COURSE STRUCTURE AND SYLLABUS

For

CIVIL ENGINEERING

(Applicable for batches admitted from 2016-2017)

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

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IV Year - II Semester

S. No.	Subjects	L	T	P	Credits
1	Estimation Specification & Contracts	4	--	--	3
2	Construction Technology & Management	4	--	--	3
3	Prestressed Concrete	4	--	--	3
4	**Elective III** i. Bridge Engineering ii. Soil Dynamics and Foundations iii. Solid and Hazardous Waste Management iv. Water Resources Systems Planning v. Urban Transportation Planning Engg	4	--	--	3
5	Seminar on Internship Project	--	3	--	2
6	Project	--	--	--	10
	Total Credits				**24**

	L	**T**	**P**	**C**
IV Year - II Semester	**4**	**0**	**0**	**3**

ESTIMATION SPECIFICATION & CONTRACTS

Course Learning Objectives:

The objective of this course is to enable the students to:

- Understand the quantity calculations of different components of the buildings.
- Understand the rate analysis of different quantities of the buildings components.
- Learn various specifications and components of the buildings.

Course Outcomes:

Upon the successful completion of this course:

- The student should be able to determine the quantities of different components of buildings.

- The student should be in a position to find the cost of various building components.

- The student should be capable of finalizing the value of structures.

SYLLABUS:

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 contigent 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 Standard specifications for different items of building construction.

UNIT-V Detailed Estimation of Buildings using individual wall method.

UNIT –VI Detailed Estimation of Buildings using centre line method.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of SIX questions from Unit 1 to Unit 4, out of which THREE are to be answered (60% weight-age) & ONE mandatory question (40% weight-age) from Units 5 & 6 is to be answered.

Text Books:

1. Estimating and Costing, B.N. Dutta, UBS publishers, 2000.
2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. Construction Planning and Technology, Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. Estimating and Costing, G.S. Birdie.

References:

1. Standard Schedule of rates and standard data book, Public works department.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works – B.I.S.
3. Estimation, Costing and Specifications, M. Chakraborthi; Laxmi publications.
4. National Building Code

	L	T	P	C
IV Year - II Semester	4	0	0	3

CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Course Learning Objectives:

The objective of this course is:

- to introduce to the student the concept of project management including network drawing and monitoring
- to introduce various equipments like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to constriction.
- to introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- appreciate the importance of construction planning
- understand the functioning of various earth moving equipment
- know the methods of production of aggregate products and concreting and usage of machinery required for the works.
- apply the gained knowledge to project management and construction techniques

SYLLABUS:

UNIT- I Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical Path Method – Applications

UNIT -II Project Evaluation and Review Technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

UNIT- III Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

UNIT –IV Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

UNIT -V Concreting equipment – crushers – jaw crushers – gyratory crushers – impact crushers – selection of crushing equipment - screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing

UNIT –VI Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering

Text Books:
1. Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgrawhill
2. Construction Project Management Theory and Practice, Kumar Neeraj Jha (2011), Pearson.
3. Construction Technology, Subir K. Sarkar and Subhajit Saraswati, Oxford University press.
4. Project Planning and Control with PERT and CPM, B. C. Punamia and K K Khandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

References:
1. Construction Project Management - An Integrated Approach, Peter Fewings , Taylor and Francis
2. Construction Management Emerging Trends and Technologies, Trefor Williams , Cengage learning.
3. Hand Book of Construction Management, P. K. Joy, Trinity Press Chennai, New Delhi.

	L	T	P	C
IV Year - II Semester	4	0	0	3

PRESTRESSED CONCRETE

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with concepts of prestressing
- Equip student with different systems and devices used in prestressing
- Understand the different losses of prestress including short and long term losses
- Familiarize students with the analysis and design of prestressed concrete members under flexure, shear and torsion

Course Outcomes:

At the end of this course the student will be able to
- Understand the different methods of prestressing
- Estimate effective prestress including the short and long term losses
- Analyze and design prestressed concrete beams under flexure and shear
- Understand the relevant IS Codal provisions for prestressed concrete

SYLLABUS:

UNIT-I Basic concepts of Prestressing- Advantages and Applications of Prestressed Concretes, High Strength Concrete- Permissible Stresses, Shrinkage, Creep, Deformation Characteristics, High strength Steel- Types, Strength- Permissible Stresses- Relaxation of Stress, Cover Requirements.

