DETAILED SYLLABUS

FOR

5th Semester B. TECH PROGRAMME

IN

CIVIL ENGINEEERING

FOR 2018-9019

ADMISSION BATCH ONWARDS

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

Chhend Colony, Rourkela

ODISHA-769004

B. Tech in Civil Engineering (Admission Batch: 2018-2019)

5th Semester

Fifth Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC 11		Design of Concrete Structures	3-0-0	3
2	PC 12		Water and Waste Water Engineering	3-0-0	3
3	PC 13		Geotechnical Engineering	3-0-0	3
4	PE 2		Structural Analysis-II.	3-0-0	3
			Advance Mechanics of Material	3-0-0	
			Masonry Structure	3-0-0	
5	PE 3		Railway and Airport Engineering	3-0-0	3
			Pavement Design	3-0-0	
			Traffic Engineering	3-0-0	
6	MC 5		Universal Human Values		0
Total Credit (Theory)					15
Practical					
1	PC 14		Design of Concrete Structures Lab	0-0-3	2
2	PC 15		Water and Waste Water Engineering Lab	0-0-3	2
3	PC 16		Geotechnical Engineering Lab	0-0-3	2
4	PSI 2		Evaluation of Summer Internship	0-0-3	1
Total Credit (Practical)					7
Total Semester Credit					22

Design of Concrete Structures (3-0-0)

Module I   **(10 Classes)**
Properties of concrete and reinforcing steel, philosophy, concept and methods of reinforced concrete design, introduction to limit state method, limit state of collapse and limit state of serviceability, application of limit state method to rectangular beams for flexure, shear, bond and torsion

Module II   **(8 Classes)**
Design of doubly reinforced beams, design of T and L beams, design of one way and two way slabs, design of staircases.

Module III   **(8 Classes)**
Design of short and long columns with axial and eccentric loadings, Design of isolated and combined column footings

Module IV   **(8 Classes)**
Retaining walls, various forces acting on retaining wall, stability requirement, design of cantilever and counterfort retaining walls,

Module V   **(6 Classes)**
Design of water tanks, design requirements, design of tanks on ground, under ground and elevated water tanks.

Books:
1. Design of Reinforced Concrete Structue by N. Subramanian, Oxford University Press
2. Limit State Design by A.K.Jain, Neemchand& Bros
3. Reinforced Concrete Design by S U Pillai & D. Menon, McGraw Hill

4. Design of concrete structures by J.N.Bandyopadhyay, PHI
5. Limit State Design of Reinforced Concrete -P.C Verghese
6. Reinforced Concrete Design by S.N.Sinha, McGraw Hill
7. RCC Design-B.C.Punmia, A.K.Jain and A.K.Jain-Laxmi Publications

Digital Learning Resources:

Course Name	Design of Reinforced Concrete Structures 12 weeks
Course Link	(https://nptel.ac.in/courses/105/105/105105105/)
Course Instructor	PROF. NIRJHAR DHANG, ,IIT Kharagpur

Water and Waste Water Engineering (3-0-0)

Module – I **(08 Classes)**

General requirement for water supply, sources, quality of water, intake, pumping and transportation of water.

Module – II **(06 Classes)**

Physical, chemical and biological characteristics of water and their significance, water quality criteria, water borne diseases, natural purification of water sources.

Module – III **(08 Classes)**

Engineered systems for water treatment : aeration, sedimentation, softening coagulation, filtration, adsorption, ion exchange, and disinfection. Design of water distribution system.

Module – IV **(08 Classes)**

Generation and collection of waste water, sanitary, storm and combined sewerage systems, quantities of sanitary waste and storm water, design of sewerage system Primary, secondary and tertiary treatment of wastewater. Waste water disposal standards,

Module –V **(10 Classes)**

Basic of microbiology. Biological wastewater treatment system : Aerobic processes activated sludge process and its modifications, trickling filter, RBC, Anaerobic Processes conventional anaerobic digester, High rate and hybrid anaerobic reactors, Sludge digestion and handling, Disposal of effluent and sludge, Design problems on water distribution, sewerage, water treatment units, wastewater treatment units and sludge digestion.

