

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(AUTONOMOUS)**

**Department of CIVIL ENGINEERING
Course Structure for R19 Regulations**

Course code Definitions

L - Lecture

T - Tutorial

P - Practical

BS - Basic Science Courses

ES - Engineering Science Courses

HS - Humanities and Social Sciences including Management courses

PCC - Professional core courses

PEC - Professional Elective courses

OEC - Open Elective courses

MC - Mandatory courses (Audit Courses)

INTERN - Internship

PROJ - Project

I B.Tech - I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	HS	19AC15T	Functional English and Life Skills	3	-	-	3
2	BS	19AC11T	Algebra and Calculus	3	1	-	4
3	BS	19AC13T	Chemistry of materials	3	-	-	3
4	ES	19A311T	Engineering Graphics –I	1	-	2	2
5	ES	19A511T	Problem solving and C Programming	3	-	-	3
6	MC	19AC16T	Environmental Sciences	2	-	-	0
Lab Courses							
7	HS	19AC15L	Communicative English Lab	-	-	3	1.5
8	BS	19AC13L	Chemistry of materials Lab	-	-	3	1.5
9	ES	19A511L	C-Programming Lab	-	-	3	1.5
				15	1	15	19.5

I B. Tech - II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	BS	19AC21T	Differential Equations and Vector Calculus	3	1	-	4
2	BS	19AC23T	Engineering Physics	3	-	-	3
3.	ES	19A521T	Python Programming	3	-	-	3
4	ES	19A321T	Engineering Graphics-II	2	-	2	3
5	ES	19A322T	Engineering Mechanics	3	-	-	3
Lab Courses							
7	ES	19A521L	Python Programming lab	-	-	3	1.5
8	BS	19AC23L	Engineering Physics Lab	-	-	3	1.5
9	ES	19A323L	Engineering & IT Work shop	-	-	3	1.5
				13	1	13	20.5

II B.Tech – I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	BS	19AC34T	Life Sciences for Engineers	2	-	-	2

2	BS	19AC31T	Partial Differential Equations & Complex Variables	3	-	-	3
3	PC	19A131T	Building materials and construction	3	-	-	3
4	PC	19A132T	Surveying	3	-	-	3
5	PC	19A133T	Mechanics of materials	3	-	-	3
6	PC	19A134T	Fluid mechanics	3	-	-	3
7	ES	19A235T	Basic Electronics, Electrical and Mechanical Technology	2	-	-	2
8	MC	19AC375	Constitution of India	2	-	-	-
Lab Courses							
7	PC	19A132L	Surveying Lab	-	-	2	1
8	PC	19A133L	Mechanics of materials lab	-	-	2	1
9	PC	19A134L	Fluid Mechanics lab	-	-	2	1
				21	-	7	22

II B.Tech – II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	BS	19AC41T	Numerical Methods & Probability and Statistics	3	-	-	3
2	ES	19A141T	Computer aided civil engineering Drawing	2	-	2	3
3	HS	19AE41T	Managerial Economics and financial Accounting	3	-	-	3
4	PC	19A142T	Concrete Technology	3	-	-	3
5	PC	19A143T	Strength of materials	3	-	-	3
6	PC	19A144T	Hydraulic Engineering	3	-	-	3
7	MC	19AC45T	Essence of Indian Traditional Knowledge	3	-	-	0
Lab Courses							
7	PC	19A144L	Hydraulics Engineering lab	-	-	2	1.0
8	PC	19A142L	Concrete Technology lab	-	-	3	1.5
9	PC	19A145L	Civil Engineering work shop	-	-	3	1.5
				20	-	11	22

III B.Tech – I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A151T	Basic Reinforced concrete Design	3	-	-	3
2	PC	19A152T	Soil Mechanics	3	-	-	3
3	PC	19A153T	Water Resource Engineering	3	-	-	3
4	PC	19A154T	Structural Analysis	3	-	-	3
5	PE	19A15AT	Advanced Structural Engineering	3	-	-	3
		19A15BT	Prestressed concrete				
		19A15CT	Advanced RCC Design				
6	OE	19A15DT	Finite Element methods	3	-	-	3
		19A15ET	Instrumentation & Sensor Technologies for Civil Engineering Applications				
		19A15FT	Watershed Management				
		19A15GT	Disaster Management				

7	HS	19AC53T	Universal Human values	2	-	-	2
Lab Courses							
8	PC	19A154L	Structural Analysis & Design lab(STAAD)	-	-	2	1
9	PC	19A152L	Soil Mechanics lab	-	-	2	1
10	HS	19AC51L	General Aptitude	-	-	2	1
				20		6	23

III

B.Tech - II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A161T	Design of Steel Structures	3	-	-	3
2	PC	19A162T	Engineering Geology	2	-	-	2
3	PC	19A163T	Environmental Engineering	3	-	-	3
4	PE	19A16AT	Engineering Hydrology	3	-	-	3
		19A16BT	Water Resources Field Methods				
		19A16CT	Bridge Engineering				
5	PE	19A16DT	Ground Improvement Techniques	3	-	-	3
		19A16ET	Foundation Engineering				
		19A16FT	Environmental Geo-Technology				
6	OE	19A26HT	Fuzzy Logic and Neural Networks	3	-	-	3
		19A26GT	Energy Management and Conservation				
		19A36ET	Introduction to Mechatronics				
		19A36FT	Fundamentals of Robotics				
		19A36GT	Non-Conventional Source of Energy				
		19A46GT	Electronic Circuits and its Applications				
		19A46HT	Basics of Communication Systems				
	19A56IT	Artificial Intelligence					
	19A56JT	Cyber Security					
Lab Courses							
7	PC	19A162L	Engineering Geology lab	-	-	2	1
8	PC	19A163L	Environmental Engineering lab	-	-	3	1.5
9	HS	19AC62L	Professional Communication skills Lab	-	-	3	1.5
		19A164I	*Internship	-	-	-	2
				17	-	8	23

- Internship grade will be awarded in IV-II marks memo

IV

B.Tech - I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A171T	Transportation Engineering	2	-	-	2
2	PC	19A172T	Estimation, costing and Valuation	3	-	-	3
3	PE	19A17AT	Sustainable Construction Methods	3	-	-	3
		19A17BT	Repairs & Rehabilitation of Structures				
		19A17CT	Construction Project Planning & Systems				
4	PE	19A17CT	Sustainable Engineering & Technology	3	-	-	3
		19A17DT	Advanced Environmental Engineering				
		19A17ET	Environmental Impact assessment & life cycle assessment				

5	OE	19A17FT	Open Elective-III(MOOC) Inter disciplinary	3	-	-	3
Lab Courses							
6	PC	19A171L	Transportation Engineering lab	-	-	2	1
7	PC	19A175L	Structural Analysis and Design lab-II	-	-	2	1
8	PW	19A17P	Project Phase-1	-	-	-	2
				15	-	2	18

IV B.Tech - II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PE	19A181AT	Advanced Transportation Engineering	3	-	-	3
		19A181BT	Advanced Surveying				
		19A181CT	Remote Sensing and GIS				
2	OE	19A28DT	Battery Energy Storage Systems	3	-	-	3
		19A28ET	System Modeling and Simulation				
		19A38ET	Entrepreneur Ship Development				
		19A38FT	Optimization in Engineering				
		19A38GT	Total Quality Management				
		19A48DT	Introduction to Digital Design				
		19A48ET	Industrial Electronics				
		19A58ET	Internet of Things				
		19A58FT	Web Programming				
Lab Courses							
2	PW	19A18P	Project Phase-2	-	-	-	8
				6	-	-	14

LIST of OPEN ELECTIVE COURSES (Provided the least of courses offered by the department to other departments)

S. No.	Category	Course Title	Offered by	Offered to	Year/Sem
1	OE	Basic Civil Engineering	CE	EEE&ECE	IV-I
				CSE&ME	III-II
2	OE	Water Resources and Conservation	CE	EEE&ECE	IV-I
				CSE&ME	III-II
3	OE	Disaster Management	CE	CSE&ME	IV-II
				EEE&ECE	IV-II
4	OE	Building Planning and Construction	CE	CSE&ME	IV-II
				EEE&ECE	IV-II

LIST OF VALUE-ADDED COURSES:

S. No.	Course Title
1	Importance of soft wares in civil engineering
2	ARCHI CAD
3	Building Information modelling
4	Building Planning and Construction
5	Revit Architecture
6.	AUTO CAD 3D Basics

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Title of the Course	Basic Reinforced concrete Design
Category	PC
Course Code	19A151T
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

Unit 1	Design methods	9
Behavior of RC elements, Design approach, Loads and stresses, load combinations, working stress approach-design constants; singly reinforced beam.		
limit state approach: Characteristic loads, Characteristic strength, Partial safety factors, stress-strain response of concrete, MS & HYSD bars, Assumptions, stress block parameters, moment of Resistance, Introduction to ultimate load method.		
Unit 2	Design for shear, bond and torsion	9
Design of rectangular sections for shear, bond and torsion, shear mechanism in RC sections (simply supported beams).		
Unit 3	Design of members for flexure	9
Design of singly & doubly reinforced beams (Rectangular and T-sections). Design of one way & Two-way slabs (restrained and unrestrained).		
Unit 4	<i>Design of compression members</i>	9
Design of Short columns; under axial loads, Uni-axial bending and biaxial bending, long columns (introduction)		
Unit 5	Design of footings & Serviceability	9
Types of footings, Design of isolated square and rectangular footings. Limit state design of serviceability; deflections and cracking.		

