ELECTIVES (VI Semester)

CE352 GROUND WATER HYDROLOGY

Groundwater occurrence – distribution – aquifer – types - Surface investigation - Geophysical - electrical resistivity - Seismic refraction - Gravity and magnetic - Geologic - Air photo interpretation - Dowsing.
Subsurface investigation - test drilling - resistivity logging- potential logging - temperature and caliper logging.
Steady unidirectional flow - well in a uniform flow - steady flow with uniform recharge - unsteady radial flow to a well - well flow near aquifer boundaries - Multiple well systems - partially penetrating wells - characteristic well losses.
Secular and seasonal variations - Fluctuations due to evapo-transpiration, Meteorological phenomena, tides, external loads and earthquakes - control by drains and wells.
Recharge through sewage pits, shafts and wells.
Occurrence of sea water intrusion - Ghypon-Heizberg relation between fresh and saline waters - shape length and structure of the fresh salt water interface - prevention and control of seawater intrusion - role of sea water in ground water - coastal zoning.
Sand models - Electrical models - Viscous fluid models - membrane models - numerical analysis methods

References

1. Raghunath H.M., Ground Water Hydrology, New-Age International, 2nd Edition, 1990.

AR451   URBAN AND REGIONAL PLANNING

Urban Development Policies And Strategies - Definition and classification of urban areas - Trend of urbanisation - District, state, national and international urbanisation levels - Impact on regional and national development - Social systems and its impact on urban planning - Slums in Indian cities - Indicators of urbanisation - Historical development of urban settlements - Impact of technology on urban settlements - National policies related to urban development.
Planning process - urban and regional plansGoals, objectives, and strategies - Planning process - Delineation of planning areas - Different types of plans - Regional plan - Master plan - Structure plan - Detailed development plan - Preparation of plans - Surveys and analysis - Principles of sustainable development - Formulation of sectorial projects - Sites and services - Neighbourhoods - regional planning.
Land use planning - land use and its interaction - Residential planning - importance of housing - Industrial and commercial land use - community facilities - educational system - recreational system - utility system - public buildings - Urban renewal and their application - community improvement - Slum improvement programmes - Preparation of profile - Preparation of action plans.
Plan evaluation - Principles of economic and financial evaluation techniques - cost benefit studies - Cash flow analysis.
Plan implementation Institutional arrangement - Financing - Public, private, non-governmental organisations and community collaboration - Subsidy - Recovery - Replicability - Development control regulations - Planning and building construction permission - Development charges - Town and Country Planning Act - building bye-laws.

References

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta, McGraw-Hill, New York, 1974.
2. Claire, Hand Book of Urban Planning, Van Nostrand Book Company, 1974.
3. Gallian, B. Arthur and Simon Eisner, The Urban Pattern - City Planning and Design, Affiliated Press Pvt. Ltd., New Delhi, 1985.
4. Margaret Roberts, An Introduction to Town Planning Techniques, Hutchinson, London, 1980.
5. Hiraskar,G.K., Fundamentals of Town Planning, Dhanpat Rai Publications, 1992.

MA302 OPERATIONS RESEARCH TECHNIQUES IN CIVIL ENGINEERING

Inventory with uniform demand with finite rate of replenishment without and with shortage - Buffer stock - Price break
Queuing Theory - M/M/1 and M/M/C models with infinite and finite waiting space.
Dynamic programming - Principle of optimality - recursive equation approach - application to allocation shortest path and production schedule - Sequencing - Johnson's algorithm - n jobs through 2 machines, n jobs through m machines, 2 jobs through 2 machines.
Replacement problem - Present worth factor - Group replacement - Nonlinear programming - Lagrange's multiplier's method - Kuhn-Tucker's condition - Quadratic programming - Wolfe's method.

References

1. Taha, H.A., Operations Research: An Introduction, Prentice Hall of India, New Delhi, 2003.

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Elective (VII Semester)

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CE451 EXPERIMENTAL STRESS ANALYSIS

Strain gauges – Mechanical, optical, acoustic, electrical inductance and capacitance pneumatic types – description and working principles
Electrical resistance strain gauges, gauge characteristics and types – Equipment for recording static strain – reduction of strain gauge data. Load, pressure and displacement transducers.
Model analysis – direct and indirect models – law of structural similitude – choice of scales – Model materials – limitations of model studies –Buckingham PI theorem – design of direct and indirect models – Beggs deformeter and its applications.
Two dimensional photo – elasticity – optical principles stress optic law – Methods of producing isoclines and isochromatics using polariscopes – Methods of measuring fractional fringe orders – model materials – separation techniques
Fundamental of Photo elastic coatings, Moire fringe and brittle coating techniques – Introduction to stress freezing techniques – Introduction to non-destructive testings

References

1. Daley and Riley, Experimental Stress Analysis, McGraw Hill Book Company, 1987
2. Srinath, L.S. et al., Experimental Stress Analysis, Tata McGraw Hill 1984.
3. Hetenyi, M., Hand Book of Experimental Stress Analysis, John Wiley & Sons. Inc New York. 1980.