Books:
1. Water Supply Engineering-Environmental Engineering v.1 by S.K.Garg, Khanna Publishers
2. Sewage Disposal and Air Pollution Engineering - Environmental Engineering v.2 by S.K.Garg, Khanna Publishers
3. Water Supply and Sanitary Engineering by B.S.BirdiDhanpat Rai Publishing Company
4. Water Supply Engineering by B. C. Punmia and A.K.Jain, Laxmi Publications
5. Water and Wastewater Technology by M.J.Hammer, PHI

Digital Learning Resources:

Course Name	WATER SUPPLY ENGINEERING, Waste water Treatment and Recycling
Course Link	https://nptel.ac.in/courses/105/105/105105201 (https://nptel.ac.in/courses/105/105/105105178//)
Course Instructor	PROF. MANOJ KUMAR TIWARI Department of Civil Engineering IIT Kharagpur

Geotechnical Engineering- I (3-0-0)

Module-I (**8 classes**)

Origin of Soil: Rock Cycle and the origin of soil, clay mineralogy, mechanical analysis of soil, grain size distribution curve, particle shape and size, weight volume relationships, specific gravity, unit weight, void ratio, moisture content, and relationships, relative density. Consistency of soil: Atterberg limits - Liquidity index and consistency index, activity, soil structure. Engineering classification of soil: Types of Soil classification, IS, USCS, HRB and ASTM.

Module-II (**8 classes**)

Soil Hydraulics: Modes of occurrence of water in soil. Stress conditions in soil- total, effective and neutral stresses and relationships.

Permeability - Bernaulli's equation, Darcy's Law, hydraulic conductivity, laboratory determination of hydraulic conductivity, Factors affecting hydraulic conductivity, equivalent hydraulic conductivity in stratified soil.

Seepage- Laplace equation of continuity, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, critical hydraulic gradient and quick sand condition.

Module-III (**6 classes**)

Soil Compaction: mechanism and principles, Laboratory compaction, factors affecting compaction, effect of compaction on soil properties, field compaction techniques.

Module-IV (**12 classes**)

Stress Distribution: Normal and shear stresses on a plane, Boussinesq's solution for a point load, line load, strip load, uniformly loaded circular and rectangular areas, Isobar and pressure bulb concept, stress distribution on horizontal and vertical planes, Newmark's chart and its application, contact pressure.

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination: direct and tri-axial shear test, unconfined compression test, vane shear test. Other methods of determining the un-drained shear strength of soil, sensitivity and thixotropy of clay.

Module-V (**6 classes**)

Consolidation of soils: Consolidation and compaction, primary and secondary consolidation, Terzhaghi's theory of one dimensional consolidation, consolidation test, coefficient of consolidation.

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Books:

1. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning

2. Soil Mechanics and Foundation Engineering, by K.R. Arora, Stanard Publishers

3. Soil Mechanics and Foundation Engineering by B.N.D. NarasingaRao, Wiley India Pvt.Ltd.

4. Basic and applied soil mechanics, by Gopal Ranjan, A S R Rao New Age International Publishers

Digital Learning Resources:

Course Name	GEOTECHNICAL ENGINEERING- 1
Course Link	(https://nptel.ac.in/courses/105/101/105101201
Course Instructor	Prof. Devendra Narain Singh, IIT Bombay 12 week

Structural Analysis-II (3-0-0)

Module – I   **(10 Classes)**
Analysis of continuous beams and plane frames by slope deflection method and moment distribution method.

