revision)
- 2. SP 16: 1980 — Design Aids (for Reinforced Concrete) to IS 456: 1978.
- 3. IS 875 (Parts 1-5): 1987 — Code of practice for design loads (other than earthquake) for buildings and structures (second revision)
- 4. SP 24: 1983 — Explanatory Handbook on IS 456: 1978
- 5. SP 34: 1987 — Handbook on Concrete Reinforcement and Detailin

GEOTECHNICAL ENGINEERING

(PH2401204)SOIL DYNAMICS AND MACHINE FOUNDATIONS

UNIT-I

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

UNIT- II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of cyclically loaded soils, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils: An introduction and evaluation using simple methods.

UNIT-III

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

UNIT-IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines.
Vibration isolation and absorption techniques.

UNIT-V

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

REFERENCES:

1. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.
2. Arya, S. D, O'Neil, M. and Pincus, G.- Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1979.
3. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
4. Prakash, S. - Soil Dynamics, McGraw Hill, 1981.
5. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.

6. Richart, F. E. Hall J. R and Woods R. D. - Vibrations of Soils and Foundations,Prentice Hall Inc., 1970.
7. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publishing,1999.
8. Das, B. M. - Principles of Soil Dynamics, PWS KENT publishing Company,Boston

(PH2401205)SOIL- STRUCTURE INTERACTION

UNIT-I

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems, Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic-plastic behaviour, Time dependent behaviour. Idealized Soil Response Models for the Analysis of Soil – Foundation Interaction – Elastic Models for Soil Behaviour, Cointler model, Elastic Continuous Model, Two – Parametric Elastic Models – Elastic – Plastic and Time Dependent Behaviour of Soil Masses.

UNIT-II

Beam on Elastic Foundation- Soil Models: Infinite beam, Two-parameters models, Isotropic elastic half-space model, Analysis of beams of finite length, combined footings.Finite Beams on a Winkler Medium – Method of Initial Parameters – Method of Super Position – Strain Energy Method.

Plates on Elastic Continuum: Thin and thick rafts, Analysis of finite plates, Numericalanalysis of finite plates. Analysis of finite plates – Axi Symmetric Leading of a Circular Plate – Circular Plate Resting on a Winkler Medium – Circular Plate Resting on a Two –parameter elastic.

UNIT- III

Analysis of Axially and Laterally Loaded Piles and Pile Groups: Elastic analysis of singlepile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap, Load deflection prediction forlaterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile-raft system.

UNIT-IV

Reinforcement – Backfill Interaction in Reinforced Soil Structures

UNIT-V

Ground-Foundation-Structure Interaction: Effect of structure on ground-foundation interaction, Static and dynamic loads.

REFERENCES:

1. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction
2. Poulos, H. G., and Davis, E. H. - Pile Foundation Analysis and Design
3. Scott, R. F. - Foundation Analysis
4. Bowles, J. E. - Foundation Design & Analyses
5. Das, B. M. - Advanced Foundation Engineering.
6. Soil mechanics by TW Lambe & Whitmen.
7. Analytical and computer methods in foundation engineering, JE Bowles, McGraw Hill publications.
8. Foundation analysis and design, JE Bowles, McGraw Hill Publications.
9. Foundation analysis by RF Scott, Printice Hall
10. Hytenyi, Beams on Elastic Foundations – university of Michigan Press.
11. Elastic Analysis of soil – Foundation Interaction. APS Selvadurai – Elsevier
12. Vibration Analysis and Foundation Dynamics, NSV Kameswara Rao, WheelerPublishing, New Delhi

TRANSPORTATION ENGINEERING

(PH2401206)HIGHWAY CONSTRUCTION, QUALITY CONTROL AND MAINTENANCE

UNIT I COMPONENTS OF PAVEMENT

Subgrade system, functions, requirements and sequence of construction operations. Plants and equipment for production of materials - crushers, mixers, bituminous mixing plants, cement concrete mixers – various types, advantages and choice.

UNIT II CONSTRUCTION OF DRAINAGE

Drainage – Assessment of drainage requirements for the road and design of various components, drainage materials, Construction of surface and subsurface drainage system and design of filter materials for roads. Drainage for urban roads.

UNIT III CONSTRUCTION EQUIPMENTS

Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice Problem on equipment usage charges; Pre-construction surveys and marking on ground - Specifications and steps for the construction of road formation in embankment and cut, construction steps for granular sub-base, quality control tests.