UNIT-II Prestressing Systems- Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems, Basic Assumptions in Analysis of prestress and design, Analysis of prestress, Resultant Stresses at a section- pressure line- Concepts of load balancing- Stresses in Tendons, Cracking moment.

UNIT-III Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes -Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation stress in steel, slip in anchorage, differential shrinkage- bending of members and frictional losses- Total losses allowed for design

UNIT-IV Design for Flexural resistance- Types of flexural failure – Code procedures- Design of sections for flexure- Control of deflections- Factors influencing Deflection- Prediction of short term and long term deflections.

UNIT-V Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion.

UNIT-VI Transfer of Prestress in pre tensioned members- Transmission length- Bond stresses- end zone reinforcement- Codal provisions- Anchorage zone Stresses in Post tensioned members- Stress distribution in end block- Anchorage Zone reinforcement.

Text Books

1. Prestressed Concrete, N. Krishna Raju, Tata McGraw hill

2. Prestressed Concrete, S. Ramamrutham

References:

1. Prestressed Concrete, P. Dayaratnam
2. Prestressed Concrete, T. Y. Lin & Burns, Wiley Publications

	L	**T**	**P**	**C**
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BRIDGE ENGINEERING
(Elective – III)

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with different types of Bridges and IRC standards
- Equip student with concepts and design of Slab Bridges, T Beam Bridges, Box Culverts
- Understand concepts of design of Plate Girder Bridges
- Familiarize with different methods of inspection of bridges and maintenance

Course Outcomes:

At the end of this course the student will be able to
- Explain different types of Bridges with diagrams and Loading standards
- Carryout analysis and design of Slab bridges, T Beam bridges, Box culvers and suggest structural detailing
- Carryout analysis and design of Plate girder bridges
- Organize for attending inspections and maintenance of bridges and prepare reports.

SYLLABUS:

UNIT-I Introduction- Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT-II Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Guyon's – Massonet Method –Hendry- Jaegar Methods- Courbon's theory- Pigeaud's method

UNIT-III T-Beam bridges- Analysis and design of various elements of bridge –Design of deck slab, Longitudinal girders, Secondary beams- Reinforcement detailing

UNIT-IV Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing

UNIT-V Box Culverts: Loading – Analysis and Design- Reinforcement detailing.

UNIT-VI Sub structure-Abutments-Stability analysis of abutments-piers-loads on piers-Analysis of piers-Wing walls-Design problems.

Text Book

1. Essentials of Bridge Engineering, Jhonson Victor D

2. Design of Bridge Structures, T. R. Jagadeesh, M.A. Jayaram, PHI

3. Design of Bridges, N. Krishna Raju, Tata McGraw Hill

References:

1. Design of Concrete Bridges, Aswini, Vazirani, Ratwani

2.Design of Steel Structures, B. C. Punmai, Jain & Jain, Lakshmi Publications

3. Design of R C Structures, B. C. Punmai, Jain & Jain, Lakshmi Publications

SOIL DYNAMICS AND FOUNDATIONS

Course Learning Objectives:

The basic course in soil mechanics/geotechnical engineering generally introduces the fundamental concepts, principles and applications of soil as engineering material with properties under static loading. This course on 'Soil Dynamics' discusses

- About the fundamentals of vibrations
- about the behaviour and properties/response of soil as a material which is subjected to various types of dynamic or cyclic time-dependent loadings.
- the design and analysis for machine foundations come along with this course to consider the dynamic properties of both soil and foundation as combined mass. Behaviour of various geotechnical structures such as shallow and deep foundations, retaining structures due to various types of time-dependent dynamic loading are discussed here along with the reference to design code provisions.
- Phenomena like liquefaction and lateral spreading of soil are also discussed.
- Discusses about the laboratory and filed tests to compute the dynamic soil properties of the soil mass.