Prescribed Text Books:

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
 3. Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
 4. Krishnaraju, N. "Design of Reinforced Concrete Structures", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
 5. Ramachandra, "Limit state Design of Concrete Structures" Standard Book House, New Delhi.
- Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

AK Jain Limit state of design

Properties behavior- purushothaman mc graw hills.

Reference Books:

- 1.Fundamentals of reinforced concrete by N.C. Sinha and S.K Roy, S. Chand publishers.
- 2.Reinforced concrete design by S.Unnikrishna Pillai & Devdas Menon, Tata Mc.Graw Hill, New Delhi.
- 3.Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi, IS456-2000.
- 4.IS Code 875- part1, part2, part 3 and part-4. SP-16 tables

Course Outcomes:

Student will be able to

Blooms Level of Learning

Understand the various design methodologies for the design of RC elements.

L2

Design for shear, bond and torsion of beams.

L3

Design the beams and slabs by limit state method.

L4

Design columns for axial, uniaxial and biaxial eccentric loadings.

L4

Design of footing and design for limit state of serviceability .

L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC151T.1	-	1	3	-	-	2	-	-	-	-	-	-
19AC151T.2	-	1	3	-	-	2	-	-	-	-	-	-
19AC151T.3	-	1	3	-	-	2	-	-	-	-	-	-
19AC151T.4	-	1	3	-	-	2	-	-	-	-	-	-
19AC151T.5	-	1	3	-	-	2	-	-	-	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: Soil Mechanics
 Category : PC
 Course Code : 19A152T
 Year : III B.Tech
 Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- To impart the fundamental concepts of soil mechanics.
- To know the importance of index properties like grain size, consistency limits, soil classification.
- To understand the permeability and seepage through soils.
- To understand the concept of compaction, consolidation of soils and shear strength.

Unit 1 : 8

INTRODUCTION: Definition, origin and formation of soil, List of different soil types, Definition of mass, weight-Relation between mass and weight- Units of mass and weight in SI units-Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their interrelationships -clay mineralogy and soil structure.Numerical problems.

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION: Index Properties of soils and their significance. Various index properties and their Laboratory determination, -Water content, Specific Gravity, Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, in-situ density, Activity of Clay, Thixotropy of clay, IS classification - Plasticity chart and its importance, numerical problems.

Unit 2 : 10

PERMEABILITY: Types of soil water – capillary rise – flow of water through soils – Darcy’s law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered systems.numerical problems.

SEEPAGE THROUGH SOILS: seepage velocity, Seepage pressure, seepage through soils- total, neutral and effective stresses – quick sand condition — flow nets: characteristics and uses,numerical problems.

Unit 3 : 10

STRESS DISTRIBUTION IN SOILS:Importance of estimation of stresses in soils – Boussinesq’s and westergaard’s theories for point loads, stress distribution in different loaded areas-line load, uniformly loaded circular, strip footing, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – newmark’s influence chart,numerical problems

COMPACTION: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction Equipment – compaction control – ZAVL - numerical problems

Unit 4 : 9

CONSOLIDATION: Types of compressibility, Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, normally consolidated soil, over consolidated soil and under consolidated soil- preconsolidation pressure and its determination- Estimation of settlements - Terzaghi’s 1-D consolidation theory – Coefficient of consolidation and its determination, numerical problems.

SHEAR STRENGTH OF SOILS: Definition and use of shear strength - Source of shear strength- Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test, Unconfined compression test and vane shear test – shear strength of granular soil, shear strength of clay, Factors affecting shear strength of granular soils and clay, Liquefaction-numerical problems.

Prescribed Text Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt . Ltd, New Delhi
2. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
3. Soil Mechanics and Foundation by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
4. Geotechnical Engineering V.N.S.Murthy, CRC Press, Newyork, Special Indian Edition.

Reference Text books:

1. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, (2002).
2. Soil Mechanics – T.W. Lambe and Whitman, Mc-Graw Hill Publishing Company, Newyork.
3. Geotechnical Engineering by Brije.M.Das, Cengage Publications, New Delhi.
4. Geotechnical Engineering by Purushotham Raj

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1: Characterize and classify soils

L2

CO2: analyze the permeability of soils

L3

CO3: compute and analyze stress distribution in soils

L2

CO4: Understand the principles of compaction and its control

L4

CO5: Identify shear strength parameters for field conditions

L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A152T.1	-	-	2	-	-	3	-	-	-	-	-	-	-	2	-
19A152T.2	-	2	-	-	3	-	-	-	-	-	-	-	-	2	-
19A152T.3	-	-	2	2	-	-	-	3	-	-	-	-	-	2	-
19A152T.4	-	-	-	-	-	-	-	-	3	-	-	-	-	2	-
19A152T.5	-	-	-	-	-	-	3	-	-	-	-	-	2	2	-

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Title of the Course	Water Resource Engineering
Category	PC
Course Code	19A153T
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To know the irrigation practices, rivers and canals.
- To study the design aspects of gravity dams, earth dams, spillway gates.
- To study various headworks and design principles of canal structures.

Unit 1 9

Canals & river engineering: Classification of canals, design of irrigation canals by Kennedy's and Lacey's theories, canal lining, classification of rivers, methods for river training works.

Irrigation: Necessity and importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility, preparation of land for Irrigation, standards of quality for Irrigation water, soil-water-plant relationship, vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, estimation of consumptive use, duty and delta, factors affecting duty, depth and frequency of Irrigation, irrigation requirements of crops, irrigation efficiencies.

Unit 2 9

DAMS : Types of dams, merits and demerits, factors affecting selection of type of dam, factors governing selecting site for dam, types of reservoirs, selection of site for reservoir, reservoir yield, estimation of capacity of reservoir using mass curve.

GRAVITY DAMS & EARTH DAMS: Forces acting on a gravity dam, causes of failures of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of gravity dam, stability analysis, types of earth dams, causes of failures of earth dam, criteria for safe design of earth dam, measures for control of seepage, seepage through earth dam-graphical method.

Unit 3 9

SPILLWAYS & SPILLWAY GATES: types of spillways, design principles of Ogee spillways, types of spillway gates.

DIVERSION HEAD WORKS & SEEPAGE THEORIES: Types of head works, layout of diversion head works, components of diversion head works, causes and failure of hydraulic structures on permeable foundations, Bligh's creep theory, Khosla's theory

Unit 4 9

CANAL FALLS: Types of falls, design principles of Sarda type fall, trapezoidal notch fall and straight glacis fall.

CANAL REGULATORS: Canal regulation works, principles of design of distributor and head regulators

Unit 5 9

CANAL OUTLETS: Flexibility, proportionality, sensitivity, types of canal outlets

CROSS DRAINAGE WORKS: Types of CD works, selection of site, design principles of aqueduct, siphon aqueduct and super passage.

Prescribed Text Books:

Water resources engineering (Vol I) by S.K Garg, Khanna publishers.

Irrigation engineering and hydraulic structures (Vol II) by S.K Garg, Khanna publishers.

Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

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Title of the Course	STRUCTURAL ANALYSIS
Category	PC
Course Code	19A154T
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To impart knowledge about various methods involved in the analysis of indeterminate structures.
- To make the students to understand types of structures and analysis methods , and also to draw ILD's for different beams.

Unit 1 9
Fixed beams – Introd statically indeterminate beams with U.D.L, central point load, eccentric point load. Number of point loads and uniformly varying loads shear force and bending moment diagrams-Deflection of fixed beams effect of sinking of support.

Unit 2 9
Continuous beams: Introduction-Clapeyron's theorem of three moments-Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

Unit 3 9
Slope deflection method: Derivation of slope deflection equation, application to continuous beams with and without settlement of supports.
Moment distribution method: continuous beams with and without sinking of supports

Unit 4 9
Influence lines: Definition of influence line for SF & BM- load position for maximum SF & BM at a section- section single point load, U.D.L longer than span, U.D.L shorter than span.
Moving loads: maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single Concentrated load U.D.L longer than the span, U.D.L shorter than the span, two point loads with fixed distance between them and several point loads.

Unit 5 9
Energy theorems: Strain energy in linear elastic system, strain energy due to axial load, Bending moment and shear forces- Castigliano's first theorem-Deflections of simple beams and pin jointed trusses.
Indeterminate structural analysis: Indeterminate Structural Analysis –Determination of static and kinematic indeterminacies–Solution of trusses with up to two degrees of internal and external indeterminacies–Castigliano's theorem.

Prescribed Text Books:

1. Analysis of Structures-Voll& Vol II by V.N.Vazirani& M.M.Ratwani, Khanna Publications, New Delhi.
2. Basic structural Analysis by C.S.Reddy, Tata Mcgrawhill, New Delhi
3. Structural Analysis by V.D.PrasadGalgotiapublications,2nd Editions.
4. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi
5. ComprehensiveStructuralAnalysis-Vol.I&2by Dr. R. Vaidyanathan & Dr.P.Perumal- Laxmi publications pvt.Ltd., New Delhi

Reference Books:

1. Mechanics of Structures by S.B.Junnarkar, Charotar Publishing House, Anand, Gujrat
2. Theory of Structures by Gupta, Pandit & Gupta; Tat Mc.Graw– Hill Publishing Co. Ltd., New Delhi.
3. Theory of Structures by R.S. Khurmi, S. Chand Publishers
4. Strength of Materials and Mechanics of Structures- by B.C.Punmia, Khanna Publications, NewDelhi.
5. Introduction to structural analysis by B.D. Nautiyal, New age international publishers, NewDelhi.