UNIT IV PAVEMENT LAYERS AND SPECIFICATIONS

Different types of granular base course – WMM, CRM, WBM; specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses; their specifications (as per IRC and MORTH); construction method and quality control tests. Different types of sub-base and base course for cement concrete (CC) pavement and construction method. Construction of cement concrete (PQC) pavements joints quality control during construction. Construction details of interlocking concrete block pavements

UNIT V QUALITY CONTROL AND MAINTENANCE

Principle of construction planning, application of CPM and PERT(Problems not included) Road maintenance works – day to day and periodic maintenance works of various components of road works and road furniture. Preparation of existing pavement – patching, profile correction, Special measures to deal with reflection cracks in pavement layers, slipperiness of surface, etc. Special problems in construction & maintenance of hill roads, land slide, causes, investigation, and preventive and remedial measures, protection of embankment and cut slopes.

REFERENCES

1. Peurifoy, R.L., and Clifford,JS ―Construction Planning Equipment and Method- McGraw Hill Book Co. Inc.
2. Sharma S.C., "Construction Equipment and its Management- Khanna Publishers
3. Freddy L Roberts, Prithvi S Kandhal et al, ―Hot Mix Asphalt Materials, mixture design and construction- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.
4. National Asphalt Pavement Association ―Hot Mix Asphalt Paving Hand book- 5100 Forbes Boulevard, Lanhm, Mary Land, USA
5. "Hand Book on Cement Concrete Roads"- Cement Manufacturers Association, New Delhi
6. MoRTH ―Specifications for Roads and Bridge Works‖ - 2001,fourth revision, Indian Roads Congress
7. MoRTH ―Manual for Maintenance of Roads"- 1989, Indian Roads Congress
8. IRC: 42-1994, IRC:15-2002, IRC SP :11-1988, , 55-2001, 57-2001,58-2001, IRC 19-1977, 27-1967, 29-1988, 34-1970, 36-1970,48-1972,61-1976, 63-1976, 68-1976, 81-1997,82-1982, 84-1983,93-1985, 94-1986, 95-1987, 98-1997, 105-1988.

(PH2401207)PAVEMENT MATERIALS

UNIT I

PROPERTIES OF SUBGRADE SOIL AND AGGREGATES

Subgrade soil – Soil composition and structure – Soil classification for engineering purposes - Origin, Classification, requirements, properties and tests on road aggregates

UNIT II

PROPERTIES OF BITUMEN

Origin, preparation, properties and tests, constitution of bituminous road binders, requirements – Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests.

UNIT III

CHARACTERISTIC OF BITUMINOUS MIXES

Bituminous Mixes: Mechanical properties – Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes.

UNIT IV

DESIGN OF BITUMINOUS MIX

Weathering and Durability of Bituminous Materials and Mixes – Performance based Bitumen Specifications – Super pave mix design method.

UNIT V

DESIGN OF CEMENT CONCRETE MIX

Cement Concrete for Pavement Construction: Requirements, design of mix for CC pavement, joint filler and sealer materials.

REFERENCE BOOKS

1. Alkins and Harold, “Highway Material” , Prentice Hall, Pearson, 2003
2. Kerbs and Walkes, “Highway Materials”, McGraw Hill Book Co.2007
3. IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988.

WATER RESOURCES ENGINEERING

(PH2401208)OPEN CHANNEL HYDRAULICS AND SEDIMENT TRANSPORT

UNIT I

Basic Concepts of Free Surface Flow: Flow Regimes, Velocity and Pressure Distribution, Energy Principles and its applications, Specific Energy, Critical Flow Computations, Momentum Equation and its Applications, Specific force Diagram, theoretical Concepts of Surface Roughness, Velocity Equation, Uniform Flow Computation.

UNIT II

Steady Gradually Varied Flow: Dynamic Equation, Characteristics of Flow Profile and Methods of Computation, Practical Problems, Gradually Varied Flow Analysis and Computation.

UNIT III

Steady Rapidly Varied Flow: Hydraulic Jump Analysis and Location, Jump in Sloping Channels and Oblique Jump. Unsteady Rapidly Varied Flow: Dam Break Problem, Moving Hydraulic Jump, Positive and Negative Surges.

UNIT IV

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 Load and Total Load. Design of stable Channels: Regime and Tractive force Methods.

