ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY GUWAHATI

Course Structure and Syllabus
(From Academic Session 2018-19 onwards)

B.TECH
CIVIL ENGINEERING
5TH SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Course Structure

(From Academic Session 2018-19 onwards)

B. Tech 5ᵗʰ Semester: Civil Engineering

Semester V/ B. TECH/CE

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	CE181501	Open Channel Flow and Irrigation Engineering	3	1	0	4	30	70
2	CE181502	Structural Design-I	3	1	0	4	30	70
3	CE181503	Environmental Engineering-I	3	1	0	4	30	70
4	CE181504	Transportation Engineering-I	3	1	0	4	30	70
5	CE181505	Geotechnical Engineering-I	3	1	0	4	30	70
6	HS181506	Engineering Economics	3	0	0	3	30	70
Practical								
1	CE181514	Transportation Engineering Lab	0	0	2	1	15	35
2	CE181513	Environmental Engineering Lab	0	0	2	1	15	35
3	CE181515	Geotechnical Engineering Lab	0	0	2	1	15	35
4	SI181521	Internship-II (SAI-Academia)	0	0	0	1	-	100
TOTAL			18	5	6	**27**	**225**	**625**
Total Contact Hours per week : 29								
Total Credits: 27								

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181501	**Open Channel Flow and Irrigation Engineering**	**3 -1- 0**	**4**

PART –I
[OPEN CHANNEL FLOW]

MODULE 1: Basic Concepts in Open Channel Flow

Introduction, Differences in Open Channel and Pipe Flow, Types of Channel, Classification of Open Channel Flow. Computation of Hydraulic depth and Hydraulic Radius of different shapes of Channels.

MODULE 2: Energy Depth Relationships

Specific Energy, Specific Energy Diagram and its characteristics, Minimum Specific Energy at a Given Discharge, Maximum Discharge at a Given Specific Energy, Critical Depth, Computations – Direct expression, Trial & Error Method, Section factor curves. Specific Force and Specific Force Diagram. Conditions for Minimum Specific Force at a Given Discharge and Maximum Discharge at a Given Specific Force. Numerical Problems. Flow Transition over hump and due to width constriction under subcritical & super flow condition.

MODULE 3: Uniform Flow

Introduction, Chezy's Equation for average velocity, Manning's Formula, Kutter's Formula, Bazin's Formula. Computation of uniform flow, Computation of normal depth – Trial & Error Method, Graphical method, Das & Bar Formula, Section factor curves. Related Numerical Problems. Hydraulically Efficient Channel sections, Numerical Problems.

MODULE 4: Gradually Varied Flow (Steady)

Dynamic equation of GVF (Steady) – dynamic equation for wide rectangular channel using Chezy's eq. And Manning's formula. Classification & characteristics of water surface profile. Computation of GVF profile: Graphical Integration method, Direct step method, Introduction to Numerical methods.

MODULE 5: Rapid Varying Flow: Hydraulic Jump

Introduction, Practical uses of Jump, Types of Jump, Length of Jump, Velocity Profile and Pressure Distribution in Jump. Momentum Equation in Hydraulic Jump and finding of the relationship between the sequent depths in case of horizontal rectangular frictionless channel. Numerical problems

PART –II
[IRRIGATION ENGINEERING]

MODULE 1: Introduction

Definition – Irrigation. Advantages, Disadvantages and Ill- Effects of Irrigation. Necessity and Development of Irrigation in Assam. Types of Irrigation, Techniques of water distribution in farms

MODULE 2: Water Requirements of Crops

Duty, Delta and Base Period, Factors affecting Duty. Definitions – Rabi crops, Kharif crops, Cash crop, Crop ratio, Kor watering, Kor period, Kor depth, Crop rotation, Intensity of irrigation, Gross commanded Area, Cultural commanded area, Capacity factor, Full supply coefficient, Nominal Duty, Irrigation Efficiencies. Consumptive Use – Estimation of consumptive use, Net Irrigation Requirement,

Numerical Problems. Soil – Moisture Relationship, Different Water holding capacities at root zone. Numerical Problems.