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1.Determine the fixed end moments in Fixed beams and also able to draw the Shear force and bending moment diagrams.	L1&L2
CO2.Determine the fixed end moments in Continuous beams and also able to draw the shear force and bending moment diagrams.	L3&L4
CO3.Apply knowledge on various methods of analyzing indeterminate structures.	L4
CO4.Perform ILD analysis of determinate beams and trusses and also able to apply knowledge on Moving loads...	L4
CO5.Apply knowledge strain energy theory and also able differ the determinate and indeterminate structures.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC154T.1	3	3	-	-	3	-	-	-	-	-	-	-
19AC154T.2	3	3	2	-	3	-	-	-	-	-	-	-
19AC154T.3	3	3	2	2	3	-	-	-	-	-	-	-
19AC154T.4	3	3	2	2	3	-	-	-	-	-	-	-
19AC154T.5	3	3	2	1	3	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Advanced Structural Engineering			
Category	PE			
Course Code	19A15AT			
Year	III Year			
Semester	I Semester			
Lecture Hours	Tutorial Hours	Practical	Credits	
3	-	-	3	

Course Objectives:

The main objective of this course is to determine indeterminate structures by using various methods.

Unit 1	9
THREE HINGED ARCHES : Three hinged arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature.	
TWO HINGED ARCHES: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, tied arches – fixed arches – (No analytical question).	
Unit 2	9
SLOPE - DEFLECTION METHOD : Analysis of single bay, single storey, portal frame including side sway.	
MOMENT DISTRIBUTION METHOD: Stiffness and carry over factors – Distribution factors – Analysis of single storey portal frames – including Sway	
Unit 3	9
KANI'S METHOD: Analysis of continuous beams – including settlement of supports and single bay, single storey portal frames with side sway. A	
Unit 4	9
FLEXIBILITY METHOD: Application to continuous beams including support settlements.	
STIFFNESS METHOD: application to continuous beams including support settlements.	
Unit 5	9
PLASTIC ANALYSIS: Introduction – Idealized stress – Strain diagram – shape factors for various sections – Moment-curvature relationship – ultimate moment – Plastic hinge – lower and upper bound theorems – ultimate strength of fixed and continuous beams.	

Prescribed Text Books:

1. Basic structural Analysis by C.S.Reddy, Tata Mcgrawhill, New Delhl.
2. Analysis of structures by Vazrani & Ratwani – Khanna Publications.
3. Strength of Materials and mechanics of solids Vol-2 by B.C. Punmia, Laxmi Publications, New Delhi.
- Analysis of Structures – Vol. I & 2 by Bhavikatti, Vikas publications
4. Comprehensive Structural Analysis-Vol.I&2 by Dr. R. Vaidyanathan & Dr. P.Perumal- Laxmi publications pvt. Ltd., New Delhi Civil Engineering
5. Structural Analysis by D.S.Prakasha Rao, Univ.Press, Delhi. 6. Structural Analysis by C.S. Reddy, Tata Macgrawhill, New Delhi

Course Outcomes:

Student will be able to	Blooms Level of Learning
CO1: Determine the normal thrust, radial shear and bending moment in Two hinged and Three hinged arches and also able to draw shear force and bending moment diagrams.	L2
CO 2: Analyze portable frames using Slope deflection and Moment distribution method and also able to draw shear force and bending moment diagrams.	L3
CO 3: Analyze continuous beams and frames using Kani's method and also able to draw shear force and bending moment diagrams.	L2

CO 4: Analyze continuous beams using Matrix method of Structural analysis and able to draw shear force and bending moment diagrams.
CO 5: Determine shape factors for various sections and also ultimate moment for different beams.

L3

L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC155A.1	3	3	-	-	3	-	-	-	-	-	-	-
19AC155A.2	3	3	2	-	3	-	-	-	-	-	-	-
19AC155A.3	3	3	2	2	3	-	-	-	-	-	-	-
19AC155A.4	3	3	2	2	3	-	-	-	-	-	-	-
19AC155A.5	3	3	2	1	3	-	-	-	-	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Prestressed Concrete
Category : PE
Course Code : 19A15B
Year : III B.Tech
Semester : I

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- This course will enable the student to understand different prestressing techniques, in order to design prestressing systems in construction field.

Unit 1 : 8

INTRODUCTION: Historic development – principles of pre-stressing; pre-tensioning and post tensioning –Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel their characteristics. IS Code provisions, Methods and Systems of Prestressing.

Unit 2 : 10

LOSSES OF PRESTRESS: Loss of pre-stress in pre-tensioned and post-tensioned members due to elastic shortage of concrete, shrinkage of concrete & creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses.

Unit 3 : 10

Analysis of sections for flexure; Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons.

Unit 4 : 9

DESIGN OF SECTIONS FOR FLEXURE AND SHEAR: Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses – design for shear in beams – Kern – lines, cable profile.

Unit 5 : 8

ANALYSIS OF END BLOCKS: Guyon's method and Magnel method, Anchorage zone; stresses & – zone reinforcement.

DEFLECTION-short term & long term deflections(simplified method) deflection limitations, deflection control.

PrescribedText Books:

1. Prestressed Concrete by Krishna Raju; - Tata Mc.Graw Hill Publications.E6
2. Design of Prestressed concrete structures (Third Edition) by T.Y. Lin & Ned H.Burns, John Wiley & Sons.

Reference Text books:

1. Prestressed Concrete by Ramamrutham; Dhanpat rai Publications.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Advanced RCC Design
Category : PE
Course Code : 19A15CT
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- To make the student more conversant with the design principles of multistoried buildings, Types of roof system, foundation, stair case and other important structures.

Unit 1 :	8
Design of a flat slab (Interior panel only) Design of grid floor	
Unit 2 :	10
Design of concrete bunkers of circular shape – (excluding staging) & Introduction to silos	
Unit 3 :	10
Design of concrete chimney & Intz water tank excluding staging	
Unit 4 :	9
Design of circular and rectangular water tank resting on the ground & Design of cantilever and counter fort retaining wall (with horizontal back fills).	
Unit 5 :	8
Design of slab less tread – riser stair case & longitudinal staircase	

PrescribedText Books:

1. Advanced RCC by Varghese, PHI Publications, New Delhi.
2. Advanced R.C.C by Krishnam Raju, CBS Publishers & distributors, New Delhi.
3. Structural Design and drawing (RCC and steel) by Krishnam Raju, Univ.Press , New Delhi
4. R.C.C Structures by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, New Delhi
5. Design of RCC structures by M.L.Gambhir P.H.I. Publications, New Delhi.

Reference Text books:

1. R.C.C Designs by Sushil kumar , standard publishing house.
2. Fundamentals of RCC by N.C.Sinha and S.K.Roy, S.Chand Publications, New Delhi.

Course Outcomes:

Student will be able to

1.Design and detail the flat slab & grid floor.

Blooms Level of Learning

L3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course	Finite Element methods
Category	PE
Course Code	19A15DT
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

The subject should enable the students to learn the principles involved in discretization in finite element methods, forming of strain displacement and stiffness matrices for simple elements, to know the various approaches followed in finite element analysis, usage of the various elements for discretization and to learn about shape functions.

Unit 1	9
INTRODUCTION: Concepts of FEM – Steps involved – merits & demerits – energy principles(– Discretization – Rayleigh –Ritz method of functional approximation. PRINCIPLES OF ELASTICITY: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.	
Unit 2	9
ONE DIMENSIONAL ELEMENTS: Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems. TWO DIMENSIONAL ELEMENTS: Different types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates	
Unit 3	9
GENERATION OF ELEMENT: Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.	
Unit 4	9
ISOPARAMETRIC FORMULATION: Concepts of, isoparametric elements for 2D analysis –formulation of CST element, 4- and 8-noded iso-parametric quadrilateral elements –Lagrangian and Serendipity elements.	
Unit 5	9
SOLUTION TECHNIQUES: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads	

Prescribed Text Books:

1. Finite Elements Methods in Engineering by Tirupati. R. Chandrupatla and Ashok D. Belegundu – Pearson Education Publications.
2. Finite element analysis in Engineering by S.Md.Jalaludeen –Anuradha publications-Chennai.
3. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers
4. Finite element analysis by S.S. Bhavakatti-New age international publishers.
5. Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.

Reference Books:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E.Plesha. Jhon Wiley & Sons.
2. Finite element analysis by David V Hutton, Tata Mcgraw Hill, New Delhi
3. Applied Finite by Rammurthy, I.K.International Publishers Pvt. Ltd., New Delhi.
4. Fem by J.N.Reddy, Mcjraw, TMH Publications, New Delhi.

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1.Understand the fundamental principles and approaches for finding FEM issues in several fields and an ability to unravel the connection for essential relationships in plane stress and plane strain condition.	L1&L2
CO2. Understand and derive stiffness matrices and form functions for bar and beam elements.	L2&L3
CO3. To formulate the stiffness matrices for 3noded and 4noded elements.	L2
CO4. Understand the formulation for CST element, lagrangian and serendipity elements.	L2&L3
CO5. Solve the numerical integration functions by applying the gauss rules.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC15T.1	3	2	2	-	-	2	-	-	-	-	-	-
19AC15T.2	2	1	-	-	-	2	-	-	1	-	-	-
19AC15T.3	1	3	-	-	-	2	-	-	-	-	-	-
19AC15T.4	2	-	-	-	-	2	-	-	-	-	-	-
19AC15T.5	3	-	-	-	-	2	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Instrumentation & sensor technologies for civil engineering applications
Category	PE
Course Code	19A15ET
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

The objective of this Course is to understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making.

Unit 1 9

Fundamentals of Measurement, Sensing and Instrumentation covering

Definition of measurement and instrumentation, physical variables, common types of sensors- Describe the function of these sensors- Use appropriate terminology to discuss sensor applications and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations..