Module – II   **(6 Classes)**
Aanalysis of continuous beam and simple portals by Kani's method

Module – III   **(8 Classes)**
Analysis of two hinged and fixed arches for dead and live loads, Suspension cables with two hinged stiffening girders

Module – IV   **(8 Classes)**
Matrix methods of analysis: flexibility and stiffness methods; Application to simple trusses and beams

Module – V   **(8 Classes)**
Plastic Analysis: Plastic modulus, shear factor, plastic moment of resistance, Load factor, Plastic analysis of continuous beam and simple rectangular portals, Application of upper bound and lower bound theorems

Books:

1. Structural analysis by C.S. Reddy Mc Graw Hill
2. Structural Analysis by T.S. Thandamoorthy, Oxford University Press
3. Structural analysis a matrix approach by Pandit & Gupta, Mc Graw Hill.
4. Limit Analysis of Structures: Monikaselvam, Dhanpat Ray Publication
5. Indeterminate Structures: J.S.Kinney
6. Indeterminate Structural Analysis: C.K.Wang ,Mc Graw Hill
7. Structural Analysis by D.S.Prakash Rao, Universities Press
8. Matrix Analysis of Structures by P.K.Singh, Cengage Learning

Digital Learning Resources:

Course Name	Structural Analysis-II
Course Link	https://nptel.ac.in/courses/105/105/105105109/#
Course Instructor	Dr. P. Banerji Department of Civil Engineering IIT Bombay

Advance Mechanics of Solids (3-0-0)

Module I (**10 Classes)**
Theories of failure: Maximum principal stress theory, maximum shear stress theory, maximum strain theory, total strain energy theory, maximum distortion theory, octahedral shear stress theory graphical representation and comparison of theories of failure.

Module II (**4 Classes)**

Thick cylinders subjected to internal and external pressures, compound cylinders, computer application in analyzing stresses in thick cylinders.

Module III (**10 Classes)**
Unsymmetrical bending: Properties of beam cross selection, slope of neutral axis, stresses and deflection in unsymmetrical bending, shear centre.
Curved Beam: Bending of beam with large initial curvature, Stress distribution in beam with rectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links.

Module IV (**8 Classes)**
Elementary concept of theory of elasticity, stresses in three dimensional, equations of equilibrium and compatibility, plane stress, computer analysis of two dimensional state of stress or strain at a point.

Module V (**8 Classes)**
Advanced topics in strength of materials: Repeated stresses and fatigue in metals, concept of stress Concentration, notch and stress concentration factors.
Experimental stress analysis: Resistance strain gauges, strain Rosettes, Two dimensional photoelastic methods of stress analysis, stress optic law, light and dark field in a polariscope, Isoclinic and Isochromatic fringe patterns, Computer Analysis of strain from strain rosette measurement.

Books:
1 Advanced Mechanics of Solids, L.S. Srinath, Mc Graw Hill.
2. Advanced Mechanics of Materials, Kumar &Ghai, Khanna Publisher.
3. Strength of Materials by R. Subramaniam, Oxford University Press
4. Strength of Material by S. S. Ratan, McGraw Hill
5. Advanced Mechanics of Materials: Seely and Smith, John Willey, New York.
6. Mechanics of Materials by Gere & Timoshenko, CBS.

Digital Learning Resources:

Course Name	Advanced Strength of Materials
Course Link	https://nptel.ac.in/courses/112/101/112101095/
Course Instructor	Prof. S.K. Maiti Department of Mechanical EngineeringIIT Bombay

Masonry Structures (3-0-0)

Module-I   **(8 Classes)**

Introduction, Masonry units, materials and types: History of masonry, Characterics of Brick, stone, clay block, concrete block, stabilized mud block masonry units-Strength, modulus of elasticity and water absorption.

Module-II   **(8 Classes)**

Strength of Masonry in Compression:Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression.

Module-III   **(8 Classes)**

Flexural and shear bond, flexural strength and shear strength:Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength,

Module-IV   **(8 Classes)**

Design of load bearing masonry buildings:Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.

