MRSPTU B.TECH. CIVIL ENGINEERING SYLLABUS
2019 BATCH ONWARDS

Total Credits= 20

Semester-IV (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BCIES1-421	Structural Analysis-I	3	0	0	40	60	100	3
BCIES1-422	Design of Concrete Structures-I	3	0	0	40	60	100	3
BCIES1-423	Transportation Engineering-I	3	0	0	40	60	100	3
BCIES1-424	Environmental Engineering-I	3	0	0	40	60	100	3
BCIES1-425	Engineering Geology	2	0	0	40	60	100	2
Departmental Elective-I (Select any one)								
BCIED1-451	Geomatics Engineering	3	0	0	40	60	100	3
BCIED1-452	Numerical Methods in Civil Engineering							
BCIED1-453	Concrete Construction Technology							
BCIES1-426	Concrete Technology Lab-I	0	0	2	60	40	100	1
BCIES1-427	Structural Analysis Lab	0	0	2	60	40	100	1
BCIES1-428	Transportation Engineering Lab	0	0	2	60	40	100	1
Total		**-**	**-**	**-**	**420**	**480**	**900**	**20**

*There will be 4-weeks Internship as per AICTE Internship Policy after 4th semester.

STRUCTURAL ANALYSIS-I				
Subject Code: BCIES1-421	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

1. To provide students with a solid background on principles of structural analysis by exposing them to the theories and concepts of analyzing the civil engineering structures.
2. To cover the analysis of statically determinate structures.

Course Outcomes:

1. The students will possess the skills to solve statically determinate problems of structural analysis dealing with different loads.
2. They will be able to apply their knowledge of structural analysis to address structural design problems.

UNIT-I (12 Hours)

1. Slope & Deflection of Beams & Frames: Review of Double Integration Method and Macaulay's Method, Moment Area Method, Conjugate Beam Method, Strain Energy / Real Work Method, Virtual Work / Unit Load Method, Castigliano's Method & Maxwell's Reciprocal Theorem.

2. Structural Stability: Introduction, Stability of Columns, Axially loaded Columns, Euler's Theory of Long Columns and Euler's Formula, End Conditions & Effective Length Factor, Equivalent Length, limitations of Euler's Theory, Columns with Eccentric and Lateral Load, Rankine Gordon Formula.

UNIT-II (11 Hours)

3. Analysis of Determinate Trusses: Introduction, determination of forces in member of trusses by method of joints, method of sections, Tension Coefficient Method, Deflection of Joints of plane frames by Castigliano's first theorem and unit load method, Effect of Lack of Fit & Temperature Change.

4. Analysis of Dams, Chimneys and Retaining Walls: Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule, wind pressure on chimneys.

UNIT-III (11 Hours)

5. Simple Cable & Arch Structures: Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, Analysis of Cables, Analysis of three hinged (Parabolic and Circular) Arches for Horizontal Thrust, Bending Moment, Normal Thrust and Radial Shear.

6. Suspension Bridges: Introduction, Analysis of suspension bridges with two hinged and three hinged stiffening girders, Temperature Stresses in Three Hinged and Two Hinged Stiffening Girders.

UNIT-IV (11 Hours)

7. Rolling Loads: Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point

load, uniformly distributed load, several point loads etc.

8. Influence Lines: Construction of Influence lines for reaction, shear forces and bending moment for beams, influence lines for girders with floor beams, Influence lines for forces in members of frames. Influence lines for Three Hinged Arches & Stiffening Girders.

Recommended Text Books / Reference Books:

1. C.S. Reddy, 'Basic Structural Analysis'.
2. Vazirani & Ratwani, 'Analysis of Structures', Vol. - I, -II.
3. C.K. Wang, 'Intermediate Structural Analysis'.

DESIGN OF CONCRETE STRUCTURES-I				

Subject Code: BCIES1-422	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

Course Objectives:
1. Learn the behaviour of structural concrete components and Ability to perform analysis and design of concrete members.