Unit 2 9

Sensor Installation and Operation covering

Predict the response of sensors to various inputs- Construct a conceptual instrumentation and monitoring program- Describe the order and methodology for sensor installation and Differentiate between types of sensors and their modes of operation and measurement - Approach to Planning Monitoring Programs, Define target-Sensor selection- Sensor siting- Sensor Installation & Configuration- Advanced topic- Sensor design- Measurement uncertainty.

Unit 3 9

Data Analysis and Interpretation covering

Fundamental statistical concepts - Data reduction and interpretation- Piezometer, Inclinator, Strain gauge, etc. -Time domain signal processing, Discrete signals, Signals and noise and a few examples of statistical information to calculate- Average value (mean)-On average, how much each measurement deviates from the mean (standard deviation)- Midpoint between the lowest and highest value of the set (median)- Most frequently occurring value (mode), Span of values over which your data set occurs (range) .

Unit 4 9

Frequency Domain Signal Processing

Explain the need for frequency domain analysis and its principles- Draw conclusions about physical processes based on analysis of sensor data- Combine signals in a meaningful way to gain deeper insight into physical phenomena- Basic concepts in frequency domain signal processing and analysis.

Unit 5 9

Flow measurements

Primary methods-Ultrasonic flow meter- Electromagnetic flow meter-Turbine flow meter-Lobed impeller meter- Rotary vane flow meter

Prescribed Text Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press

Reference Books:

- 1.S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
2. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course Watershed Management
 Category PE
 Course Code 19A15FT
 Year III Year
 Semester I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. To understand different watershed behavior.
2. To be able to interpret runoff data and quantify erosion by using various modelling Methods.
3. To understand land use classification and impact of land use changes on hydrological Cycle parameters.

Unit 1		9
	Introduction,- concept of watershed, need for watershed management, concept of sustainable Development. Hydrology of small watersheds	
Unit 2		9
	Principles of soil erosion- causes of soil erosion, types of soil erosion, estimation of soil Erosion from small watersheds, Control of soil erosion, methods of soil conservation – Structural and non-structural measures.	
Unit 3		9
	Principles of water harvesting, methods of rainwater harvesting, design of rainwater Harvesting structures.	
Unit 4		9
	Artificial recharge of groundwater in small watersheds-, methods of artificial recharge.	
Unit 5		9
	Reclamation of saline soils - . Micro farming - , biomass management on the farm.	

Prescribed Text Books:

1. Murthy, V.V.N. and M.K. Jha Land and Water Management, Kalyani Publishers, 2015
2. Watershed Management by Madan Mohan Das and M.D. Saikia, Prentice Hall of India, 2013
3. Watershed Management Muthy, J. V. S., , New Age International Publishers, 1998

Reference Books:

1. Watershed Hydrology by P E Black, Prentice Hall Englewood Cliffs, 1991
2. Watershed Hydrology by R Suresh, Standard Publishers and Distributors, Delhi, 2007

Course Outcomes:

Student will be able to	Blooms Level of Learning
CO1. Understand about watershed concept	L1
CO2. Plan and design soil conservation measures in a watershed	L4 & L5
CO3. Plan and design water harvesting	L5

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Disaster Management
Category	PE
Course Code	19A15GT
Year	III Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

Unit 1 9

INTRODUCTION - Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, prevention, mitigation).

Unit 2 9

DISASTERS - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit 3 9

DISASTER IMPACTS - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and National disaster trends; climate-change and urban disasters.

Unit 4 9

DISASTER RISK REDUCTION (DRR) - Disaster management cycle—itsphases; prevention, mitigation, preparedness, relief and recovery; structural andnon-structural measures; risk analysis, vulnerability and capacity assessment;early warning systems, Post-disaster environmental response (water, sanitation,food, safety, waste management, disease control); Roles and responsibilities ofgovernment, community, local institutions, NGOs and other stakeholders;Policies and legislation for disaster risk reduction, DRRprogrammes in India and the activities of National Disaster Management Authority.

Unit 5 9

Disasters, Environment and Development - Factors affecting vulnerability suchas impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Reference Books:

1. <http://ndma.gov.in/> (Home page of National Disaster Management Authority).
2. <http://www.ndmindia.nic.in/> (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahnii, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Civil Engineering

Title of the Course	Universal Human Values - II
Category	HS
Couse Code	19AC53T
Year	III B. Tech
Semester	I Semester / II Semester
Branch	CE, ME, CSE & AIDS / ECE, EEE

Lecture Hours	Tutorial Hours	Practical	Credits
1	1	-	2

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

Unit 1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 6

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for
- fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2 Understanding Harmony in the Human Being - Harmony in Myself! 6

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct
- appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Unit 3 Understanding Harmony in the Family and Society- Harmony in Human-
Human
Relationship 6

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Unit 4 Understanding Harmony in the Nature and Existence -Whole existence as Coexistence 6

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit 5 Implications of the above Holistic Understanding of Harmony on Professional
Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Prescribed Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. F. Schumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

	Blooms Level of Learning
• Students are expected to become more aware of themselves, and their surroundings (family, society, nature)	L2
• They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	L2
• They would have better critical ability.	L2
• They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	L2
• It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC53T.1/63T.1												3
19AC53T.2/63T.2												3
19AC53T.3/63T.3												3
19AC53T.4/63T.4												3
19AC53T.5/63T.5												3

Assessment pattern for UHV-2

Assessment Pattern for Universal Human Values-II courses assessment is described hereunder.

UHV-2 course carries two credits. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

A student has to secure 40% marks out of 100 in the CIE and SEE together to qualify for the award of the degree. The distribution shall be 50 marks for continuous internal assessment and 50 marks for semester end examination.

Internal evaluation shall be conducted for the course during semester and shall be evaluated for 50 marks and distributions of marks as follows:

- Assessment by faculty mentor: 10 marks
- Self-assessment: 10 marks
- Assessment by peers: 10 marks
- Socially relevant project/Group Activities/Assignments: 20 marks

Semester End examination is done for 50 marks and is of 2 hours duration. The question paper shall be of subjective type with 5 questions, one question from each unit, with internal choice. All the questions carry equal marks of 10 each.

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Soil Mechanics Lab
 Category : PC
 Course Code : 19A152L
 Year : III B.Tech
 Semester : I

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- This course will enable the students to identify and classify different types of soil.
- Able to calibrate different soil index and engineering properties

List of experiments:

1. Field Density using
Core Cutter method.
Sand replacement method.
2. Natural moisture content using Oven Drying method.
3. Field identification of Fine Grained soils.
4. Specific gravity of Soils.
5. Grain size distribution by Sieve Analysis.
6. Consistency limits by
.Liquid limit
.Plastic limit,
.Shrinkage limit.
7. Permeability test using
Constant-head test method.
Falling-head method.
8. Compaction test: by
Standard Proctor test.
Modified Proctor test.
9. Relative density.
10. Consolidation Test.
11. Triaxial Test (UU)
12. Vane shear test
13. Direct Shear Test
14. Unconfined Compression Strength Test.

Any of the 10 experiments are mandatory to be performed.

Course Outcomes:

Student will be able to	Blooms Level of Learning
Determine the permeability and consolidation parameters of soils through various laboratory	L5
Perform laboratory test to determine the maximum dry density and optimum moisture content of the soil;	L5
Perform laboratory experiments to estimate various Atterberg limits and evaluate index properties of soils	L5
Perform various shear strength tests and appreciate the different field conditions which they simulate;	L5

Classify any soils based on their particle size distribution and index properties;

L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A152L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A152L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A152L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A152L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A152L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	General Aptitude
Category	HS
Course Code	19AC51L
Year	III B. Tech
Semester	I / II Semester
Branch	CE, ME & CSE / EEE & ECE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	2	1

Course Objectives:

- To equip students with aptitude and reasoning skills in order to help them succeed in competitive exams.
- To help students improve their knowledge of quantitative and reasoning skills, which in turn helps them comprehend and solve various mathematical problems in professional life.
- To equip students with English verbal and reasoning skills in order to help them succeed in exams like GRE, TOEFL and help them to do well in placement drives.
- To help students improve their knowledge of grammar, vocabulary and reasoning skills pertain to English.

Quantitative Aptitude:

Number Systems - HCF and LCM - Averages - Problems on ages- Percentages - Profit and loss - Simplification - Ratio and Proportion - Time and Work - Time and Distance - Simple interest and Compound interest - Calendar - Clocks - Mensuration: Area, Volume and Surface Areas - Data Interpretation: Tabulation, Line Graphs, Bar Graphs, Pie charts.

Reasoning:

Directions - Blood Relations - Series and Sequences - Odd man out - Coding and Decoding - Data Sufficiency- Logical deductions.

English for Competitive Examinations

Synonyms - Antonyms - Analogy - Words often confused, One-word substitutions - Idioms and Phrases - Homonyms - Spellings

Reading comprehension - Cloze tests

Articles - Prepositions - Tenses - Voice - Error spotting and correcting - Sentence improvement.