MODULE 3: Canal Irrigation
Alignment of canals – Ridge canal, Contour canal, Side – Slope canal. Distribution system in canal Irrigation. Canal Head Works – Layout with major components, Brief Descriptions of all Major components. Design of Irrigation canal in Alluvial soil -- Kennedy's Theory and Lacey's Theory for the Design of canals. Numerical Problems.

MODULE 4: Cross Drainage Works
Definition- Cross- Drainage Works. Aqueduct, Super passage, Level Crossing, Inlet – outlet

MODULE 5: Lift Irrigation
Introduction, Sources of ground water, ground water yield, Transmissibility, Specific yield, Storage coefficient, Thiem's equation Confined and unconfined aquifer, Dupit's equation for unconfined and unconfined aquifer, Interference among wells, Well loss & specific capacity. Numerical.

Textbooks/Reference Books:

1. Open Channel Hydraulics --- V. T. Chow, V. T. Chow, The Blackburn press,2009.
2. Flow Through Open Channels --- K. G. Ranga Raju, McGraw Hill Education, 2001
3. Open Channel Flow --- M. M. Das PHI, 2009
4. Flow in Open Channels --- K. Subramanya, Tata McGraw Hill Education Private   limited,2008
5. Flow Through Open Channels --- Rajesh Srivastava, Oxford University Press, 2008
6. Mechanics of Sediment Transport & Alluvial Stream Problems --- Garde & Ranga Raju
7. John Wiley & Sons (Asia) private limited, 1986.
8. Irrigation Engineering and Hydraulic Structures --- S. K. Garg, Khanna Publishers, 2006
9. Irrigation Water Power and Water Resource Engineering --- Arora, Standard publisher's distributors, 2015
10. Irrigation Engineering --- R. K. Sharma & T. K. Sharma, S Chand and Company, 2007
11. Irrigation and Water Resource Engineering --- G. L. Asawa, new Age Publication, 2008
12. Irrigation and Water Power Engineering --- B. C. Punmiya Laxmi Publications, 2016
13. Ground water Hydrology– H. M. Roghunath, New Delhi: New Age International (P) Ltd., Publishers, 2006

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181502	**Structural Design-I**	**3 -1- 0**	**4**

MODULE 1: Introduction to Reinforced Concrete
Concrete, Reinforced Cement Concrete, Discussion on Materials, Inspection, Testing and Quality of RC Structures, Characteristic Strength of Concrete and Steel, Concept of Limit state of Collapse and Serviceability Methods of design Objectives of design- RCC- Limit State method- Assumptions-Stress-Strain behavior of Steel and Concrete- Stress block parameters- Working stress method-comparison of Limit state and Working Stress design method.

MODULE 2: Design of Singly Reinforced Beams & Doubly Reinforced Beams
Analysis of Cracked and Un-Cracked RC section, Concept of Moment of resistance.
Analysis of Singly Reinforced RC Section, Depth of Neutral Axis-Balanced-Under Reinforced-Over Reinforced Sections- Limiting Moment - Design parameters- Design examples.
Analysis of Doubly Reinforced RC Section- Limiting Moment - Design parameters- Design examples.

MODULE 3: Design for Shear, Bond and Torsion
Design of Vertical Stirrups-Bent-up bars- Limitation, Development Length-Design for shear and bond. Discussion on Maximum shear strength of concrete.

MODULE 4: Design of Flanged Beams
Analysis of flanged RC section- T- Beam and L-Beams, Singly and Doubly Reinforced-Effective flange width- Limiting Moment - Design examples.

MODULE 5: Design of Slabs
Design of One and Two way slabs- Effect of edge conditions- Moment of Resistance-Torsion reinforcement at corners- Design examples, IS-code method of Slab design.