Course Outcomes:
1. Identify the different failure modes and determine their design strengths.
2. Select the most suitable section shape and size for beams according to specific design criteria.

Note: 1. IS 456, Indian Standard. Plain and Reinforced Concrete -Code of practice is permitted in examination.
2. Examiner requested to provide requisite data for Mix Design Problems; if any.

UNIT-I (05 Hours)

Concrete Mix Design: Introduction, Selection of mix proportions, Durability of concrete, Quality Control of concrete, Introduction of various mix proportion methods, Proportioning of concrete mixes by BIS method of mix design.

UNIT-II (07 Hours)

RCC Design Philosophies: Introduction, Objectives & methods of analysis & Design, Properties of Concrete and Steel. Philosophies of Working Stress Methods (WSM) & Limit State Method (LSM) in RCC design.
Shear, Torsion & Bond (Only Theory/Concept): Types of shear & torsion, importance in RCC Design Structures, IS Provisions for Shear & Torsion, Bond-types of bonds, Anchorage Bond, Development length & its determination.

UNIT-III (21 Hours)

RCC Beams: Types of beams, Behaviour in Flexure-Singly reinforced beam, Doubly reinforced beam, Flanged beam, Cantilever beam, Neutral Axis, Neutral Axis Depth, Moment of Resistance, Design of beams- Singly reinforced beam, Doubly reinforced beam, Flanged beam, Cantilever beam.

UNIT-IV (12 Hours)

RCC Slabs: Types of slab systems, Guidelines for Design, Design of One Way and Two Way

Slab.

Columns: Classifications (According to Shape, Length and Loading Conditions), Assumptions, Behaviour and Design of Axially Loaded Columns.

Recommended Text Books / Reference Books:

1. M.S. Shetty, 'Concrete Technology', S. Chand & Co.

2. A.M. Neville, 'Properties of Concrete', Prentice Hall.

3. M.L. Gambhir, 'Concrete Technology', Tata McGraw Hill Publishers, New Delhi.

4. Pillai & Menon, 'Reinforced Concrete Design', Tata McGraw Hill Education.

5. N. Krishna Raju, 'Advanced Design of Structures'.

TRANSPORTATION ENGINEERING-I				
Subject Code: BCIES1-423	**L** **T** **P** **C**			**Duration: 45 hrs.**
	3 0 0 3			

Course Objectives:
1. The objective of this course is to acquaint the students about highway planning and development in India.
2. The course will cover selection of highway alignment, design of geometric elements of highways, carry out traffic studies and implement traffic regulation and control measures and intersection design.
3. The characteristic properties of road construction materials and design of flexible and rigid pavements as per IRC guidelines shall also be covered in this course.

Course Outcomes:
1. The student will learn about essentials of highway planning and features of highway development in India.
2. The student will learn how to do selection of highway alignment and design the geometric elements of highways.
3. The student will learn how to carry out traffic studies and implement traffic regulation and control measures and intersection design.
4. The student will know about characteristic properties of road construction materials and design the flexible and rigid pavements as per IRC guidelines.

UNIT-I (12 Hours)

Highway Development and Planning: Classification of roads, road development in India, current road projects in India, highway alignment and project preparation.

Geometric Design of Highways: Highway cross section elements, sight distance, design of horizontal alignment, design of vertical alignment.

UNIT-II (11 Hours)

Traffic Characteristics & Studies: Road user characteristics, driver characteristics, vehicular characteristics. Volume studies, speed studies, O-D survey, parking study.

Traffic Safety and Control Measures: Traffic signs, markings, islands, signals, cause and type of accidents, use of intelligent transport system.

UNIT-III (11 Hours)

Pavement Materials: Materials used in highway construction- soils, stone aggregates, bituminous binders, desirable properties, tests, requirements for different types of pavements.

