

**ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

CIVIL ENGINEERING

FOR

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for batches admitted from 2010-2011)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India



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CIVIL ENGINEERING
COURSE STRUCTURE

IV YEAR		II SEMESTER		
S. No.	Subject	T	P	Credits
1	Estimation, Specifications & Contracts	4	-	4
2	ELECTIVE – II a) Advanced Structural Design b) Ground Water Development and Management c) Environmental Impact Assessment and Management d) Quality Control and Quality Assurance	4	-	4
3	ELECTIVE – III a) Water Shed Management b) Finite Element Method c) Pavement Analysis and Design	4	-	4
4	ELECTIVE – IV a) Soil Dynamics and Machine Foundations b) Advanced Structural Analysis c) Water Resources System Planning and Management	4	-	4
5	Project Work	4	-	12
	Total			28



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IV Year B.Tech. Civil Engineering. II-Sem.

ESTIMATING, SPECIFICATION AND CONTRACTS

PART-A

UNIT – I

General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT – II

Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT-III

Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT – IV

Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings.

UNIT – V

Standard specifications for different items of building construction.

PART-B

Detailed Estimates of Buildings using individual wall method & centre line method.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of part A and Part B. Part-A should consist of five questions and design out of which three are to be answered. Part -B consists of two questions and out of which one question is to be answered. Weightage for part –A is 60% and part –B is 40%

TEXT BOOKS

1. Estimating and Costing by B.N. Dutta, UBS publishers, 2000.
2. Estimating and Costing by G.S. Birdie

REFERENCE BOOKS:

1. Standard Schedule of rates and standard data book by public works department.
2. I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)
3. Estimation, Costing and Specifications by M. Chakraborti; Laxmi publications.
4. National Building Code



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**ADVANCED STRUCTURAL DESIGN
(ELECTIVE –II)**

UNIT – I

Design of Retaining walls, cantilever and counter fort

UNIT – II

Design of RCC water tanks, Circular and rectangular types.

UNIT – III

Design of steel water tanks

UNIT - IV

Introduction to bunkers, silos and Chimney, concepts of loading and Design.

UNIT – V

Introduction to concrete bridges, IRC loading, slab bridges and T - beam bridges design concepts.

UNIT – VI

Design of plate girder railway bridges and gantry girders.

UNIT – VII

Design of steel truss bridges for railway loading

UNIT – VIII

Multistory building system – detailing for Ductility, Design for earthquake and wind forces.

TEXT BOOKS:

1. Advanced Reinforced concrete structures by Varghese, Prentice Hall India.Pvt. Ltd.
2. Design drawing of concrete and steel structures by N.Krishna Raju University Press 2005.
3. Reinforced concrete structures Vol-2 by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

REFERENCE BOOKS:

1. Essentials of Bridge Engineering by D.Johnson Victor, Oxford and IBM publication Co., Pvt. Ltd.
2. Reinforced concrete design by S.U,Pillai and D.Menon, Tata Mc.Ghrawhill Publishing Company

Codes: Relevant IS: codes.



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**GROUND WATER DEVELOPMENT AND MANAGEMENT
(ELECTIVE –II)**

UNIT – I

Introduction

Ground Water Occurrence, formation properties affecting Ground water-porosity, Specific yield and Specific retention, permeability, transmissivity and storage coefficient. differential equation governing ground water flow

UNIT – II

Well Hydraulics

Unsteady radial flow into a well – Non-equilibrium equations – Theis solution – Jacob and Chow's methods, Leaky aquifers.

UNIT – III

Geophysics

Surface and Subsurface Investigations: Surface methods of exploration – Electrical resistivity and Seismic refraction methods, Sub-surface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications

UNIT – IV

Well Design

Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery

UNIT V

Well Construction and Development

Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT VI

Artificial Recharge

Artificial Recharge of Ground Water: Concept of artificial recharge, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge

UNIT – VII

Seawater Intrusion

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion.

UNIT – VIII

Groundwater Basin Management

Concepts-hydrologic equilibrium equation, basin management by conjunctive use.