Module-V   **(8 Classes)**

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions
Masonry arches, domes and vaults:Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

Books:
1. Dayaratnam P, "Brick and Reinforced Brick Structures"- Oxford & IBH
2. Sinha B.P & Davis S.R., "Design of Masonry structures"- E & FN Spon
3. Hendry A.W.,"Structural masonry"- Macmillan Educaon Ltd., 2nd edion.
4. Curtin, "Design of Reinforced and Prestressed Masonry"- Thomas Telford.
5. Sven Sahlin, "Structural Masonry"-Prence Hall.

Digital Learning Resources:

Course Name	DESIGN OF MASONRY STRUCTURES
Course Link	https://nptel.ac.in/courses/105/106/105106197
Course Instructor	PROF. ARUN MENON Department of Civil Engineering IIT Madras

Railway and Airport Engineering (3-0-0)

MODULE-I   **(8 Classes)**

History of Indian railways, component parts of railway track, problems of multi gauge system, coning of wheels, alignments and survey, permanent way track components, Type of rail sections, creep of rails, wear and failure in rails , Ballast requirements, sleeper requirements, types of sleepers, various train resistances

MODULE-II   **(8 Classes)**

Geometric design: Gradients and grade compensation, various speeds on a railway track, super-elevation, horizontal and vertical curves, Points and crossings, Design of simple turn-out, Signalling and interlocking,

MODULE-III   **(8 Classes)**

Airport site selection, Air craft characteristics, various surface of an airport, Wind rose diagram, Geometric elements of run way and taxiway , holding apron, parking configuration , terminal building , visual aids, air traffic control, airport marking and lighting.

MODULE-IV   **(8 Classes)**

Harbour Engineering: Classification of Harbour basin, general layout of harbours, Docks, Different components of docks.

MODULE-V   **(8 Classes)**

Inland waterways, Inland water transportation in India, classification of waterways, economics of inland waterways transportation, national waterways

Books:

1. A text book of railway engineering , By S.C.Saxena and M.G.Arora
2. Railway Engineering by Satish Chandra & MM Agrawal, Oxford University Press.
3. Transportation Engineering, Volume-II- Railways, Airports, Docks and Harbours, Bridges and Tunnels by C. venkatramaih, Universities Press
4. Air-port Engineering by S.K.Khanna and M.G.Arora

Digital Learning Resources:

Course Name	Transportation Engineering II
Course Link	https://nptel.ac.in/courses/105/107/105107123/
Course Instructor	Prof. Rajat Rastogi, IIT Roorkee

Pavement Design (3-0-0)

Module – I   **(08 Classes)**

Introduction: Classification of pavements, Difference between highway and runway pavements, Factors affecting structural design, Characteristics of traffic loading, Concept of VDF and Computation of design traffic.

Module – II   **(10 Classes)**

Principles of pavement design: Concepts of structural and functional failures, Performance criteria; Analysis of pavements: ESWL, Analysis of flexible and concrete pavements.

Module – III   **(10 Classes)**

Design of pavements: IRC, AASHTO and other important methods of design of bituminous and concrete pavements.

Module – IV   **(06 Classes)**

Pavement evaluation techniques: Benkelman beam, Falling weight deflectometer and other equipments.

Module – V   **(06 Classes)**

Concepts of pavement maintenance management.

Books:
1. Principles of Pavement Design, E. J. Yoder & M.W. Witzack, John Wiley
2. Pavement Design by R Srinivasa Kumar, Universities Press
3. Principles of Transportation Engineering, P. Chakroborty& A. Das, PHI Publication
4. Pavement Analysis and Design, Y. H. Huang, Prentice Hall

Digital Learning Resources:

Course Name	Advanced Transportation Engineering
Course Link	https://nptel.ac.in/courses/105/104/105104098/
Course Instructor	Prof. A. Das, Prof. ParthaChakraborty,IIT Kanpur,

Traffic Engineering (3-0-0)

MODULE-I   **(08 Classes)**
TRANSIT SYSTEM AND ISSUES
Introduction to Mass Transport, Role of various modes of Mass Transport, Transport System Performance at National, State, Local and International levels, National Transport Policy, Urban transportation problems and their impact, Modes of mass transit- their planning, construction and operation, Case studies of existing mass transit systems
Technical and economic evaluation of mass transit projects