Paving Mixes: Marshall method of bituminous mix design, Super pave and Concrete mix design for rigid pavements.

UNIT-IV (11 Hours)

Design of Pavements: Pavement types, factors affecting design and performance of pavements, flexible pavements- components and functions, stresses in flexible pavements, design of flexible pavements as per IRC.

Rigid Pavements- components and functions, stresses in rigid pavements, design of cement concrete pavements as per IRC.

Recommended Text Books / Reference Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros., Roorkee.
2. Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers, Delhi.
3. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning, New Delhi.
4. S.K. Sharma, 'Principles, Practice & Design of Highway Engineering', S. Chand & Company Ltd., New Delhi.
5. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', John Wiley& Sons, USA.
6. Paul H. Wright and Karen K. Dixon, 'Highway Engineering', Wiley Student Edition, USA.
7. C.A.O. Flaherty, 'Highway Engineering', Vol. 2, Edward Arnold, London.

ENVIRONMENTAL ENGINEERING-I		

Subject Code: BCIES1-424	L T P C	Duration: 45 Hrs.
	3 0 0 3	

Course Objectives:

The course should enable the students to:

1. Inculcate the basics of water demand, supply, source & future demand estimation.
2. The applicability of concepts of water quality & its examinations.
3. Inculcate the basic concepts of water treatment, its design and management.
4. Extensive knowledge of sources, conversion, distribution & maintenance of water supply system.
5. Modern low cost water treatment techniques for rural supply system.

Course Outcomes:

1. An ability to design a system, component, or process to meet desired needs.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, welfare, and environmental factors.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data for future demand & supply.

UNIT-I (11 Hours)

Introduction: Beneficial uses of water, water demand, per capita demand, variations in demand, water demand for firefighting, population forecasting and water demand estimation.

Water sources and development: Surface and ground water sources; Selection and development of sources; intakes and transmission systems.

UNIT-II (11 Hours)

Pumps and pumping stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.

Quality and Examination of Water: Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.

UNIT-III (12 Hours)

Water treatment: Water treatment schemes; Basic principles of water treatment; Design of Plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and deflouridation, water desalination and demineralization, taste and odour removal.

UNIT-IV (11 Hours)

Water Supply Systems: Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.

Rural water supply: Principles, selection of source, rain water harvesting, quantitative requirements, low cost treatment techniques.

Recommended Text Books / Reference Books:

1. Water Supply Engineering- Environmental Engg. (Vol. – I) by B.C. Punmia, Ashok Jain, Arun Jain, Laxmi Publications, New Delhi.
2. Environmental Engg. - A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi
3. "Environmental Engg." By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
4. Water Supply Engineering- Environmental Engg. (Vol. – I) by S.K. Garg, Khanna Publishers, Delhi
5. Water Supply and Sewerage by Steel EW and McGhee, Terence J.; McGraw Hill.

ENGINEERING GEOLOGY				
Subject Code: BCIES1-425	**L**	**T P C**		**Duration: 30 Hrs.**
	2	0 0 2		

Course Objectives:
1. The principal objective of the engineering geologist is the protection of life and property against damage caused by various geological conditions.
2. Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of structures.

Course Outcomes:

1. It will provide the students with basic knowledge and understanding in the most central part of engineering geology, rock and soil.
2. The course will give students an overview & an understanding of the engineering properties of rock and soil materials, debris generation and distribution, engineering geological investigations, slope stability, geological factors affecting the stability of a facility on and in the soil, engineering, stability and protection of underground facilities, etc.
3. Students will develop the ability to perform basic engineering geological assessments and analyses, and to understand the relevance of engineering geology in complex projects in and on solid rock.

UNIT-I (07 Hours)

General Geology: Scope of geology in Civil Engineering - the earth, its structure and environment - Standard geological time scale, unit & fossils, physiographic, stratigraphic and tectonic divisions of India - geomorphologic (surface) processes – weathering – types , weathered products, Fluvial processes, Glacial Deposits, wind action, and their significance in Civil Engineering.