Rearrangement of jumbled words and jumbled sentences - word pairs - sentence completion

Prescribed Textbooks:

3. R.S. Agarwal, Quantitative Aptitude, S. Chand Publishers, New Delhi, 2005.
4. R. S. Agarwal, Verbal and Non-Verbal Reasoning, S. Chand Publishers, New Delhi, 1998.
5. Hari Prasad, "Objective English for Competitive Exams", TMH
6. R. S. Agarwal, "Objective English", S. Chand Publishers

Reference Books

1. Shakuntala Devi, Puzzles to Puzzle you, Orient Paper Backs Publishers (OPB), New Delhi, 2005.
2. Arun Sharma, How to Prepare for Quantitative Aptitude, TMH Publishers, New Delhi, 2003.
3. Sharon Weiner-Green, IrnK.Wolf, Barron's GRE, Galgotia Publications, New Delhi, 2006.
4. Shakuntala Devi, More Puzzles, OPB, New Delhi, 2006.
5. Ravi Narula, Brain Teasers, Jaico Publishing House, New Delhi, 2005.
6. George J Summers, Puzzles and Teasers, Jaico Publishing House, Mumbai, 2005

Course Outcomes:
Student will be able to

Blooms Level of
Learning

- demonstrate various principles involved in solving mathematical problems pertain to Quantitative functions.
- decode information from charts and interpret their logical thinking in the aspects.
- interrelate English vocabulary with the knowledge of synonyms, antonyms, idiomatic expressions and, accuracy in English spelling
- apply knowledge of articles, prepositions, tenses and voice to correct errors or to improve sentences

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC51L/61L.1	3											3
19AC51L/61L.2	3											3
19AC51L/61L.3										3		3
19AC51L/61L.4										3		3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Design of Steel Structures
Category	PC
Course Code	19A161T
Year	III Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
- Design of structural systems such as roof truss members, gantry girders and plate girders as per provisions of current code (IS 800 – 2007) of practice.

Unit 1 9

WELDED CONNECTIONS: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of welds fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

BOLTED CONNECTIONS: Introduction, Classification, IS specifications, Terminology, Assumptions Advantages and disadvantages of bolted connections, types of bolted connections, Design strength of bearing bolts, plates and efficiency of joint

Unit 2 9

TENSION AND COMPRESSION MEMBERS: General Design of members subjected to direct tension and bending – effective length of columns. Slenderness ratio – permissible stresses. Design of compression members, struts etc.

Unit 3 9

BEAMS: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams- Curtailment of flange plates, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

PLATE GIRDER: Design consideration – I S Code recommendations Design of plate girder-Welded – Curtailment of flange plates stiffeners.

Unit 4 9

DESIGN OF BUILT UP MEMBERS: - Design of Built up compression members – Design of lacings and batten.

DESIGN OF COLUMN FOUNDATIONS: Design of slab base and gusseted bases. Column bases subjected to moment.

Unit 5 9

DESIGN OF PURLINS: Different types of trusses – Design loads – Load combinations IS Code recommendations, structural details – Design of purlins.

GANTRY GIRDER: Gantry girder impact factors – longitudinal forces, Design of Gantry girders.

Prescribed Text Books:

1. Structural Design and Drawing by N.Krishna Raju, University Press, Hyderabad
2. Design of Steel Structures by Ramachandra. Vol – 1, Universities Press. Hyderabad
3. Steel Structures by Subramanyam.N, Oxford Higher Education, New Delhi
4. Limit State Design of steel structures by S.K. Duggal, Tata Mcgraw Hill, New Delhi.
5. Design of Steel Structures by K.S.Sai Ram , Pearson Publishers.
6. Design of steel structures by Bhavikatti.

Reference Books:

1. Comprehensive Design of Steel structures, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
2. Structural design in steel by Sarwar Alam Raz, New Age International Publishers, New Delhi
3. Design of Steel Structures by P.Dayaratnam; S. Chand Publishers
4. Design of Steel Structures by M.Raghupathi, TataMc. Graw-Hill
5. Design of Steel Structures by Edwin Gaylord, Charles Gaylord, James Stallmeyer, Tata Mc.Graw-Hill, New Delhi.
6. IS -800 – 2007
7. IS – 875 – Part III
8. Steel Tables.

Design Standards Code and steel tables to be permitted into the examination hall.

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1. Understand and design different types of steel welded and bolted connections.

L2 &L4

CO2. Design the tension and compression members

L4

CO3. Design the laterally unsupported beams and plate girder.

L4

CO4. Design the built up members like lacings and battens and different types of column bases.

L4

L4

CO5. Design the different types of purlins and gantry girder.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A161T.1	-	2	3	-	-	-	-	-	-	-	-	3	-	3	3
19A161T.2	-	2	3	-	-	-	-	-	-	-	-	3	-	3	3
19A161T.3	-	2	3	-	-	-	-	-	-	-	-	3	-	3	3
19A161T.4	-	2	3	-	-	-	-	-	-	-	-	3	-	3	3
19A161T.5	-	2	3	-	-	-	-	-	-	-	-	3	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Engineering Geology
Category	PC
Course Code	19A162T
Year	III Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	-	2

Course Objectives:

- The objective of this is to give the basic knowledge of Geology that is required for construction of various Civil Engineering Structures. The syllabus includes the basics of geology. Geological hazards and gives a suitable picture on the geological aspects that are to be considered for the planning and construction of major Civil Engineering projects.

Unit 1 9

INTRODUCTION: Importance of geology from civil engineering point of view Brief study of case histories of failure of some civil engineering constructions due to geological draw backs – Importance of physical geology, petrology and structural geology; weathering: Effects of weathering of rocks – Importance of weathering with reference to dams, reservoirs and tunnels.

Unit 2 9

MINERALOGY: Definition of mineral – Importance of study of minerals – Different methods of study of minerals– Advantages of study of minerals by physical properties - Identification of minerals – Physical properties of common rock forming minerals: Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite, Study of other common economic minerals such as Pyrite, Hematite, Magnetite, Galena, Pyrolusite, Graphite, Magnesite and Bauxite.

Unit 3 9

PETROLOGY: Definition of rock – Geological classification of rocks into igneous, sedimentary and metamorphic rocks –Dykes and sills – Common structures, textures – Features of igneous, sedimentary and metamorphic rocks –Megascopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

STRUCTURAL GEOLOGY: Out crop - Strike and dip – Classification and recognition of folds, faults, unconformities, and joints – Their importance in-situ –Foliation and lineation – Concept of stress and strain, analysis of stress and response of rock to stress – Analysis of deformation and strain ellipsoid – Common types of soils, their origin and occurrence in India.

Unit 4 9

GROUNDWATER, EARTHQUAKE AND LANDSLIDES: Groundwater – Water table – Common types of groundwater – Springs – Cone of depression –Geological controls of groundwater movement – Groundwater exploration –Hydrological properties of rocks: porosity, permeability, transmissibility , specific yield and specific retention Earthquakes, their causes and effects - shield areas and seismic zones – Seismic waves - Richter scale - Precautions to be taken for building construction in seismic areas – Landslides, their causes and effect - Measures to be taken to prevent their occurrence.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Environmental Engineering
Category	PC
Course Code	19A163T
Year	III Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	-	2

Course Objectives:

1. To provide the knowledge of sources and collection, conveyance and distribution of waste water and its treatment.
2. To convey the concepts of sewage and its collection, characteristics and treatment.

Unit 1 9

INTRODUCTION: Importance–Need–Objective– Flow diagram of water supply systems.

SOURCES AND DEMAND OF WATER: Different sources of water– Quantity and quality of different sources – Types and variation in water demand – Factors affecting water demand – Design period –Forecasting of population, different methods and their suitability.

Unit 2 9

WATER COLLECTION, CONVEYANCE AND DISTRIBUTION: Intake works for collection of surface water – Conveyance of water – Gravity and pumping methods – Systems of distribution –Distribution reservoirs – Distribution networks

QUALITY REQUIREMENTS OF WATER: Sources of water pollution – Water borne diseases – Physical, chemical and biological impurities – Tests conducted for determining impurities – Water standards for different uses - Water quality standards WHO.

Unit 3 9

WATER TREATMENT – I: Conventional water treatment processes units and their functions - Theory and design of aeration, coagulation, flocculation, and clarification - Determination of optimum dose of alum for coagulation of water. Theory of filtration – Different types of filters and their design - Disinfection – Disinfectants – Mechanism of disinfection – Different methods of disinfection – Break point chlorination – Types chlorination – Dose of disinfectant.

Unit 4 9

SEWAGE: Fundamental Definitions- system of sewerage- classification of sewers-Factors affecting the quantity of sewage, Determination of sewage, flow variation of sewage, Factors affecting the storm water, Determination of rainfall intensity, determination of run-off coefficient, computation of storm water, Design of sewers, Shapes of sewer, sewer materials, sewer appurtenance.

Unit 5 9

SEWAGE CHARACTERISTICS: Fundamental Definitions- Decomposition, Physical and chemical characteristics of Sewage-Determination of solids, Dissolved oxygen- Oxygen and chemical oxygen demand- Biochemical oxygen demand,-Chlorine demand- Carbonaceous demand-Nitrogenous demand.

SEWAGE TREATMENT: Preliminary treatment methods- screening, grit chambers, skimming tank-Primary treatment methods- sedimentation tank-Secondary treatment methods- Trickling Filters, aeration tank, Activated sludge process, oxidation pond, septic tank, Imhoff tank, sludge digestion tank-Tertiary treatment methods-general description

Prescribed Text Books:

1. G.S. Birdie and J. S. Birdie, Water Supply and Sanitary Engineering, 8th Edition, Dhanpat Rai and Sons Publishers, New Delhi, 2010.
2. S.K. Garg, Environmental Engineering (Vol.I): Water Supply Engineering, 20th Revised Edition, Khanna Publishers, New Delhi, 2011.

Reference Books:

1. K.N. Duggal, Elements of Environmental Engineering, 1st Edition, S.Chand Publishers, New Delhi, 2010.
2. Nazih K. Shammam and Lawrence K. Wang, Fair, Geyer and Okun's Water and Waste Water Engineering: Water Supply and Wastewater Removal, 3rd Edition, John Wiley and Sons, New Delhi, 2011.
3. H.S. Peavy and D.R.Rowe, Environmental Engineering, 1st Edition,McGraw-Hill Publishing Company, New York, 1984.