CE453 GIS and REMOTE SENSING

History and development of GIS, Hardware requirement, System concepts, Coordinate systems - Type of data - Spatial and non - spatial data, Vector and raster, Files and data formats, Data compression

Spatial analysis, Data retrieval, Query, Overlay, Vector and Raster data analysis, Digital Elevation Model - Sources of errors, Types of errors - Elimination – Accuracy

Concepts and foundations of remote sensing- electromagnetic spectrum, spectral signatures, remote sensing systems - Remote sensing platforms and sensors - Satellite system parameters, sensor parameters - Visual Image Interpretation - Digital Image Processing

Applications of GIS and remote sensing in survey, mapping, natural resources management, land use and transportation planning, water resources engineering and environment.

Intelligent Transportation Systems - Global Positioning System - Vehicle Tracking - Area Traffic Control - Automatic Toll Collection - Commercial Vehicle Operation - Traveller Information System

References

1. Burrough P.A., and Rachacl A. McDonnell Principles of Geographical Information Systems, Oxford Publication, 2004.
2. CP. Lo, Albert K. W. Yeung, Concepts and Techniques of Geographical Information System, Prentice Hall of India, 2006.
3. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, 2003.

CE455 HYDROLOGY

Precipitation circulation - temperature - Humidity – wind formation and forms of precipitation - Interpretation of precipitation data - snow cover and snow fall. Factors affecting and methods of determining evaporation, infiltration and evapotranspiration- Run-off cycle - factors affecting run-off - estimation of run-off by stream gauging - stage - discharge rating curves - Selection of site for a stream gauge station.

Derivation of unit hydrograph from complex storms - unit hydrographs for various duration - Synthetic unit hydrograph - Transposing unit hydrograph - Application of the unit hydrograph. Linear Regression - Statistical and probability analysis of hydrological data - Flood frequency probability and stochastic methods - Basics of Stochastic and Deterministic models.

References

1. Ragunath, H.M., Hydrology, Wiley Eastern, 1990.

ELECTIVES (VIII Semester)

CE452 EARTHQUAKE RESISTANT STRUCTURES

Elements of Engineering Seismology - Theory of Vibrations -Indian Seismicity -Earthquake History - Behaviour of structures in the past Earthquakes.

Seismic Design Concepts - Cyclic loading behaviour of RC, Steel and Prestressed Concrete elements - Response Spectrum- Design spectrum - capacity based design.

Provision of Seismic Code frames, shear walls, Braced frames, Combinations - Torsion.
Performance of Regular Buildings 3D Computer Analysis of Building Systems (Theory only) - Design and Detailing of frames - Shear walls and Frame walls.
Seismic performance - Irregular Buildings -Soil performance, Modern Concepts - Base Isolation - Adoptive systems - Case studies.

References

1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice- Hall of India, New Delhi, 2003.
2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

CE454 ADVANCED FOUNDATION ENGINEERING

Sheet pile structures - cantilever sheet pile walls in granular and cohesive soils - Anchored bulk heads - Free earth support and fixed earth support methods - Anchors.
Cofferdams - types - cellular cofferdam - uses - Design by TVA and Cumming's method.
Well foundations - Types of caissons - Analysis of well foundations - determination of scourdepth - steining thickness - well sinking.
Foundations subjected to vibrations - elements of vibrations - Free, damped, free and forced vibrations - Design criteria - Pauw's analogy - IS Code of practice for impact and reciprocating machines.
Foundation drainage and water proofing - Dewatering well points system, sand drains.
Foundations in expansive soils - Mechanism - factors influencing swelling - Use of Geosynthetics.
Stability analysis of slopes - infinite slopes in sand and clays - finite slope - Swedish circle - stability of earth dam slope during steady and sudden draw down - friction circle method - Taylor's stability number. Sheet pile structures - Anchored bulk heads

References

1. Bowles, J.E., Foundation Analysis and Design, McGraw Hill., 1996.
2. Braja M. Das, Principles of Foundation Engineering, Thomos Asia Pvt. Ltd., Singapore, 2005.
3. Shamsher Prakash, Soil Dynamics, McGraw - Hill Book Company, 1985.

CE456 WATER POWER ENGINEERING

Source of energy – Statistics of power - hydro power estimation of water power potential - mini and pumped storage plant - cost and value of water power.
Mini and Pumped storage plants- Penstocks - types and design criteria - anchor blocks - conduit valves - bends and manifolds - water hammer - Intakes - canals - forebay - trash rack tunnels - surge tank - power plant operation- surface and sub surface power stations.
Description and function of various hydraulic, electrical and mechanical equipment - power plant operation pertaining to base load and peak load
Principles included in the planning of a surface and sub surface power stations.
Elementary treatment of the principles involved in tidal power.

References

1. Barrows, H.K., Water Power Engineering, McGraw Hill, 1990.

CE458 FINITE ELEMENT METHOD

Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases - Principle of stationary potential energy - application to finite element methods - Some numerical techniques in finite element Analysis

Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

Assemblage of elements – Direct stiffness method. Special characteristics of stiffness matrix - Boundary condition & reaction - Gauss elimination and LDLT decomposition. Basic steps in finite element anlaysis.