Course Outcomes:

- On successful completion of these course, the student able to
- Use theory of vibrations to find the behavior of soil under dynamic loading
- Design machine foundations under different loads and soil conditions
- Understand the liquefaction phenomina
- Conduct various laboratory and filed tests to determine the dynamic soil prosperities and its interpretation.
- Design vibration isolators under any vibratory machines.

SYLLABUS:

UNIT-I Introduction: Types of motion- SHM- Fundamental definitions- SDOF systems- Free and forced vibration with and without damping - Constant force and rotating mass type excitation –Types of damping-Equivalent stiffness of springs in series and parallel. – Resonance and its effect - magnification-logarithmic decrement –Transmissibility.

UNIT-II Theories of Vibration Analysis- EHS Theory and lumped parameter model- Different modes of vibration- Natural frequency of foundation soil system – Barkan and IS methods – Pressure bulb concept – Reisner Theory – Limitations of Reisner theory – Sung's solutions -- Pauw's Analogy – Heigh's Theory.

UNIT-III Dynamic properties of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes- Stress waves in bounded elastic medium- Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests.– Block vibration test – Determination of Damping factor.

UNIT-IV Types of machine foundations – general requirements design – criteria for machine foundations, permissible amplitudes and bearing pressure
Design data, design criteria, IS code provisions for the design foundations of reciprocating machines.

UNIT-V Design data, design criteria, IS code provisions for the design foundations of Impact type of machines.

UNIT-VI Vibration Isolation: Transmissibility, Principles of isolation- Methods of isolation- Vibration isolators- Types and their characterizes
Special Topics: Liquefaction of soils, CSR, CRR, Factor of safety against liquefaction -

Dynamic bearing capacity, Earth retaining structures under dynamic loads

Text Book:

1. Soil Mechanics and Machine foundations, Swami Saran, Galgotia Publications.

2. Fundamentals of Soil Dynamics, B M Das, Centage Learning

References:

1. Vibrations of Soils and Foundations, Richart Hall and Woods

2. Vibration Analysis and Foundation Dynamics, NSV Kameswara Rao, Wheeler Publishing, New Delhi.

3. Foundations of Machines- Analysis and Design, Prakash and Puri

4. Analysis and design of Foundations for Vibrations, P J Moore

5. Dynamics of bases and Foundations, D D Barkar

SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Learning Objectives:

The objective of this course is:

- To impart the knowledge the methods of collection and optimization of collection routing of municipal solid waste
- To acquire the principles of treatment of municipal solid waste
- To know the impact of solid waste on the health of the living beings
- To learn the criterion for selection of landfill and its design
- to plan the methods of processing such as composting the municipal organic waste

Course Learning Outcomes

Upon successful completion of this course, the students will be able to:

- Design the collection systems of solid waste of a town
- Design treatment of municipal solid waste and landfill
- Know the criteria for selection of landfill
- Characterise the solid waste and design a composting facility
- Know the Method of treatment and disposal of Hazardous wastes.

SYLLABUS:

UNIT- I Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste - Factors Influencing generation of solid waste - sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities, Terms related to ISWM like WTE, ULB, TLV etc..Measurement of NPK and Calorific value.

UNIT- II Basic Elements in Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste
Collection of Solid Waste: Type and methods of waste collection systems, analysis of collection system - optimization of collection routes– alternative techniques for collection system.

UNIT- III Transfer, Transport and Transformation of Waste: Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements. Unit operations used for separation and transformation: shredding - materials separation and recovery, source reduction and waste minimization

UNIT- IV Processing and Treatment: Processing of solid waste - Waste transformation through combustion and composting. Market yard wastes and warming composting and vermin composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- V Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation. Case studies

UNIT VI Hazardous Waste Management- sources, collection, transport, treatment and disposal methods; Biomedical waste Management; Electronic waste Management; Environmental law related to waste Management; Case studies.