MODULE-II   **(08 Classes)**
PUBLIC TRANSIT SYSTEM
Urban Transport System, Public Transport System Re-genesis and Technology, Physical performance of Public Transport System, Public Transport and Urban Development Strategies, Mass Transit concepts- Trip interchanges and assignments, Characteristics of Rail Transit, Vehicle Characteristics

MODULE-III   **(08 Classes)**
BUS TRANSIT PLANNING AND SCHEDULING
Route Planning and Scheduling, Bus Transport System, Performance and Evaluation, Scheduling, Conceptual patterns of bus service, Network Planning and Analysis, Bus Transport System Pricing, Bus Transit System Integration, Analytical Tools and Techniques for Operation and Management, Bus Rapid Transit Systems, Case Studies

MODULE-IV   **(06 Classes)**
RAIL TRANSIT TERMINALS AND PERFORMANCE EVALUATION
Performance Evaluation, Efficiency, Capacity, Productivity and Utilisation, Performance Evaluation Techniques and Application, System Network Performance, Transit Terminal Planning and Design

MODULE-V   **(10 Classes)**
IMPACT OF TRANSIT
Policies and Strategies for Mass Transport, Need for Integrated Approach, Unified Transport Authorities, Institutional arrangement, Urban Transport Fund, Parking Policies, Private Sector in Mass Transport, Bus and Rail Integration, Co-ordination of Feeder Services, Transit Oriented Land Use Development., Case Studies, Urban Transportation and Land use, Impact of Transport Development on Environment, Remedial measures, Policy Decisions, Recent Trends in Mass Transportation Planning and Management

Books
1. Michael J.Bruton , "An Introduction to Transportation Planning", Hutchinson,1985
2. Michael D.Meyer and Eric J.Miller , "Urban Transportation Planning – A Decision Oriented Approach", McGraw Hill Book Company, New York,1984
3. F.D.Hobbs, "Traffic Planning and Design", PoargamonOress
4. John W.Dickey, "Metropolitan Transportation Planning" – Tata McGraw Hill Publishing Company Limited, New Delhi, 1980
5. Paul H.Wright, "Transportation Engineering – Planning and Design", John Wiley and Sons, New York, 1989.

Digital Learning Resources:

Course Name	Urban transportation planning
Course Link	https://nptel.ac.in/courses/105/107/105107067/
Course Instructor	Dr. M. Parida IIT Roorkee ,

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5Th Semester

Universal HumanValues
(Self, Society and Nature)

Pre-requisites: Universal Human Values: Self & Family (desirable); 4-day Harmony-2 Workshop (co-requisite). Please refer to AICTE Model Curriculum-Vol-II.

1. Objective:

The objective of the course is four-fold:

- A. Sensitization of student towards issues in society and nature.
- B. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
- C. Strengthening of self reflection.
- D. Development of commitment and courage to act.

(For elaboration on some of the above, consult course description for Universal Human Values 1: Self and Family, AICTE Model Curriculum-VOL-II).

2. Course Topics :

In this Universal Human Values course, the focus is more on understanding society and nature on the basis of self and human relationships.

- i)   Purpose and motivation for the course.
- ii)   Recapitulation (from the previous course) on ideas of self, pre-conditioning, and natural acceptance.
- iii)   Harmony in the self. Understanding human being as co-existence of self and body. Identifying needs and satisfying needs of self and body. Self-observations. Handling peer pressure.
- iv)   Recapitulation on relationships. Nine universal values in relationships. Reflecting on relationships in family. Hostel and institute as extended family. Real life examples.
- v)   Teacher-student relationship. Shraddha. Guidance. Goal of education.
- vi)   Harmony in nature. Four orders of nature – material order, plant order, animal order and human order. Salient features of each. Human being as cause of imbalance in nature. (Film **"Home"** can be used.)
- vii)   Human being as cause of imbalance in nature. Depletion of resources – water, food, mineral resources. Pollution. Role of technology. Mutual enrichment not just recycling.
- viii)   Prosperity arising out of material goods and understanding of self. Separation of needs of the self and needs of the body. Right utilization of resources. lkekU; vkdka{kk ,oa egRokdka{kk, Understanding the purpose they try to fulfil.