MODULE 6: Design of Columns
Design principles of RC columns- Assumptions- Short Column and Long Column, Rectangular and Circular Columns- Helical reinforcement

MODULE 7: Design of Footings
Analysis and design of Shallow Foundations, Design for Bending- One-way shear and Two-way shear, Design example of Isolated footing and Combined footing.

MODULE 8: Stair Case
Analysis and Design of dog legged staircase, open newel staircase. Earthquake safety provision of Stair Case as per IS:4326-1993

Text/ Reference Books:
1. IS:456 - 2000 - Plain and Reinforced concrete - Code of practice.
2. Design of Reinforced Concrete Structures (Limit State) – A.K.Jain, 1st Edition, Nemchand Brothers, Roorkee.
3. P.C. Verghese, Limit State Design of Reinforced Concrete, PHI.
4. *Reinforced Concrete Design*, S U Pillai& *DevdasMenon*. Tata McGraw Hill.
5. Design of Reinforced Concrete Structures, N. Subramanian, OUP India

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181503	Environmental Engineering-I	3-1-0	4

MODULE 1: Introduction
Population Forecasting and Water Demand

MODULE 2: Sources of Water and Wastewater
Water: Surface source and Groundwater source, Well: Definition, classification, Numerical
Wastewater: Point Source and Non-Point Source

MODULE 3: Physical, Chemical and Biological Characteristics of Water and Wastewater
Water: Test. Turbidity, Odour, Temperature, Colour, Total dissolved solid
Chemical: pH, Alkalinity, Hardness, Chloride, Fluoride, Sulphate
Biological: MPN, E-Coli
Wastewater:
Odour, Temperature, Colour
Chemical: pH, Nitrogen, Chloride, Fluoride, Sulphate, Phoporous
Biological: DO, BOD, COD, TOC

MODULE 4: Unit Operations and Processes for Surface Water and Wastewater Treatment
Water Treatment Processes: Theory and Application
Aeration, Solids Separation, Settling Operations, Coagulation, Filtration, Softening, Disinfection
Wastewater Treatment Processes: Theory and Application
Aeration, Solids Separation, Settling Operations, Coagulation, Filtration, Softening, Disinfection

MODULE 5: Water Conveyance System
Intake works: River, reservoir and channel intakes, selection of intake.
Types of conduit, Pipe materials, Pipe testing

MODULE 6: Distribution System
Layout, and design of distribution system, Maintenance of distribution system, Detection of leakage and wastage and their prevention, Gates and valves in distribution system

MODULE 7: Water Supply and Drainage of Building
Introduction, Principles. Governing design of water supply in buildings, lay out, Design of water pipes-traps, Sanitary fitting, Plumbing System of Drainage- Single stack system, One pipe system, two pipe system

MODULE 8: Adverse Effects
Adverse Effects on Human Health & Environment, Aquatic life, Animal life, Plant life, Water Pollution Measurement Techniques, Water Pollution Control Equipment & Instruments, Indian Standards for Water Pollution Control

Textbooks / Reference Books:
1. H. S Peavy, D. R. Rowe and George Tchobanoglous, *Environmental Engineering*, McGraw-Hill International Ed.
2. T. J McGhee, *Water Supply and Sewerage*, McGraw-Hill Inc.

3. Environmental Engineering Vol. I and II Santosh Kumar Garg
4. Environmental Engineering K. N. Duggal.
5. Environmental EngineeringVol. I and II, B.C. Punmia
6. M. L Davis and D. A Cornwell, *Introduction to Environmental Engineering*, McGraw-Hill, Inc.
7. Metcalf & Eddy*, Wastewater Engineering- Treatment and Reuse* (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill, 4th Edn.
8. C. N Sawyer, P. L McCarty and G. F. Parkin, *Chemistry for Environmental Engineers*, McGraw-Hill
9. APHA, *Standard Methods Examination of Water and Wastewater*, American Public Health Association, Washington DC
10. *Manual for Sewer and Sewerage*, Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban Development, Govt. of India
11. *Manual for water supply and treatment*, Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban Development, Govt. of India

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181504	**Transportation Engineering-I**	**3 -1- 0**	**4**

MODULE 1: Transportation Infrastructure
Classification of Indian Road Network; Characteristics of road transport; National Highway Development Programme: Golden Quadrilateral and North-south & East-West economic corridor; Introduction to DRRP and PMGSY; Highway alignment and engineering surveys.