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1. Forecasting population by different methods.	L5
CO2. Understand the sources, collection, conveyance and distribution of water.	L2
CO3. Acquire knowledge about different treatment processes of water.	L4
CO4. Estimate the quantity of sewage, storm water and Design the sewers.	L5
CO5. Analyze sewage characterizes and treatment methods.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A163T.1	2	2	-	-	-	2	-	-	-	-	-	3
19A163T.2	2	-	-	-	-	2	-	-	-	-	-	3
19A163T.3	2	-	-	-	-	-	-	-	-	-	-	2
19A163T.4	2	3	3	-	-	-	-	-	-	-	-	2
19A163T.5	2	2	2	-	-	2	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Engineering hydrology
Category	PE
Course Code	19A16AT
Year	III Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. To study the theory of hydrology and its applications.
2. To impart knowledge on hydrograph analysis and ground water concept.

Unit 1

9

HYDROLOGY: Global water resources, introduction to hydrology and its applications, hydrologic cycle, types and forms of precipitation, rainfall measurement, types of rain gauges

RAINFALL ANALYSIS: Computation of average rainfall over a basin, missing rainfall data, rain gauge network, processing of rainfall data

- mass curve, hyetograph, moving average curves, intensity duration curves, intensity duration frequency curves, depth area duration curves, double mass curve.

Unit 2

9

EVAPORATION & INFILTRATION: Factors affecting evaporation, measurement of evaporation, evapotranspiration, measurement of evapotranspiration, factors affecting infiltration, measurement of infiltration, infiltration indices,

Unit 3

9

STREAM GAUGING: stream gauging - stage, discharge

HYDROGRAPH ANALYSIS: Unit hydrograph - uses, limitations, application, derivation, S-curve hydrograph, synthetic unit hydrograph, Soil Conservation Service UH, instantaneous UH.

Unit 4

FLOODS & FLOOD ROUTING: Floods - rational method, UH method, Gumbel's method, empirical methods, envelope curves, flood routing - reservoir routing, inflow storage discharge method, modified pulse method, channel routing, Muskingum method.

GROUNDWATER: Forms of subsurface water, types of saturated formations, types of aquifers, aquifer parameters, Darcy's law, sea water intrusion, types of wells, pump test, recuperation test.

STEADY FLOW INTO WELLS: steady flow into wells for confined and unconfined aquifers.

Prescribed Text Books:

1. Engineering Hydrology by K.Subramanya, The Tata Mcgraw Hill Company, New Delhi
2. Engineering Hydrology by P.Jayarami Reddy, Laxmi publications pvt. Ltd., New Delhi
3. Irrigation and water power engineering by Punmia & Lal, Laxmi publications pvt. Ltd., New Delhi

Reference Books:

1. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.
2. Water resources engineering (Vol I) by S.K Garg, Khanna publishers.

Course Outcomes:

Student will be able to

Blooms Level of Learning

- CO1. To understand about the rainfall and its analysis. L2
- CO2. Have the knowledge of measurements of evaporation, infiltration and runoff. L3
- CO3. To understand the stream gauging and hydrograph theory. L2
- CO4. To understand the measurement of floods and flood routing. L3
- CO5. Have the knowledge of importance of groundwater. L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A164A.1	1	2	2	-	-	2	-	-	-	-	-	-
19A164A.2	1	1	1	-	-	2	-	-	-	-	-	-
19A164A.3	1	-	1	-	-	-	-	-	-	-	-	-
19A164A.4	-	-	1	-	-	-	-	-	-	-	-	-
19A164A.5	-	1	-	-	-	2	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Design and drawing of irrigation structures		
Category	PE		
Course Code	19A16BT		
Year	III Year		
Semester	II Semester		

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	2	3

Course Objectives:

- To make the student more conversant with the design principles of Surplus weir, Glacis Weir, Sluice Tank, Trapezoidal notch, important structures belonging to irrigation

Design and drawing of the following irrigation structures

- Surplus Weir
- Tank Sluice with a tower head
- Trapezoidal Notch fall
- Sloping Glacis Weir
- Canal Regulator
- Type III Syphon aqueduct

Final Examination pattern: Any two questions of the above six designs may be asked out of which the candidate has to answer one question. The duration of examination will be three hours.

Prescribed Text Books:

- Design of minor irrigation and canal structures by C.Satyanarayana Murthy, Wiley Eastern Ltd.

Reference Books:

- Irrigation Engineering and Hydraulic Structures by S.K.Garg, Khanna Publishers, New Delhi.

Course Outcomes:

Student will be able to	Blooms Level of Learning
CO1. Design fundamentals of Sloping glacis weir..	L5
CO2. Design fundamentals of Tank sluice with tower head.	L5
CO3. Design fundamentals of Type III Syphon aqueduct.	L5
CO4. Design fundamentals of Surplus weir.	L5
CO5. Design fundamentals of Canal regulator.	L5
CO6. Design fundamentals of Trapezoidal Notch Fall	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A164B.1	2	-	-	-	-	2	3	-	-	-	-	-
19A164B.2	2	-	-	-	-	2	3	-	-	-	-	-
19A164B.3	2	-	-	-	-	-	3	-	-	-	-	-
19A164B.4	2	-	3	-	-	-	3	-	-	-	-	-
19A164B 5	2	-	2	-	-	2	3	-	-	-	-	-
19A164B 6	2	-	3	-	-	2	3	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Bridge Engineering
Category	PE
Course Code	19A16CT
Year	III Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. To know the IRC class loadings, stages of investigation for bridge construction
2. It deal with different types of Bridges like deck slab bridge, T – Beam Bridge etc
3. It gives a good knowledge on different components of bridges.
4. To know the bridge bearings and functions, abutments, piers analysis.

Unit 1 9

INTRODUCTION: Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor. Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

BOX CULVERT: General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only.

Unit 2 9

DECK SLAB BRIDGE: Introduction – Effective width method of Analysis Design of deck Slab Bridge (Simply supported) subjected to class AA Tracked Vehicle only.**BEAM & SLAB BRIDGE (T-BEAM BRIDGE):** General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.,

Unit 3 9

PLATE GIRDER BRIDGE: Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.

COMPOSITE BRIDGES: Introduction – Advantages – Design of Composite Bridges consisting of RCC slabs over steel girders' including shear connectors.

Unit 4 9

BRIDGE BEARINGS: General features – Types of Bearings – Design principles of steel Rocker & Roller Bearings – Design of a steel Rocker Bearing – Design of Elastometric pad Bearing.

Unit 5 9

PIERS & ABUTMENTS: General features – Bed Block – Materials piers & Abutments Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of Bridge foundations (excluding Design).

Prescribed Text Books:

1. Bridge Engineering by PonnuSwamy, TATA Mcgraw Hill Company, New Delhi.
2. Design of Bridges by N.KrishnamRaju, Oxford & IBH, Publishing Company Pvt.ltd., Delhi.
3. Design of Bridges Structure by T.R.Jagadish&M.A.Jayaram Prentice Hall of India Pvt., Delhi.

Reference Books:

1. Design of Steel structures, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
2. Design of Steel structures by Ramachandra.
3. Design of R.C.C. structures B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.

Course Outcomes:

Student will be able to	Blooms Level of Learning
CO1. Implement standard loading specifications for bridge design followed by IRC codes. To understand about the rainfall and its analysis.	L2
CO2. Analyze and perform design of Box culvert and RC slab culverts and RCT-Beam Bridges	L2
CO3. Analyze and perform design of plate Girder Bridge and composite bridges	L3
CO4. Design various types of bearings and joints in bridge structures	L4
CO5. Analyze and design various elements of sub-structures of a bridge	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A164C.1	-	2	-	-	-	-	-	-	-	-	-	-
19A164C.2	-	1	-	-	-	-	-	2	-	-	-	-
19A164C.3	2	-	3	-	-	2	-	-	-	-	-	-
19A164C.4	-	-	2	-	-	-	-	-	3	-	-	-
19A164C.5	-	2	-	-	-	3	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: GROUND IMPROVEMENT TECHNIQUES
Category : PE
Course Code : 19A16DT
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- Students will gain an understanding of the concepts behind a range of Ground Improvement Techniques, and be able to identify appropriate techniques for a range of ground and site conditions.

Unit 1 : (9hrs)

DEWATERING: Methods of de-watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis.

GROUTING: Objectives of grouting- grouts and their properties-grouting methods- ascending, descending and stage grouting- hydraulic fracturing in soils and rocks- post grout test.

Unit 2 : (9hrs)

DENSIFICATION METHODS IN GRANULAR SOILS:-In – situ densification methods in granular Soils:- Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.

DENSIFICATION METHODS IN COHESIVE SOILS:-In – situ densification methods in Cohesive soils:- preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

Unit 3 : (9hrs)

STABILISATION: Methods of stabilization-mechanical-cement- lime bituminous- chemical stabilization with calcium chloride, sodium silicate and gypsum.

Unit 4 : (9hrs)

REINFORCED EARTH: Principles – Components of reinforced earth – factors governing design of reinforced earth walls – design principles of reinforced earth walls.