Analysis of framed Structures: 2D – truss element - 2D - beam element. Analysis of plate bending- displacement functions - plate bending Elements. Plane stress and plane strain analysis: Triangular elements - Rectangular elements

References

1. Krishnamoorthy, C.S, Finite Element Analysis Theory & Programming, McGraw- Hill, 1995.
2. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated East west Press Pvt. Ltd. New Delhi 2000.

CE460 TRANSPORTATION PLANNING

Transportation Planning Process and Concepts- Role of transportation - Transportation problems - Urban travel characteristics - Concept of travel demand - Demand function - demand estimation - Sequential, recursive and simultaneous processes

Trip Generation Analysis - Zoning - Types and sources of data - Expansion factors - Accuracy checks - Trip generation models - Zonal models - Household models - Category analysis - Trip attractions of work centers.

Trip Distribution Analysis - Trip distribution models - Growth factor models - Gravity models - Opportunity models.

Mode Split Analysis - Mode split Models - Mode choice behaviour, Competing modes, Mode split curves, Probabilistic models.

Traffic Assignment - Route split analysis: Elements of transportation networks, Nodes and links - minimum path trees - all-or-nothing assignment - Multipath assignment - Capacity restraint.

References

1. Hutchinson B.G., Principles of Urban Transportation System Planning, McGraw Hill, 2007.
2. Bruton M.J., Introduction to Transportation Planning, Hutchinson, London, 1992.
3. C. Jotin Khisty, B. Kent Lall, Transportation Engineering, Prentice Hall of India, 2002.

ELECTIVES (To be substituted whenever needed)

1. STRUCTURAL DYNAMICS

Dynamic analysis - Elements of vibratory systems and simple Harmonic Motion- Mathematical models of SDOF systems - Principle of Virtual displacements - Evaluation of damping resonance.

Fourier series expression for loading - (blast or earthquake) - Duhamel's integral - Numerical evaluation - Expression for generalised system properties - vibration analysis Rayleigh's method - Rayleigh - Ritz method.

Differential equation of motion - Beam flexure including shear deformation and rotatory inertia - Vibration analysis using finite element method for beams and frames

Evaluation of structural property matrices - Natural vibration - Solution of the eigen value problem - Iteration due to Holzer and Stodola

Idealisation of multi-storeyed frames - analysis to blast loading - Deterministic analysis of earthquake response - lumped SDOF system - Design of earthquake resistant structures.

References

1. Mario Paz, Structural Dynamics, CBS, Publishers, 1987.
2. Roy R Craig, Jr., Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chpora "Dynamics of Structures Theory and Application to Earthquake Engineering" Pcarson Education, 2001.

2. MODELS FOR AIR AND WATER QUALITY

Introduction to Mathematical Models: Modeling approaches to water quality - classification of models

Mathematical models for water quality - model development, calibration and verification - cost: benefit analysis using models, Model requirements and limitations. D.O. Models for Streams: Dissolved oxygen model for streams - sources and sinks of dissolved oxygen

Estimation of system parameters - Streeter - Phelps model - oxygen 'sag' curve - determination of deoxygenation and reaeration coefficients - Benthal oxygen demand - mass transport mechanisms - Advective and diffusive mass transport

Models by O'connor, Dobbins and Thomann. Models for Estuary and Lakes: Physical chemical and biological processes in estuaries - water quality distribution in estuaries - modeling estuaries and lakes for water quality - temperature models for lakes and rivers

Models for microorganisms decay, nitrogen and phytoplankton. Air quality models: Micrometeorological processes, wind rose, dispersion, coefficients and stability classes, Gaussian and dispersion model, Regional air quality models,

References

1. Chapra, Steven C., "Surface water quality modeling", McGraw Hill Book Company, New York, 1997.
2. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Prentice Hall, 1998.

3. PAVEMENT ANALYSIS AND DESIGN

Pavements - Types and Component - Factors affecting Design and Performance of Pavements, Comparison between Highway and Airport pavements - Functions and Significance of Sub grade properties
Stresses in Flexible Pavements - Stresses and Deflections in Homogeneous Masses - Burmister's 2-layer, 3-layer Theories - Wheel Load Stresses, ESWL of Multiple Wheels Repeated Loads and EWL factors
Flexible Pavement Design - Empirical - Semi-empirical and Theoretical Approaches; Principles and procedure, design, Advantages and Applications of different Pavement Design Methods - Stresses in Rigid pavements - Types of Stresses and Causes - Factors influencing the Stresses, General conditions in Rigid Pavement Analysis, ESWL, Wheel Load Stresses, Warping Stresses, Friction Stresses, Combined Stresses
Rigid Pavement Design - Types of Joints in Cement Concrete Pavements and their Functions, Joint Spacings, Design of Slab Thickness, Design of Joint Details for Longitudinal Joints, Contraction Joints and Expansion Joints, IRC Method of Design

References

1. Yoder and Witezak, Principles of pavement design, John Wiley and sons, 1975
2. Yang, Design of functional pavements, Mc Graw -Hill, 2004.
3. IRC: 58 - 2002, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways
4. IRC:37 - 2001, Guidelines for the Design of Flexible Pavements