MODULE 2: Road Geometry
Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, gradients, sight distances, horizontal and vertical alignments as per IRC: 73 and IRC: 86

MODULE 3: Pavement Materials
Characterization of different pavement materials including bitumen, aggregate, subgrade soil, modified bitumen, emulsion, cutback and bituminous mix; their desirable properties and quality control tests; Blending of Aggregates; Design of bituminous paving mixes using Marshall method of mix design; Selection of pavement materials as per IRC and MORTH; Road Construction Technologies

MODULE 4: Pavement Design
Design factors for flexible and rigid pavements including Vehicle Damage Factor (VDF), Equivalent Single Axle Load (ESAL), Equivalent Axle Load Factor (EALF), Lane Distribution Factor (LDF) and Fourth Power Damage Law; Calculation of stresses in Rigid Pavements; Design of flexible pavement using IRC: 37; Design of rigid pavements using IRC: 58

MODULE 5: Pavement Rehabilitation
Distresses in flexible and rigid pavement and their maintenance measures; functional and structural evaluation of flexible pavement, overlay design as per IRC-81

MODULE 6: Traffic Engineering
Traffic studies on flow, speed, travel time - delay and O-D study, PCU, Peak Hour Factor (PHF), parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Grade separated intersections and channelization; Highway capacity and level of service of rural highways and urban roads; Traffic signs.

Textbooks / Reference Books :

1. Principles of Transportation Engineering by P. Chakroborty and Animesh Das

2. Analysis of Pavement Structures by Animesh Das

3. Pavement Analysis and Design by Yang H. Huang

4. Traffic Engineering and Transport Planning by L.R. Kadiyali

5. Ministry of Road Transport and Highways: Specification for Road and Bridge works (5th Revision)

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181505	Geotechnical Engineering-I	3 -1- 0	4

MODULE 1: Composition, Index Properties Classification of Soils

Soil structure and its behavior. Typical clay mineral structures of Kaolinite, Montmorillonite and Illite. Soil-water system. Soil as a three phase system. Index properties and Phase relationship. Particle-size analysis. Consistency of soils and Atterberg's limits. Activity of clays. Soil classification – according to grain size, according to plastic properties (IS classification). Numerical problems.

MODULE 2: Permeability of Soil

Darcy's law – discharge velocity and seepage velocity, it's validity. Factors affecting permeability. Laboratory and field determination of permeability co-efficient. Permeability of stratified soil deposits. Numerical problem.

MODULE 3: Seepage Analysis

Seepage pressure – quick condition. Derivation of Laplace equation of flow in 2-D. Properties and applications of flow net – determination of quantity of seepage, seepage pressure, uplift pressure and exit gradient. Construction of flow net. Phreatic line of an earth dam – Casagrande's method of determining phreatic line in a dam. Numerical problems.

MODULE 4: Stress and Stress distribution

Stress path. Effective stress concept. Geostatic Stresses Boussinesq's theory and Westergaard theory. Pressure distribution diagrams – stress isobar. Newmark's influence chart. Contact pressure. Numerical Problems.

MODULE 5: One Dimensional Consolidation

Introduction. The consolidation process. Consolidation of laterally confined soil – compression index, co- efficient of compressibility, co- efficient of volume change. Consolidation of undisturbed specimen. Determination of pre-consolidation pressure. Secondary Compression. Numerical problems.

MODULE 6: Compaction

Introduction. Standard Proctor Test. Zero air voids line. Modified Proctor test. Field compaction methods and its control. Factors affecting compaction. Numerical problems.