Unit 5 : (9hrs)

EXPANSIVE SOILS: Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles

Prescribed Text Books:

1. Hausmann M.R. (1990), Engineering Principles of Ground Modification, McGraw-Hill International Edition.
3. Dr.P.Purushotham Raj. Ground Improvement Techniques, Laxmi Publications, New Delhi / University science press, New Delhi

Reference Books:

1. Moseley M.P. (1993) Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA.
2. Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) Ground Control and Improvement, John Wiley and Sons, New York, USA.
3. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercey, USA

Course Outcomes:

Student will be able to

Blooms Level of Learning

- | | |
|---|----|
| 1. Identify ground conditions and suggest remedial measures of ground improvement. | L2 |
| 2. Design and identify the degree densification methods used in soils. | L3 |
| 3. Understand the methods of soil stabilization techniques used in ground improvement. | L2 |
| 4. Understand the Design principles of soil reinforcement and confinement in engineering constructions. | L3 |
| 5. Learn different methods and remedial measures for expansive soils | L3 |

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
19A165A.1	2	3	-	-	1	-	-	-	-	-	-	-	-	-	-
19A165A.2	3	3	-	3	2	-	-	1	-	-	-	-	-	-	-
19A165A.3	2	1	-	2	2	-	-	1	-	-		2	-	-	-
19A165A.4	2	1	-	2	2	-	-	1	-	-	-	2	-	-	-
19A165A.5	2	-	-	3	3	-	-	2	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: Foundation Engineering
Category : PE
Course Code : 19A16ET
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. Understand various site investigation techniques and their in-situ applications.
2. Evaluate factor of safety of infinite slopes based on different ground conditions.
3. Understand various methods for computation of factor of safety for finite slopes and retaining structures.
4. To evaluate the type of footing for structures, and bearing capacity of soil.

Unit 1 : (9hrs)

SOIL EXPLORATION- Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, Field tests – Penetration Tests – Plate load test – Pressure meter investigation report. Sampling procedures, trail pits, borings, Penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods. – planning of Programme and preparation of soil

Unit 2 : (9hrs)

STABILITY OF SLOPES -Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

EARTH PRESSURE THEORIES: Rankine's theory of earth pressure – earth pressures in layered soils – coulomb's earth pressure theory – Rebhann's and Culmann's graphical method

Unit 3 : (9hrs)

RETAINING WALLS: Types of retaining walls – stability of retaining walls
SHALLOW FOUNDATIONS: Types – choice of foundation – Location of depth – Safe Bearing Capacity – Terzaghi's, Meyerhoff's and Skempton's Methods.

Unit 4 : (9hrs)

ALLOWABLE BEARING PRESSURE: Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – allowable settlements of structures – Settlement Analysis

Unit 5 : (9hrs)

PILE FOUNDATION: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

WELL FOUNDATIONS: Types – Different shapes of wells – Components of wells – functions and Design Criteria – Sinking of wells – Tilts and shifts.

Prescribed Text Books:

1. Soil Mechanics and Foundation Engineering by Arora, Standard Publishers and Distributors, Delhi
2. Geotechnical Engineering by C.Venkataramaiah,
3. Foundation Engineering by V.N.S.Murthy, CRC Press, New Delhi.
4. Soil Mechanics and Foundations by – by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt.Ltd., New Delhi

Reference Books:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons

3. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning	
4. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning	
5. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy	
6. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.	
Course Outcomes:	
Student will be able to	Blooms Level of Learning
6. Know the soil exploration techniques	L2
7. Determine the safety analysis for slopes with different method.	L3
8. Design retaining wall subjected to various loads with the knowledge of earth pressure theories..	L2
9. Learn about types and purposes of different foundation systems and structures.	L4
10. Be able evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A165B.1	-	2	-	-	-	-	-	-	-	-	-	-
19A165B.2	-	1	-	-	-	-	-	2	-	-	-	-
19A165B.3	2	-	3	-	-	2	-	-	-	-	-	-
19A165B.4	-	-	2	-	-	-	-	-	3	-	-	-
19A165B.5	-	2	-	-	-	3	-	-	-	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Environmental Geo-Technology

Category : PE

Course Code : 19A16FT

Year : III YEAR

Semester : II SEMESTER

Lecture Hours/Week	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. To learn the concept of geo-techniques used in environment.
2. Awareness about the adverse effects of soil and ground water contaminants
3. Analyze and apply the various techniques for remediation of the contaminants

Unit-1: (6 hrs)

Soil Contamination: Introduction to Geo environmental engineering 2 sources, production and classification of waste 2 factors governing soil-pollutant interaction - Contaminant transport in sub Surface: advection, diffusion, dispersion, governing equations

Unit-2: (7hrs)

SOIL MINERALOGY: Soil mineralogy; significance of mineralogy in determining soil behavior; Mineralogical characterization. Sources, types and composition of different wastes - Characteristics and classification of hazardous wastes - Generation rates - Potential problems in soils due to contaminants. Impact of climate change, energy resources, water and soil pollution, and health risks posed by heavy metals and emerging pollutants.

Unit-3: (6hrs)

Wastes and Contaminants: sources of wastes-types of wastes- composition of different wastes- characteristics and classification of hazardous wastes- generation rates- ground water contamination- sources of ground water contamination- transport mechanisms-potential problems in soils due to contaminants.

Unit-4: (8hrs)

Methods for Soil Remediation: Soil Washing, Thermal Desorption, Soil vapor Extraction, Air stripping, Bio ventilation, Bio-sparging, Ground freezing, soil heating. Landfills, Leachate generation and detection, Energy generation, Hazardous Waste, Case study: Nuclear waste disposal and its importance

Unit V: (6hrs)

REMEDIAL TECHNIQUES

Introduction to advanced soil characterization techniques; volumetric water content; gas permeation in soil; electrical and thermal properties; pore –size distribution; contaminant analysis.

Prescribed text Books:

1. Fundamentals of Soil Behavior, Mitchell J.K and Soga K., John Wiley and Sons Inc.-2012
2. Introduction to Environmental Geo technology, Fang, H.Y., CRC press-1997
3. Geotechnical Practice for Waste Disposal, Daniel D.E,-1993
4. Geotechnical and Geo environmental Engineering Handbook, Rowe R. K, Kluwer Academic Publishers-2001
5. Introduction to Environmental Geo technology by Hsai – Yang Fang.

Reference Books:

1. Geo environmental Engineering: Principles and Applications, Reddi L.N. And Inyang H.F, Marcel

Dekker Inc-2000

2. Waste Containment Systems, Waste Stabilization And Landfills: Design and Evaluation, Sharma H. D. And Lewis S.P, John Wiley & Sons In-1994
3. D.E.Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London.

Course Outcomes:

The student will be able

Blooms Level of Learning

1. Analyze the soil contamination concentration and type L3,L4
2. Understand the concepts soil mineralogy & climate change L1,L2
3. Understand the methods of Socio Cultural Environment L1,L2
4. Suggest the steps to remediation of soil L3
5. understand the advance concept of remedial techniques L2,L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A165C.1	1	2	-	-	2	-	-	-	-	-	-	2
19A165C.2	2	-	-	2	-	3	-	-	-	-	-	3
19A165C.3	2	-	2	-	-	-	-	2	-	-	-	3
19A165C.4	3	-	2	-	-	-	2	-	-	-	-	-
19A165C.5	2	-	-	2	-	-	-	3	2	-	-	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES
RAJAMPET
(An Autonomous Institution)**

Title of the Course	Energy Management and Conservation
Category	OE2
Course Code	19A26GT
Year	III B.Tech
Semester	II Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	4

Course objective:

- To impart basic knowledge to the students about current energy scenario, energy conservation and management.
- To inculcate among the students systematic knowledge and skill about assessing the energy efficiency and energy management.

Unit-I Principles of energy management –

Organizing an energy management program – Initiating and managing an energy management program - Planning - Leading – Controlling – Promoting – Monitoring and reporting.

Unit-II Electrical energy management –

Energy efficient motors – Power factor improvement – Lighting and lighting system control – Energy saving opportunities.

Qualities and functions of energy managers – Qualities and functions of an energy manager – questionnaire -Check list for top management.

Unit-III Energy Scenario

6

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy sector reforms, energy and environment, energy conservation and its importance, energy efficiency and its need, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

Unit-IV Energy Conservation:

Principles of Energy Conservation. Energy Conservation Act 2001 and its feature, Electricity Act -2003 and features, The Energy Conservation (Amendment)Act,2010 and its importance. Prominent organizations at Centre and state level responsible for its implementation. Energy Consumption pattern, Resource availability, Energy pricing, Energy Security.

Unit-V Basics of Energy, pricing and its uses in buildings

Electricity tariff, load management and maximum demand control, power factor Improvement, selection & location of capacitors.

Estimation of Energy use in buildings: Estimation of Energy use in a building, Heat gain and Thermal Performance of building envelope- steady and Non-Steady heat transfer through the glazed window and the wall-standard for thermal performance of building envelope, Evaluation of the overall Thermal Transfer.

Text Books :

1. "Energy Management" - W.R.Murphy&G.MckeyButterworths.
2. "Energy Management Hand Book" - W.C.Turner, John Wiley and Sons.
3. "Energy Management Principles" – Craig B Smith – Pergamon press
4. "Energy Conservation" - Paul O'Callagan - Pergamon press.
5. S.C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991

Course Outcomes:

Student will be able to	Blooms Level of Learning
1.To understand the Principles and organization of energy management	L2 &L4
2.To acquaintance with electrical energy management like energy saving opportunities and Power factor improvement.	L3
3.Analyze the current energy scenario and its importance in energy conservation	L4
4.Understand the concepts of Energy conservation and its features.	L2
5.Understand the estimation of Energy use in buildings.	L2

COs-POs-PSOs Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A26GT.1	3	3	-	-	-	2	3	-	-	-	-	3
19A26GT.2	3	3	-	-	-	3	3	-	-	-	-	3
19A26GT.3	3	3	-	-	-	2	2	2	-	-	-	3
19A26GT.4	3	3	-	-	-	2	2	2	-	-	-	2
19A26GT.5	3	3	-	-	-	2	2	2	-	-	-	2

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES RAJAMPET
(AN AUTONOMOUS INSTITUTION)**

Title of the course: Fuzzy Logic and Neural Network

Category : OE

Course code : 19A26HT

Year : III B.Tech

Semester : II Semester

Lecture Hours	Tutorial Hours	Practical Hours	Credits
3	-	-	3

Course Objectives

- To understand the fundamental concepts of Artificial Neural network
- To Understand the concepts of different types Neural network architectures and training algorithms
- To understand the concepts of classical sets Fuzzy sets
- To understand the concepts Fuzzy logic controllers
- To gain knowledge in neuro- fuzzy control and its applications in power systems

Unit 1: Introduction to Artificial Neural Networks 12

Introduction, Biological Neuron, Biological Artificial Neuron model , Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of neural networks , Historical developments, Neural network architectures, McCulloch-Pitts Model, Types of neuron activation functions, Learning methods(supervised, unsupervised, Reinforcement), Applications of Neural Networks.