TEXT BOOKS:

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
2. Groundwater by H.M.Raghunath, Wiley Eastern Ltd.
3. Ground water assessment and development by KR Karanth

REFERENCE BOOKS:

1. Groundwater by Bower, John Wiley & sons.
2. Groundwater Syatem Planning & Managemnet – R.Willes & W.W.G.Yeh, Printice Hall.
3. Applied Hydrogeology by C.W.Fetta, CBS Publishers & Distributers.



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IV Year B.Tech. Civil Engineering. II-Sem.

**ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT
(ELECTIVE –II)**

UNIT – I

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

UNIT – II

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

UNIT – III

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives.

UNIT-IV

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT – V

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

UNIT – VI

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT-VII

Post Audit activities, The Environmental pollution Act, The water Act, The Air (Prevention & Control of pollution Act.), Mota Act, Wild life Act.

UNIT-VIII

Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, KAKINADA.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers

REFERENCE BOOKS:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katania & Sons Publication., New Delhi.
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi.



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QUALITY CONTROL AND QUALITY ASSURANCE
(ELECTIVE –II)



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**WATER SHED MANAGEMENT
(ELECTIVE –III)**

UNIT-I

INTRODUCTION: Concept of watershed development, objectives of watershed development, need for watershed development in India, Integrated and multidisciplinary approach for watershed management.

UNIT-II

CHARACTERISTICS OF WATERSHED: size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

UNIT-III

PRINCIPLES OF EROSION: Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation.

UNIT-IV

MEASURES TO CONTROL EROSION: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rockfill dams, brushwood dam, Gabion.

UNIT-V

WATER HARVESTING: Rainwater Harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks.

UNIT-VI

LAND MANAGEMENT: Land use and Land capability classification, management of forest, agricultural, grassland and wild land. Reclamation of saline and alkaline soils.

UNIT-VII

ECOSYSTEM MANAGEMENT: Role of Ecosystem, crop husbandry, soil enrichment, inter, mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, horticulture, social forestry and afforestation.

UNIT-VIII

Planning of watershed management activities, people's participation, preparation of action plan, administrative requirements.

TEXT BOOKS:

1. Watershed Management by JVS Murthy, - New Age International Publishers.
2. Water Resource Engineering by R.Awurbs and WP James, - Prentice Hall Publishers.

REFERENCE BOOKS:

1. Land and Water Management by VVN Murthy, - Kalyani Publications.
2. Irrigation and Water Management by D.K.Majumdar, Printice Hall of India.



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IV Year B.Tech. Civil Engineering. II-Sem.

**FINITE ELEMENT METHODS
(ELECTIVE –III)**

UNIT -I

Introduction: Concepts of FEM, Steps involved, merits & demerits, energy principles, discretization, Rayleigh –Ritz method of functional approximation.

UNIT -II

Principles of Elasticity: Equilibrium equations, strain displacement relationships, constitutive relationships for plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT -III

One Dimensional Elements: Stiffness matrix for bar element, shape functions for one dimensional elements, one dimensional problems.

UNIT –IV

Two Dimensional Elements: Different types of elements for plane stress and plane strain analysis, Displacement formulation, generalized coordinates, shape functions, convergent and compatibility requirements, geometric invariance, Natural coordinate system, area and volume coordinates, generation of element stiffness matrix and nodal load vector for 3-node triangular element and four node rectangular elements.

UNIT –V

Finite element formulation for Beams: Stiffness matrix, load vector, comparison of FE solution to exact solution.

UNIT –VI

Isoparametric formulation – Concepts of, isoparametric elements for 2D analysis -formulation of CST element, 4 –noded and 8-noded iso-parametric quadrilateral elements –Lagrangian and Serendipity elements.

UNIT-VII

Axi-symmetric analysis- Basic principles-Formulation of 4-node iso-parametric axi-symmetric element

UNIT-VIII

Solution Techniques: Numerical Integration using Gauss quadrature, static condensation, assembly of elements and solution techniques for static loads.

TEXT BOOK:

1. Finite Elements Methods in Engineering by Tirupati.R. Chandrupatla and AshokD. Belegundu - Pearson Education Publications.
2. A first course in the Finite element method by Daryl L. Logan, Cengage learning India

REFERENCE BOOKS:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E.Plesha. John Wiley & Sons.
2. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers.
3. Text book of Finite Element analysis by P.Seshu – Prentice Hall of India.