ix) Recapitulation on society. Five major dimensions of human society. Fulfilment of the individual as major goal. Justice in society. Equality in human relationships as naturally acceptable. Establishment of society with abhaya (absence of fear).

x) Ethical human conduct. Values, character and netikataa.

xi) Professional ethics. Conduct as an engineer or scientist.

Design of Concrete Structures Lab(0-0-3)

1. Workability test of concrete:Slump test, compaction factor test and flow table test
2. Cube Test of Concrete(Nominal Mix)
3. Cylinder Test for Concrete(Nominal Mix): Determination of axial stress, longitudinal strain, lateral strain and Poision's ratio. Plotting of stress-strain curve and determination of modulus of elasticity.
4. Split Tensile Strength Test of Concrete
5. Prism test for determining modulus of rupture of concrete
6. Design of Concrete Mix (As per Indian Standard Method)
7. Failure of RC beam in bending and shear (two point and one point loading)
8.Complete design of a simple load bearing residential building comprising of beams, slab, column, footing, staircases, etc. and the detailing of steel reinforcement.

Course Name	**Design of Concrete Structures Lab**
Course Link	https://nptel.ac.in/courses/105/107/105107067/
Course Instructor	,

WATER SUPPLY AND SANITARY ENGINEERING LAB

LIST OFEXPERIMENTS:

1. *Analysis of water Quality Parameter*

   a) Measurement of pH, Electrical conductivity
   b) Determination of Turbidity of water samples.
   c) Determination of Chlorides in water.
   d) Determination of Iron and Fluoride in water.
   e) Determination of Acidity and Alkalinity of water.
   f) Determination of Sulphate in water.
   g) Determination of Hardness of water.
   h) Determination of Residual Chlorine of water.
   i) Determination of Total Dissolved Solids.
   j) Determination of optimum coagulant dosage.
   k) Microbiological culture analysis of bacterial samples
   l) MPN Test
   .

2. *Analysis of Waste Water Characteristics*

   a) Determination of Total Solids, Settlable Solids, Dissolved Solids, Suspended Solids and Volatile Solids.
   b) Determination of Dissolved Oxygen, COD and BOD.
   c) Determination of Ammonia–nitrogen and Nitrates.

Digital Learning Resources:

Course Name	Environmental Engineering 1
Course Link	https://ee1-nitk.vlabs.ac.in/
Course Instructor	NIT Suratkal,

GEOTECHNICAL ENGINEERING-1 LAB

1. *Determination of specific gravity of soil grains*
2. *Determination of grain size distribution of soil*
   (a)Sieve test (b) Hydrometer/ pipette test
3. *Determination of Atterberg limits of soil*
   Liquid limit (b) plastic limit (c) shrinkage limit
4. *Measurement of soil compaction in the field*
   Core cutter method (b) Sand replacement method
5. *Determination of Density – Water content relationship of soil.*
   Proctor compaction test (ii) Modified Proctor compaction test (c) Use of Proctor penetration needle
6. *Determination of relative density of granular soil*
7. *Determination of shear strength parameters of soil*
   (a)Shear Box test (b) Tri-axial compression test (c) Unconfined compression test (d) Vane shear test
8. *Determination of consolidation characteristics of soil using fixed ring Oedometer*
9. *Determination of California Bearing Ratio (CBR) of soaked and un-soaked soil specimens*
10. *Determination of coefficient of permeability of soil*
    (a)Constant head permeameter (b) Falling head permeameter

Digital Learning Resources:

Course Name	Soil Mechanics Lab
Course Link	http://smfe-iiith.vlabs.ac.in/
Course Instructor	IIIT Hyderabad