UNIT-II (08 Hours)

Mineralogy and Petrology: Physical properties of minerals – classification - study of important rock forming minerals – Quartz family, feldspar family, Mica family, calcite, Iron oxide minerals, Clay minerals and their behaviour and significance in the field of Civil Engineering. Classification of rock - mode of formation - distinction between igneous, sedimentary and metamorphic rocks. Characteristic of rocks. Study of important rocks: granite, syenite, diorite, gabbro, pegmatite, dolerite, basalt, sand stone, limestone, shale, quartzite, marble, slate.

UNIT-III (07 Hours)

Structural Geology and Geophysical Methods: Attitude of beds - out crops, study of structures such as folds, faults, joints, unconformities, in-lier and out-lier - their brief classification and their bearing on engineering construction. Principles of geophysical methods, electrical resistivity method, seismic method and its applications in civil engineering.

UNIT-IV (08 Hours)

Geology and Construction: Role of geology in site investigation, Geotechnical classification of rock, geological considerations in open excavation, tunnels and dam site, reservoir site, buildings, road cuttings, landslides and land subsidence its causes, classification and preventive measures, groundwater- types of aquifers, properties of geological formations affecting groundwater and its role as a geological hazard.

Recommended Text Books / Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons
2. A Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Reddy D.," Engineering Geology for Civil Engineers", Oxford & IBH , 1995
4. Blyth, F.G.M., "A Geology for Engineers", Arnold, Londo, 2003.
5. Bell. F.G, "Fundamentals of Engineering Geology" Butterworth, 1983.

GEOMATICS ENGINEERING			
Subject Code: BCIED1-451	L T P C		Duration: 45 Hrs.
	3 0 0 3		

Course Objectives:

1. Have the basic math & science knowledge and technical skills of the Geomatics Engineering Technology discipline appropriate to enter careers in the geospatial community, for example, boundary surveying and legal principles, route and construction surveying, survey measurement analysis and adjustments, Global Positioning System (GPS), Photogrammetry, geodesy, land/Geographic Information Systems (GIS), and 3D scanning.
2. Have the ability to execute Geomatics project activities for delivery in response to the needs of private and public industry.
3. Have appropriate understanding of standards and specifications of Geomatics practices in analyzing positional accuracy of measurement systems and in preparing land records and plats by meeting legal requirements.
4. Have the knowledge to pass the national Fundamentals of Surveying and PS exams, and after gaining experience, be qualified to take the Professional Surveying License Exams with an understanding of continued lifelong learning.
5. Have an understanding of the professional, ethical and social issues with commitment to quality and dependability.

Course Outcomes:

1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline.
2. An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;
3. An ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and an ability to function effectively as a member as well as a leader on technical teams.

UNIT-I (12 Hours)

Photogrammetry: Introduction, Basic Principles, Photo-Theodolite, Elevation of a Point by Photographic Measurement, Aerial Camera, Vertical Photograph, Tilted Photograph, Scale, Crab and Drift, Flight Planning for Aerial Photography, Ground Control for Photogrammetry, Photomaps and Mosaics, Stereoscopic Vision, Stereoscopic parallax, Stereoscopic Plotting Instruments, Applications.

UNIT-II (11 Hours)

Remote Sensing: Introduction, Basic Principles, Electromagnetic Energy Spectrum, Interaction of EM Energy with Matter, Effect of Atmosphere on EMR, Interaction of EM radiations with Earth's Surface, Remote sensing Sensor systems, Remote Sensing Observation Platforms, Ideal and Real Remote Sensing Systems, Data Acquisition and Interpretation, Resolution Concept, Applications

of Remote Sensing. Methodology for Land Use /Land Cover Analysis and Mapping, Remote Sensing in India. Satellite Data products.