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IV Year B.Tech. Civil Engineering. II-Sem.

**PAVEMENT ANALYSIS AND DESIGN
(ELECTIVE –III)**

UNIT – I

MATERIAL SPECIFICATIONS:

Types of pavement Construction –MORTH specifications for construction of GRAVEL ROADS, WBM layers, bituminous pavement layers, CC pavements.

UNIT – II

PAVEMENT FAILURES

Causes of pavement failures – failures in flexible pavements – alligator cracking – consolidation of pavement failures – shear failure – longitudinal cracking – frost heaving – reflection cracking – formation of waves and corrugation.

FAILURES IN CEMENT CONCRETE PAVEMENTS: factors – scaling of cement concrete – shrinkage cracks – spalling of joints – warping cracks – mud pumping – structural cracking.

UNIT – III

MAINTENANCE OF HIGHWAYS:

Routine maintenance – periodic maintenance – special repairs – maintenance of earth roads – maintenance of WBM roads – maintenance of bituminous surfaces – special repairs in flexible pavements – maintenance CC roads – special repairs of CC pavements.

UNIT – IV

PAVEMENT EVALUATION:

Evaluation of pavement surface condition – pavement surface index – cracking – pot holes – rut depth etc... – **STRUCTURAL EVALUATION OF PAVEMENTS:** methods evaluation – static loading – Benkelman beam method – falling weight deflection (FWD) – impulse loading – dynamic cone penetration (DCP).

UNIT – V

STRENGTHENING OF EXISTING PAVEMENTS

Objectives – types of overlay – Design of overlay – flexible overlay over flexible pavement – Overlay design by Benkelman beam deflection studies – Rigid overlay over rigid pavement – Flexible overlay over rigid pavement – Rigid overlay over flexible pavement.

UNIT – VI

HIGHWAY DRAINAGE

Importance of highway drainage – requirements of highway drainage system – surface drainage – design of surface drainage system n- cross drainage – subsurface drainage – lowering of water table – control of seepage flow – control of capillary rise – design of subsurface drainage system.

UNIT – VII

PAVEMENT MANAGEMENT SYSTEM (PMS)

Need for PMS – Pavement deterioration models – HDM – Project level and network level management.

UNIT – VIII

ASSET MANAGEMENT (AM)

Need for AM – Concepts – Network management – Traffic management – safety management – Bridge management.

TEXT BOOKS:

1. Highway Engineering – S.K.Khanna & C.E.J.Justo, New chand & Bros., Roorke.
2. Text book of highway engineering, R. Srinivasa kumar, Universities press pvt. Ltd. 2011.
3. Highway engineering – LR Kadiyali and lal – khanna publishers.

REFERENCE BOOKS:

1. Highway engineering, Paul H. wright and Karen Dixon – John wiley & sons.



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IV Year B.Tech. Civil Engineering. II-Sem.

**SOIL DYNAMICS AND MACHINE FOUNDATIONS
(ELECTIVE –IV)**

UNIT – 1

Theory of vibrations: Basic definitions- free and forced vibrations with and without damping for single degree freedom system- Resonance and its effect – magnification – Logarithmic decrement – Transmissibility

UNIT – II

Natural frequency of foundation – Soil system: Barkan's and IS methods – pressure bulb concept – Pauw's Analogy.

UNIT – III

Wave propagation: one dimensional wave motion – propagation in an elastic infinite medium- wave propagation in an elastic half space – propagation of flexural waves in beams on elastic foundations

UNIT – IV

Dynamic Soil Properties: Field and Laboratory methods of determination – Uphole, Down hole and cross hole methods –Cyclic plate load test – Block vibration test – Determination of Damping factor.