UNIT V

Sediment Transport Modelling in rivers – 1D, 2D and 3D models

REFERENCE BOOKS:

1. Chow, . V.T. (1979) “Open Channel Hydraulics”, Mc Graw Hill Inc. N York.
2. Subramanya, K (1996) “Flow in Open Channels”, Tata Mc Graw Hill Pub., 1995.
3. Pasquali, D. (Ed.). (2022). Modeling of Sediment Transport. IntechOpen. doi: 10.5772/intechopen.97911

1. Chaudhry M.H. (1994), "Open –Channel Flow", Prentice Hall of India, N Delhi
2. French, R.H.(1986), "Open Channel Hydraulics", Mc Graw Hill Pub Co., N York.
3. Garde and Ranga Raju, K.G. (1980): "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern, N Delhi

ENVIRONMENTAL ENGINEERING

(PH2401209)SOLID & HAZARDOUS WASTE MANAGEMENT

UNIT I

Solid Waste Collection, Segregation and Transport:

Definition of solid wastes – types of solid wastes – Sources - Industrial, mining, agriculturaland domestic – Characteristics. Solid waste Problems - impact on environmental health – Concepts of waste reduction, recycling and reuse. Handling and segregation of wastes at source. Collection and storage of municipal solid wastes; Analysis of Collection systems.Transfer stations.

UNIT II

Municipal Solid Waste Management:

Solid waste processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery: composting, vermi- composting, termi-gradation, fermentation. Incineration of solid wastes. Disposal in landfills: site selection, design, and operation of sanitary landfills; Leachate and landfill gas management; landfill closure and post-closure environmental monitoring; landfill remediation. Regulatory aspects of municipal solid waste management.

UNIT III

Hazardous Wastes:

Hazardous waste definition. Physical and biological routes of transport of hazardous substances – sources and characterization categories and control. Sampling and analysis ofhazardous wastes –

analytical approach for hazardous waste characterization – proximate analysis – surveyanalysis – directed analysis – analytical methods.

UNIT IV

Hazardous Wastes Management:

Sources and characteristics: handling, collection, storage and transport, TSDF concept.Hazardous Waste treatment technologies - Physical, chemical and thermal treatment of hazardous waste: solidification, chemical fixation, encapsulation, pyrolysis and incineration. Hazardous waste landfills - Site selections, design and operation. Hazardous waste reduction and Recycling - Regulatory aspects of HWM.

UNIT V

Biomedical, Radioactive and e-Waste Management:

Biomedical waste: Definition, sources, classification, collection, segregation Treatment and disposal.

Radioactive waste: Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB. Waste characteristics, generation, collection, transport and disposal.

REFERENCE BOOKS:

1. Hazardous waste management by Prof. Y. Anjaneyulu.
2. Hazardous waste management Charles A. Wentz. Second edition 1995. McGraw Hill
3. International.
4. Integrated solid waste management, George Tchobanoglous, Hilary Theisen & Sammuel A. Vigil.
5. Criteria for hazardous waste landfills – CPCB guidelines 2000.
6. Environmental Science by Daniel B. Botkin and Edward A. Keller, Wiley student, 6th edition-2009.

(PH2401210)AIR POLLUTION AND CONTROL TECHNOLOGIES

UNIT I

Classification and properties of air pollutants:
Emission sources -major emissions from Global sources -importance of anthropogenic sources- behaviour and fate of air pollutants- photochemical smog-effects of air pollution- health, vegetation and materials damage in India-air pollution standards - Isolation and heat balance of the atmosphere – different types of terrain – effects of terrain features on atmosphere – mechanical and thermal turbulence- Indoor air pollution.

UNIT II
Meteorological aspects of air pollution dispersions:

Temperature lapse Rates and Stability-wind velocity and turbulence-Plume behaviour dispersion of air pollutants- solutions to the atmospheric dispersion equation - the GaussianPlume Model.

UNIT III

Air pollution sampling and measurement: Types of pollutant sampling and measurement - Ambient air sampling - collection of gaseous air pollutants - collection of particulate pollutants - stack sampling, analysis of air pollutants - sulfur dioxide - nitrogen dioxide, carbon monoxide, oxidants and ozone - hydrocarbons - particulate matter.