Text Books:

1. Integrated Solid Waste Management, George Techobanoglous, McGraw Hill Publication, 1993

References:
1. Solid Waste Engineering, Vesilind, P.A., Worrell, W., Reinhart, D., Cenage learning, New Delhi, 2004

2. Hazardous Waste Management, Charles A. Wentz, McGraw Hill Publication, 1995.

3. Solid and Hazardous Waste Management PM Cherry, CBS Publishers and Distributors. New Delhi, 2016.

4. Solid Waste Engineering, William A Worrell, P Aarue Vesilind, Cengage Learning, New Delhi 2016

WATER RESOURCES SYSTEMS PLANNING

Course Learning Objectives:

The course is designed to

- introduce the concepts of system analysis in the planning, design, and operation of water resources.
- appreciate mathematical optimization methods and models.
- learn and apply basic economic analysis tools to water resources projects.
- understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning and design problems.
- appreciate simulation and management techniques in water resources systems.

Course Outcomes

At the end of the course the student will be able to

- apply optimization methods to solve problems related to water resource systems.
- perform basic economic analysis to evaluate the economic feasibility of water resources projects
- formulate optimization models for decision making in water resources systems.
- use simulation models for planning and design of Water Resources Systems.

SYLLABUS:

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: Formulation of linear programming models, graphical method, simplex method, application of linear programming in water resources, revised simplex method, duality in linear programming, sensitivity analysis.

UNIT – III Dynamic programming: Principles of optimality, forward and backward recursive dynamic programming, curse of dimensionality, application for resource allocation.

UNIT – VI Non-linear optimization techniques: Classical optimization techniques, Lagrange methods, Kuhn-Tucker conditions, Search techniques, overview of Genetic Algorithm

UNIT – V Water Resources Economics: Basics of engineering economics, economic analysis, conditions of project optimality, benefit and cost analysis

UNIT – VI Simulation and management: Application of simulation techniques in water resources, 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 S and P. P. Mujumdar, McGraw Hill Company Ltd, 2005.
2. Water Resources Economics, James D and R. Lee, Oxford Publishers, 2005.

References:
1. Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications, Loucks D P and E V Bee, UNESCO Publications, 2005 (http://ecommons.cornell.edu/bitstream/1813/2804/21/00_intro.pdf)
2. Optimal design of water distribution networks, Bhave, P. R, Narosa Publishing house, 2003.

URBAN TRANSPORTATION PLANNING

SYLLABUS:

UNIT –I Urban Transportation Problems & Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT –II Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT –III Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT –IV Mode Choice Analysis: Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation

UNIT –V Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

UNIT –VI Corridor Identification, Plan Preparation & Evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies

Text Books:

1. Introduction to Urban System Planning, Hutchinson, B.G., McGraw Hill.
2. Transportation Engineering - An Introduction, Khisty C.J., Prentice Hall

References:

1. Introduction to Transportation Planning, Bruton M.J., Hutchinson of London.

2. Fundamentals of Transportation Planning, Papacostas, Tata McGraw Hill

3. Urban Transportation Planning: A decision oriented Approach, Mayer M and Miller E, McGraw Hill

4. Traffic Engineering and Transportation Planning, Kadiyali.L.R., Khanna Publishers, New Delhi.

5. Metropolitan Transportation Planning, Dicky, J.W., Tata McGraw Hill

IV Year - I Semester

L	T	P	C
0	3	0	2

SEMINAR

	L	T	P	C
IV Year - I Semester

L	T	P	C
0	0	0	10

PROJECT WORK

The main objective of the Project work is

- To enable the student apply engineering knowledge that has been taught all through the programme for solving practical engineering problem.
- To enable the student capable for prblem solving / problem shooting.
- To instill and inculcate team spirit/ team work in to the minds of the students.
- To enable/ train the students report making/ documnetation.
- To provide students an opportunity to use any civil engineering software for their project work.

Out comes of the Project work.

Up on completion of the Project work, the student will be able to
- Apply all levels of Engineering knowledge in solving the Engineering problems.
- Work together with team spirit.
- Use Civil Engineering software at least one.
- Document the projects