UNIT – V

Dynamic response of foundations: Shallow and deep foundations – dynamic bearing capacity theory – codal provisions – dynamic response of deep foundations- dynamic testing of piles

UNIT – VI

Block foundation: Degrees of freedom - analysis under different modes of vibration- codal provisions for design and construction of foundations for reciprocating machine, impact type and rotary type

UNIT – VII

Seismic stability of slopes- analysis for stability of slopes- Swedish circle, friction circle, Newmark sliding block method- reliability of slopes of earth dam

Unit – VIII

Vibration Isolation: Generation and propagation of vibrations – basic concept of vibration isolation- base isolation- shock isolation- seismic isolation of bridges

TEXT BOOKS:

1. Soil Dynamics and earth quake of engineering- Bharat Bhushan Prasad, PHI publications
2. Advanced Soil Dynamics and earth quake of engineering- Bharat Bhushan Prasad, PHI publications

REFERENCE BOOKS:

1. Soil Dynamics by Shamsheer Prakash
2. Vibration of soils and foundations by Richart, Hall and Woods, Printice Hall.



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IV Year B.Tech. Civil Engineering. II-Sem.

**ADVANCED STRUCTURAL ANALYSIS
(ELECTIVE –IV)**

UNIT - I

Introduction to theory of elasticity: Notations for forces and stresses, components of stresses, components of strains, Hooke's law.

UNIT – II

Plane stress and plane strain: Definitions, differential equations of equilibrium, boundary conditions, and compatibility equations.

UNIT - III

Two dimensional problems in rectangular co-ordinates: Airy stress function, solution by polynomials, saint venant principle, solution of bi-harmonic equation using Fourier series.

UNIT - IV

Two dimensional problems in polar co-ordinates: general equations in polar co-ordinates, solution of bi-harmonic equation for axial symmetry, general solution of bi-harmonic equation, bending of a curved bar, analysis of thick cylinder.

UNIT - V

Introduction to structural dynamics: Dynamic loadings, formulation of equation of motion – Newton's second law of motion, D'Alembert's principle, solution of undamped single degree of freedom system.

UNIT - VI

Free Vibrations: Damped single degree of freedom system, Viscous damping, equation of motion, critically damped, over damped and under damped system, logarithmic decrement.

UNIT - VII

Forced Vibrations: Response of one degree of freedom system to harmonic loading: undamped harmonic excitation damped harmonic excitation, evaluation of damping at resonance, response to support motion.

UNIT - VIII

Response to Impulsive loading: Duhamel integral, numerical evaluation of Duhamel integral for undamped system.

TEXT BOOKS:

1. Mechanics of solids by Arbind Kumar Singh, Prentice-Hall of India, New Delhi.
2. Theory of Elasticity by Timoshenko and Goodier, McGraw Hill Book Company, New Delhi.
3. Structural Dynamics by Mario Paz, CBS Publishers, New Delhi.

REFERENCE BOOKS:

1. Theory of Elasticity by Sadhu Singh, Khanna Publishers.
2. Dynamics of structures by A. K. Chopra, Prentice Hall of India.



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**WATER RESOURCES SYSTEM PLANNING AND MANAGEMENT
(ELECTIVE -IV)**

UNIT – I

Introduction: concepts of systems analysis, definition, systems approach to water resources planning and management, role of optimization models, objective function and constraints, types of optimization techniques.

UNIT – II

Linear programming –I: Formulation of linear programming models, graphical method, simplex method, application of Linear programming in water resources.

UNIT – III

Linear programming – II: Revised simplex method, duality in linear programming, sensitivity and past optimality analysis.

UNIT – IV

Dynamic programming: principles of optimality forward and backward recursive dynamic programming, case of dimensionality, application for resource allocation.

UNIT – V

Non-linear optimization techniques: Clerical of method optimization, Kuch-Tucleer, gradential based research techniques for simple unconstrained optimization.

UNIT – VI

Simulation: application of simulation techniques in water resources.

UNIT – VII

Water-resources economics: Principles of Economic analysis, benefit-cost analysis socio economic intuitional and pricing of water resources.

UNIT – VIII

Water resources management: Planning of reservoir system, optimal operation of single reservoir system, allocation of water resources, optimal cropping pattern, conjunctive use of surface and sub-surface water resources.

TEXT BOOKS:

1. Water Resources System Analysis – Vedula & Mujumdar – Tata Mc.Graw Hill Company Ltd. 2005.
2. Water Resources Economics - James & Lee. Oxford Publishers 2005.

REFERENCE BOOK:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.



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PROJECT WORK