MODULE 7: Shear Resistance of Soil

Introduction- Friction and cohesion. Mohr's stress circle. Mohr- Coulomb Failure theory. Drainage conditions and measurement of shear strength – direct shear test, tri-axial test, unconfined compression test, vane shear test. Pore pressure parameters. Sensitivity and thixotropy of cohesive soils. Stress-strain-volume change characteristics of cohesion less and cohesive soils. Numerical problems

Textbooks / Reference Books:

1. Soil Mechanics and Foundation Engineering- P. Purushothama Raj, Pearson Education in South Asia, Second Edition, (2018)

2. Geotechnical Engineering – Debasish Moitra, Universities Press; First Edition edition (2016)

3. Geotechnical Engineering – Shashi K Gulati & Manoj Dutta, McGraw Hill Education (16 May 2005)

4. Basic and Applied Soil Mechanics- Gopal Ranjan & A. S. Rao (1991), Wiley Eastern Ltd., New Delhi.

5. Soil Mechanics and Foundation: Dr. B. C. Punmia, Laxmi Publications; Sixteenth edition (2017), Language: English, ISBN-10: 8170087910, ISBN-13: 978-8170087915

6. Soil Engineering in Theory and Practice (Part I & Part II): Dr. Alam Singh, CBS; 2 edition (1 December 2009)

7. Foundation Analysis and Design: Joseph E. Bowles, McGraw-Hill

Course Code	Course Title	Hours per week L-T-P	Credit C
HS181506	**Engineering Economics**	**3-0-0**	**3**

Course Outcomes (COs):

The students will be able to

1. Acquire knowledge about economics its nature, scope and importance.

2. Understand the economic laws, principles, and theories and their relevance in present day situation.

3. Develop the ability of critical thinking to meet the challenges at the national and global problems.

4. Apply knowledge in finding out socio-economic problems and appropriate measures to deal with them.

5. Equip students with vital knowledge to run government and non-government institutions and bodies.

6. Assemble knowledge which is vital for industry and research and evolve proper policy for economic development.

MODULE 1: Introduction to Economics (3 Lectures)
Meaning and Definition of Economics, Nature and Scope of Economics, Concept of Micro and Macro Economics

MODULE 2: Utility Analysis (3 Lecture)
Meaning of Utility, Utility Function, Consumers Equilibrium, Concept of Indifference Curve, properties of Indifference Curve, Equilibrium under Indifference Curve

MODULE 3 : Demand and Supply Analysis (4 Lectures)
Law of Demand, Demand Function, Elasticity of Demand, Types of Elasticity of Demand, Measurement of Elasticity of Demand, Demand Forecasting, Law of Supply, Supply Function

MODULE 4: Revenue, Production & Cost Analysis (4 Lectures)
Average, Marginal and Total Revenue, Revenue Function, Average, Marginal and Total Cost, Cost Function, Short and Long Run Cost Curves. Break Even Point, Managerial Uses of Cost Function, Cobb Douglas Production Function

MODULE 5 : Market Structure (4 Lectures)
Concept of Market, Price-Output Determination under Perfect Competition, Monopoly Market and Monopolistic Competition

MODULE 6 : Money, Banking and National Income (8 Lectures)
Definition of Money, Function of Money, Index Numbers, Construction of Index Numbers, value of Money, Causes of Inflation, Functions of Commercial and central bank, Central bank and its monetary policy, Money Market and Capital Market, Functions of Stock exchange, Concept of National Income, Measurement of National Income, Concept of Investment.

MODULE 7: Introduction to Environmental Economics   **(5 Lectures)**

Concept of Environmental Economics, Cost -Benefit Analysis, Social Cost, Externalities, Concept of Pareto Equilibrium, Externality, Market Failure

MODULE 8: Public Finance   **(3 Lectures)**

Introduction to Public Finance, Concept of Budget, Types of Budget, Budget Receipts, Concept of Goods and services Tax (GST)