UNIT-III (11 Hours)

Geographical Information System (GIS): Introduction, Sub system of GIS, Hardware of GIS, Data and Data structure for GIS, Representation of features, Vector data & Raster data structure, Data format conversions, Capabilities/Functionalities of GIS, Neighborhood Functions, Map Overlay Analysis, Data Quality, Sources of Errors, Applications of GIS, GIS Software.

UNIT-IV (11 Hours)

Global Positioning System (GPS): Introduction, GLONASS system, GALILEO System, NAVIC system, GPS over view, Space Segment, Control segment, User segment, Principle of position determination, Determining Satellite-to-User Range, Calculation of user position, GPS system time, Carrier phase measurement techniques, Indian Coordinate system for using GPS, Uses and Applications of GPS.

Recommended Text Books / Reference Books:

1. Arora, K.R., 2007: Surveying Vol.-III, Standard Book House.
2. Duggal, S.K Higher.; Surveying Vol.-II, Tata McGraw Hill.
3. Campbell, J.B.2002: Introduction to Remote Sensing. Taylor Publications.
4. Chang,T.K. 2002: Geographic Information Systems, Tata McGraw Hill.
5. Joseph George, 2003: Fundamentals of Remote Sensing. Universities Press.
6. Punmia, B.C., Jain A.K., 2005: Higher Surveying, Luxmi Publications.

NUMERICAL METHODS IN CIVIL ENGINEERING				
Subject Code: BCIED1-452	**L**	**T**	**P**	**C**

Duration: 45 Hrs.

	L	T	P	C
	3	0	0	3

Course Objectives:
The course should enable the students to:
1. Provide the numerical methods of solving the linear, non-linear & transcendental equations, interpolation, integration and differential equations.
2. Improve the student's skills in numerical methods by using the numerical analysis facilities.
3. Help in solving complex mathematical problems using only simple arithmetic operations.
4. Approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations.
5. Approach for fitting the polynomials using raw data.
6. Ability to implement the basic principles of numerical techniques in day to day application of Civil Engineering.

Course Outcomes:
Upon successful completion of this course, student will be able to:
1. Identify the application potential of numerical methods
2. Solve Civil engineering problems using numerical methods

3. Demonstrate application of numerical methods to civil engineering problems
4. Apply differential equations and integration to solve civil engineering problems
5. Outline and Propose the finite difference techniques
6. Apply the concept of partial differential equations and Solve practical problems

UNIT-I (12 Hours)

Equation: Roots of algebraic transcendental equations using bisection, Regula-Falsi, Secant & Newton's method, Solution of linear simultaneous equations by different methods using Elimination, Iteration (Gauss Seidal & Gauss Jacobi), Gauss-Jordan method, Homogeneous and Eigen Value problem, Non-linear equations.

UNIT-II (11 Hours)

Finite Difference Technique: Initial and Boundary value problems of ordinary and partial differential equations, Solution of Various types of plates and other civil engineering related problems.

UNIT-III (11 Hours)

Numerical Integration: Numerical Integration by trapezoidal and Simpson's rule.
Statistical Methods: Method of correlation and Regression analysis for fitting a polynomial equation by least square.

UNIT-IV (11 Hours)

Initial Value problem: Galerkin's method of least square, Initial Value problem by collocation points, Runge-Kutta Method for first and higher order differential equations.
Interpolation: Newton's Backward, Forward and Lagrange's Interpolation methods.

Recommended Text Books / Reference Books:

1. Numerical Methods by B.S. Grewal, Khanna Publishers.

2. Numerical Mathematical Analysis: James B. Scarborough Oxford and IBH Publishing

3. Introductory Methods of Numerical Analysis: S.S. Sastry, PHI Learning (2012).

4. Introduction to Computer Programming and Numerical Methods by Xundong Jia and

   Shu Liu, Dubuque, Iowa: Kendall/Hunt Publishing Corporation.