UNIT IV
Control methods:

Sources- correction methods - particulate emission control - gravitational settling chambers - cyclone separators- fabric filters - electrostatic precipitators - wet scrubbers - control of gaseous emissions - adsorption by solids - absorption by liquids - combustion, condensation –control of SO2 emission – desulphurization of flue gases – dry methods – wet scrubbing methods. Control of sulphur dioxide emission - desulphurization of flue gases - dry methods- wet scrubbing methods - control of nitrogen oxides - modification of operating conditions - modification of design conditions - effluent gas treatment methods - carbon monoxide control
- control of hydrocarbons - mobile sources.

UNIT V
Air pollution from specific industries:

Portland cement plants – steel mills – petroleum refineries
Vehicular air pollution:

Genesis of Vehicular emissions-Natural Pollution - Gasification of Vehicles - Point sources of

Air Pollution from automobiles - Fuel tank, carburettor, crank case - Exhaust emissions - Mechanism of Origin of air pollution from automobiles. Automobile air pollution – Indian Scenario - Population and pollution loads of vehicles - Automobile Pollution Control - Control at sources - Exhaust gas treatment devices - Alternate fuels comparison - Thermal Reactor - Catalytic Converter - Automobile Emission Control - Legal measures.

REFERENCE BOOKS:

Air Pollution, H.C.V. Rao, 1990, McGraw Hill Co.
Environmental Pollution Control, C.S.Rao, Wiley Eastern Ltd., 1993 Air Pollution, M.N. Rao McGraw Hill 1993.

Fundamentals of Air Pollution, Samuel, J.W., 1971, Addison Wesley Publishing Co. Air Pollution, Kudesia, V.P. International Student Edition McGraw Hill - KosakushaLtd.,Tokyo.
Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand & CompanyLtd., 1994

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

(PH2401211)REMOTE SENSING AND GIS FOR URBAN PLANNING AND MANAGEMENT

UNIT I : Introduction : Remote sensing for detection of urban features – Scale and resolution – Scope and limitations – Interpretation from Aerial and satellite images – Digital image processing techniques – Image fusion.

UNIT II: Settlement Mapping : Classification and settlement – settlement structure – Segmentation of Built-up areas – Classification algorithms – Land use/ Land cover mapping – change detection – high resolution remote sensing.

UNIT III: Analysis and Planning : Urban morphology – Housing typology – Population estimation from remote sensing – Infrastructure demand analysis – Urban renewal Land suitability analysis – Plan formulation – Regional, Master and detailed development – Use of remote sensing and GIS in plan preparation – Urban information system – Web GIS

Unit IV: Transportation Planning : Mapping transportation network – Classification – Optimum route/ shortest route – Alignment planning – Traffic and parking studies – Accident analysis.

UNIT V : Current Trends : Urban growth modeling – Expert systems in planning – 3D city models – ALTM – Land use Transportation interaction models – Intelligent transportation systems .

REFERENCES: 1. Juliana Maantay, John Ziegler, John Pickles, GIS for the Urban Environment, Esri Press 2006. 2. Allan Brimicombe, GIS Environmental Modeling and Engineering, CRC; 1 edition 2003. 3. Paul Longley, Michael Batty, Spatial Analysis: Modeling in a GIS Environment Wiley,1997. 4. Michael F. Goodchild, Louis T. Steyaert , Bradley O. Parks, Carol Johnston, David Maidment, Michael Crane , Sandi Glendinning, GIS and Environmental Modeling: Progress and Research Issues (Hardcover) by,Publisher: Wiley; 1 edition, 1996. 5. Roland Fletcher, The Limits of Settlement Growth: A Theoretical Outline (New)

GENERAL CIVIL ENGINEERING

(PH2401212)APPLICATIONS OF SOFT COMPUTING TECHNIQUES

UNIT-1 Information and uncertainty, Chance versus ambiguity, Classical sets and fuzzy sets, Logic and reasoning,

UNIT-2 Fuzzy set operations and fuzzy relations, Membership Functions.

UNIT-3 Fuzzy Systems, Decision Making with Fuzzy Information. Fuzzy Classification and Pattern Recognition.

UNIT-4 Artificial Neural Networks (ANN), Types of ANN, Learning algorithms

UNIT-5 Neuro-Fuzzy Systems, Applications in Civil Engineering.

REFERENCES :

1. Haykin (2008), "Neural Networks: A Comprehensive Foundation", Prentice Hall India, New Delhi

2. Rajasekaran S., and Vijayalakshmi Pai G.A. (2003), Nueral Neworks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications, Prentice-Hall India, New Delhi

1. Jang, J.R., Sun Chuen-tsai, and Mizutani Eiji, (2009), "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", PHI Learning