Textbooks/Reference Books:
1. Managerial Economics by V. Agarwal: Pearson Pvt. Limited, New Delhi.
2. Engineering Economics by Dr. A. Ahmed & G. Begum: Chandra prakash, Guwahati
3. Principles of Engineering Economics with Application by Dr. Z. A. Khan, A. N. Siddiquee, B. Kumar, M. H. Abidi: Cambridge University Press.
4. Public Finance and Public Policy by Dr. R. K Choudhury: Kalayani publishers
5. Quantitative Methods for Economics by R. Veerachamy: New Age International Publication Ltd.
6. Micro and Macro Economics by Dr. M. L. Seth: Educational Publishers, Agra -3
7. A Koutsoyiannis: Modern Microeconomics
8. Environmental Economics by R. N. Bhattacharya: Oxford Publication

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181514	**Transportation Engineering Lab**	0- 0-2	1

LIST OF EXPERIMENTS:

1. Sieve analysis [as per IS 2386 (Part I)-1963] and blending of aggregates by Triangulation and Rothfuchs Method

2. Combined Flakiness and Elongation Index test [as per IS 2386 (Part I)-1963]

3. Specific Gravity test of coarse and fine aggregates [as per IS 2386 (Part III)-1963]

4. Aggregate Impact Value test [as per IS 2386 (Part IV)-1963]

5. Los Angeles Abrasion Value test [as per IS 2386 (Part IV)-1963]

6. Aggregate Crushing value Test [as per IS 2386 (Part IV)-1963]

7. California Bearing Ratio (CBR) test [as per IS 2386 (Part XVI)-1987]

8. Dynamic Cone Penetrometer test [as per ASTM D6951/D6951M-09]

9. Penetration test on bitumen [as per IS: 1203-1978]

10. Ductility test on bitumen [as per IS: 1208 – 1978]

11. Ring and Ball test for softening point determination [as per IS 1205-1978]

12. Flash and fire point determination using Pensky-Martens apparatus [as per IS: 1209 1978]

13. Striping value test of aggregates [as per IS: 6241-1971]

14. Saybolt Viscosity test on bitumen emulsion [as per ASTM D7496-11]

15. Marshal Stability test on bituminous mixes to determine optimum binder content [as per ASTM-D6927, ASTM- D5581]

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181513	**Environmental Engineering Lab**	**0-0-2**	**1**

LIST OF EXPERIMENTS:
Water:
1. Determination of pH, Conductivity value of a given sample
2. Determination of Alkalinity of a given sample
3. Determination of Acidity of a given sample
4. Determination of Hardness of a given sample
5. Determination of Total Solids (TS, SS) of a given sample
6. Determination of Chloride Content of a given sample
7. Determination of Sulphate Content of a given sample
8. Determination of Ca, Mg Content of a given sample
9. Determination of Sulphate Content of a given sample
10. Determination of Plate Counts and MPN test; of a given sample

Waste water:
1. Determination of DO Content of a given sample
2. Determination of BOD of a given sample
3. Determination of COD of a given sample
4. Determination of Fluoride and metals using colorimetric methods
5. Introduction to advance instruments i.e. Atomic Adsorption Spectroscopy (AAS). Flame Photometer, UV spectrophotometer

Textbooks/Reference Books:

1. C. N Sawyer, P. L McCarty and G. F. Parkin, Chemistry for Environmental Engineers, McGraw-Hill
2. APHA, Standard Methods Examination of Water and Wastewater, American Public Health Association, Washington DC
3. Manual for Sewer and Sewerage, Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban Development, Govt. of India
4. Manual for water supply and treatment, Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban Development, Govt. of India

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181515	Geotechnical Engineering Lab	0-0-2	1

LIST OF EXPERIMENTS:

1. Water content determination by-
    i. Oven drying method
    ii. Infrared Moisture meter method
2. Specific gravity by-
    i. Density bottle
    ii. Pycnometer
3. Grain size distribution
4. Determination of plastic limit. Determination of liquid limit by-
    i. Casagrande apparatus
    ii. Cone penetrometer
5. Standard Proctor test
6. Constant head and falling head Permeability test
7. Consolidation test
8. Direct Shear test
9. Unconfined compression test

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