5. Numerical Methods, J.B Dixit, USP Laxmi publication.

6. Numerical Methods by C.P. Gandhi.

CONCRETE CONSTRUCTION TECHNOLOGY		
Subject Code: BCIED1-453	**L T P C**	**Duration: 45 Hrs.**
	3 0 0 3	

Course Objectives:

1. Understand properties of concrete and types of concrete

2. Know the procedure to determine the properties of fresh and hardened of concrete.

3. Understand properties of cement and aggregate and types of cement.

4. Gives ideas on the construction and inspection requirements the buildings

Course Outcomes:
Based on this course, the students will understand/evaluate/develop
1. To understand the behaviour of fresh and hardened concrete.
2. To make aware the recent developments in concrete technology.
3. To understand factors affecting the strength, workability and durability of concrete.
4. To impart the methods of proportioning of concrete mixtures.

UNIT-I (11 Hours)

Introduction of Concrete materials: Admixtures, Fly Ash, Polymers, Early Age Properties, Strength, Permeability & Durability. Principles of Concrete mix design, Concrete Mix Design procedure by: IS/ACI/British Standards.

UNIT-II (11 Hours)

Concreting Operations: Practices and Equipment, batching; Mixing; Transporting; Placing and Compacting; curing. Properties and technique of construction for concrete, Fibre reinforced concrete, light weight concrete, Heavy weight concrete, High performance Concrete.

UNIT-III (12 Hours)

Special Concrete Operations: Shot Crete, grouting, Grunting, under water concreting, hot and cold weather concrete, pump able concrete. Construction techniques for reinforced concrete elements, design and fabrication of form work for R.C.C. elements.

UNIT-IV (11 Hours)

Introduction to Pre-stressed concrete Construction: Principle, methods, materials, Tools and equipment used in Pre-stressed construction.
Inspection and Quality Control of Concrete Construction: Stages, Principles, Checklist, Statistical Controls, procedures.

Recommended Text Books / Reference Books:

1. M.L. Gambhir, 'Concrete Technology', McGraw Hill Education.
2. M.S. Shetty, 'Concrete Technology', S. Chand.
3. Neville and Brooks, 'Concrete Technology', Prentice Hall.

CONCRETE TECHNOLOGY LAB-I				
Subject Code: BCIES1-426	**L** **T** **P** **C**			**Duration: 30 Hrs.**
	0 0 2 1			

Course Objectives:

The course should enable the students to:

1. Give practical exposure of laboratory testing of different kinds of building construction materials such as brick, cement, lime, aggregate, etc.
2. Check the suitability for different materials used in civil construction works.
3. Determine the engineering properties in terms of strength, strain, fatigue, creep, elasticity, stiffness, durability and workability.
4. The knowledge of these tests is very essential to choose appropriate construction material to exercise better quality control in a civil construction project.

Course Outcomes:

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

1. Determine the consistency, setting time and fineness of cement.
2. Determine the specific gravity, soundness and compressive strength of cement
3. Determine the fineness modulus, grading, density & specific gravity of aggregates.
4. Determine the shape & size, compressive strength and water absorption of bricks.
5. Determine the compressive strength and water absorption of interlocking Pavers.
6. Determine the yield Stress, ultimate Stress, elongation of Steel bars.

Laboratory Experiments:

1. To Determine the Specific Gravity of cement.

2. To Determine the Soundness of cement.

3. To Determine the Standard Consistency, Setting Times (Initial and Final Setting Time) of Cement.

4. To Determine the Compressive Strength of Cement.

5. To Determine the Fineness Modulus & Grading of Fine and Coarse Aggregates.

6. To Determine the Bulk Density, Water Absorption and Specific gravity of Fine and Coarse Aggregates.

7. To Determine the Compressive strength, Efflorescence and Water absorption of Bricks as per IS standard.

8. To perform Shape and Size test on Bricks.

9. To Determine the Compressive strength and Water absorption of interlocking Pavers as per IS standard.

10. To Determine the Yield Stress, Ultimate Stress and Elongation of Steel bars.

11. To Perform Bend & Rebend test on Steel bars.

Recommended Books / Manuals:

1. M.L. Gambhir, 'Building and Construction Materials: Testing and Quality Control', TMH.

2. Concrete Lab Manual by NITTTR Chandigarh.

3. Concrete Technology, Theory and Practice by M.S. Shetty, S. Chand & Company.

STRUCTURAL ANALYSIS LAB			
Subject Code: BCIES1-427	L T P C		Duration: 30 Hrs.
	0 0 2 1		

Course Objectives:

1. To introduce engineering students to the theory and experimental techniques of structural mechanics.
2. To experimentally illustrate, in a comprehensive way, the basic principles of structural analysis and their applications.
3. To prepare the students learn best by doing.
4. To familiarize them, through the laboratory exercises, with the model behavior and practical limitations of each set-up and to get opportunity to critically examine and developing various skills in them for structural analysis of theoretical concepts, data handling and decision making.

Course Outcomes:

1. Students will be able to effectively link the theory / analytical concepts.
2. They will be able to demonstrate the background of the theoretical aspects, with practice and application.
3. They will be able to generate and analyze data using experiments and develop observational skill by the exposure to equipment and machines.
4. They will be able to use computing tools in analyzing and presentation of the experimental data.

Laboratory Experiments:

1. To study the behavior of different types of struts.

2. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.

3. To determine the Flexural Rigidity of a given beam.

4. To verify Moment- Area Theorems for slope and deflection of a given beam.

5. To determine the Carry over Factor (C.O.F.) for beams with rigid connections.

6. Experiment on three-hinged arch and influence line diagram for horizontal thrust.

7. Experiment on two-hinged arch.

8. To determine the deflection of a Pin-connected truss.

9. Forces in members of a redundant frame.

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10. Experiment on curved beams.

11. Unsymmetrical bending of a cantilever beam.

12. Influence line diagrams for BM of a beam with one end hinged and the other fixed.

Recommended Books / Manuals:

1. Experimental methods in Structural Mechanics by C.B. Kukreja and V.V. Sastry, Standard Publishers Distributors, Delhi.
2. Laboratory Manual of Testing Materials - William Kendrick Hall
3. Laboratory Manual on Structural Mechanics by Harvinder Singh.

TRANSPORTATION ENGINEERING LAB

Subject Code: BCIES1-428	L T P C	Duration: 30 Hrs
	0 0 2 1	

Course Objectives:

1. The main objective of this course is to give practical exposure of laboratory testing of different kinds of highway construction materials such as Soil, Aggregate and Bitumen to check their suitability for their use in road construction.
2. The knowledge of these tests is very essential for a civil engineer to choose appropriate construction material to exercise better quality control in a road construction project.

Course Outcomes:

1. The student will learn the laboratory testing of different kinds of highway construction materials such as Soil, Aggregate and Bitumen.
2. The student will learn to check the suitability of highway construction material so as to exercise better quality control in a road construction project.

Tests on Sub-Grade Soil:

1. Proctor's Compaction Test
2. California Bearing Ratio Test

Tests on Road Aggregates:

1. Crushing Value Test
2. Los Angles Abrasion Value Test
3. Impact Value Test
4. Shape Test (Flakiness and Elongation Index)

Tests on Bituminous Materials:

1. Penetration Test
2. Ductility Test
3. Softening Point Test
4. Flash & Fire Point Test

Recommended Books / Manuals:

1. S.K. Khanna and C.E.G. Justo, 'Highway Material & Pavement Testing', Nem Chand and Brothers, Roorkee.
2. Ajay K. Duggal, Vijay P. Puri, 'Laboratory Manual in Highway Engineering', New Age Publications, New Delhi.