Unit-2: Single layer and multi layer feed forward neural networks 12

Perceptron Models: Discrete, Continuous (concepts only), Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications, ADALINE, MADALINE, Back Propagation Network, BP Learning Rule, Input Layer, Hidden Layer and output Layer computations, Radial Basis function network, Hetero associative memory neural and Auto associative memory net, applications.

Unit-3 Classical and Fuzzy sets

08

Introduction to classical sets, Fuzzy sets – Properties, Operations and Relations, Membership, Uncertainty, Fuzzy Relations, Cardinalities and Membership Functions.

Unit-4 Fuzzy Logic system and components 10

Fuzzification, Membership Value assignment, Development of Rule Base, Defuzzification to crisp sets, Defuzzification methods

Unit 5 Neural network and fuzzy logic applications to Power system

10

ANN Based Short Term Load Forecasting, Load Flow Studies, Fault diagnosis and Fuzzy Logic based Unit Commitment and load frequency control.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Introduction to Mechatronics
 Category : OE
 Course Code : 19A36ET
 Year : III Year
 Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

1. Familiarize the technologies behind modern mechatronic systems.
2. Explain fundamentals for the development of fully automated system.
3. Develop a robotic or automated systems focusing on the hardware and software integration.
4. Demonstrate the development of mechatronic system and MEMS.

Unit 1 Introduction 09

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications–Computer numerical control(CNC) machines, Tool monitoring systems, Flexible manufacturing system(FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

Unit 2 : Signal Conditioning 09

Introduction, hardware digital I/O, analog input – ADC resolution, speed channels filtering noise using passive components – resistors, capacitors – amplifying signals using OP amps – software – digital signal processing – low pass, high pass, notch filtering.

Unit 3 Sensors & Actuators 09

Sensors: Static characteristics & sensors, displacement, position and proximity sensors. Force and torque sensors, pressure sensors, flow sensors, temperature sensors, acceleration sensors, level sensors, selection criteria for sensors.

Actuators: Mechanical, electrical, hydraulic & pneumatic actuation systems characteristics and their limitations. Design of hydraulic & pneumatic circuits.

Unit 4 Microprocessors, Micro controllers and Programmable Logic Controllers 09

Architecture of of Microprocessor, Micro controller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: Fundamentals of Robotics

Category : OEC

Course Code : 19A36FT

Year : III Year

Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To acquire the knowledge on Robotics and its performance
- To develop the ability of kinematics and dynamics of Robots
- To acquire the knowledge on trajectory planning and manipulator
- To develop the ability on various sensor integration on robot
- To develop the ability to use the programming and tools for operation of robot

Unit 1 Introduction to Robotics 11

Types and components of a robot, Classification of robots - Robotics, Robots-Anatomy, Structure and classification, Robot performance parameters – resolution, accuracy and repeatability, Arm and wrist configuration - Social issues and safety

Unit 2 Robot Kinematics and Dynamics 11

Description of links and joints, Kinematic modeling of manipulator, Translation and Rotation Representation, Coordinate transformation, Denavit - Hartenberg (DH) notation, Examples of DH notation, Jacobian, Singularity, and Statics.

Unit 3 Trajectory Planning and Manipulator 08

Control Terminology, Steps in trajectory planning, Joint space techniques, path description, Use of polynomials as interpolating function, various trajectories, Introduction to Cartesian space techniques.

Unit 4 End effectors, sensors and vision system 08

Tools as end effectors, Robot Grippers - Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper system. Sensors for Robots - Characteristics of sensing devices, Classification, applications and selection of sensors. Robotic vision system, image acquisition, spatial and amplitude digitization, image processing and analysis.

Robot applications in material handling, machine loading/unloading, assembly, inspection and processing.

Robot Programming – Methods, Lead through methods, Robot Programming-Language overview, commands for elementary operations

Prescribed Text Books:

1. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014. , ISBN - 0070140014
2. Ghosal, A., “Robotics”, Oxford, New Delhi, 2006. ISBN - 9780195673913
3. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi. 2001. ISBN - 0130613096

Reference Books:

7. Tsuneo Yoshikawa, Foundations of Robotics, MIT Press. Roy. 2010. ISBN - 0262514583
8. Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill. 2017, ISBN - 9780070482937
9. Mukherjee S., “Robotics and Automation”, Khanna Publishing House, Delhi. 2017. 2017, ISBN - 9386173751

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the concept of Robots, Structure and its specifications.	L2
2. Solve robot forward and inverse kinematic problems.	L5
3. Carry out trajectory planning and joint modeling for the simple robotic system.	L4
4. Identify appropriate end effectors and sensors for particular application	L4
5. Execute various steps robot programming and Knowledge will be gained on application of Robotics used in various sectors.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36FT.1	3	3	3	-	-	3	3	3	-	-	-	-	-	-	-
19A36FT.2	2	2	2	-	-	2	-	2	-	-	-	-	-	-	-
19A36FT.3	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.4	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.5	2	-	2	-	-	2	-	2	-	2	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Non-conventional sources of energy
Category : OEC
Course Code : 19A36GT
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To grasp the role and potential of new and renewable source
- To recognize the principle, storage and applications of solar energy
- To understand the sources and potentials of wind energy and also to comprehend the Principles of Bio-Conversion of bio-mass and bio-gas uses.
- To explain the principle, working procedure and types of geothermal energy, ocean energy and tidal & wave energy.
- To know the knowledge on direct energy conversion.

Unit 1 Principles Of Solar Radiation 09

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation , potential in India

Unit 2 Solar Energy Collectors 09

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage And Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion, potential in India.

Unit 3 Wind Energy 08

Sources and potential in India, horizontal and vertical axis wind mills, performance characteristics, Betz criteria. Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, and economic aspects, potential in India

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37ET.1	3	2	-	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.2	3	3	-	1	3	3	-	-	-	-	-	3	-	-	-
19A37ET.3	3	2	3	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.4	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-
19A37ET.5	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Electronic Circuits and its Applications
Category	OE
Course Code	19A46GT/19A47GT
Year	III B.Tech/IV B.Tech.
Semester	II/I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To analyze and design the transistor and feedback amplifiers.
- To understand and analyze the concepts of oscillators, linear and nonlinear wave shaping circuits.

Unit 1 : **SMALL SIGNAL ANALYSIS OF AMPLIFIERS** 14

Introduction to h-parameter model, Small Signal model of BJT, Analysis of CB, CE and CC configurations using h-parameters – simplified hybrid model – miller’s theorem – dual of miller’s theorem. Analysis of Cascaded Transistor Amplifiers- RC Coupled amplifier, Frequency response of RC Coupled, Direct coupled and Transformer coupled amplifiers.

Unit 2 : **FEEDBACK AMPLIFIERS** 14

Concept of Feedback, Classification of feedback amplifiers, Transfer Gain with feedback, General characteristics of negative feedback amplifiers. Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components (Topologies).

Unit 3 : **OSCILLATORS** 10

Condition for oscillations. Oscillator Types, Frequency and amplitude stability of oscillators, LC oscillators-Hartley and Colpitts oscillators, RC-phase shift and Wien bridge oscillators, Crystal Oscillators

Unit 4 : **LARGE SIGNAL AMPLIFIERS** 9

Classifications, Class A power Amplifiers- Direct coupled and Transformer Coupled, Class B power Amplifiers- Push-pull and Complementary Symmetry-Transistor power dissipation, Power and Efficiency calculations.

Unit 5 : **LINEAR AND NON LINEAR WAVE SHAPING** 12

High pass & low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and Exponential inputs.
Diode and Transistor clippers and clampers, clamping circuit theorem.

Prescribed Text Books:

1. J. Millman and Christos C. Halkias- "Integrated Electronics", Mc Graw-Hill, 1972.
1. Robert T. Paynter- "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition.
2. J. Millman and H. Taub, "Pulse, Digital and Switching Waveforms", McGraw-Hill, second edition, 2007.

Reference Text books:

1. Robert L. Boylestad and Louis Nashelsky - "Electronic Devices and Circuits Theory", Pearson/Prentice Hall, 9th Edition, 2006.
2. Donald A. Neumann- "Electronic Circuit Analysis and Design", Mc Graw Hill.
3. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005. Second Edition.

Course Outcomes:

Upon completion of the course, student can

Blooms Level of Learning

- | | |
|--|----|
| 1. Analyze the single stage amplifiers using h-parameter model at low frequencies. | L4 |
| 2. Understand the feedback amplifiers and oscillators. | L2 |
| 3. Analyze the concepts of large signal amplifiers. | L4 |
| 4. Design and analyze linear and nonlinear wave shaping circuits. | L6 |

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	3	3	2	3	3	1	-	-	2	-	-	-	2	3	-
	1	3	3	2	2	-	-	-	2	-	-	-	3	-	-
	3	3	3	2	2	1	-	-	2	-	-	-	2	3	-
	2	2	2	-	-	-	-	-	2	-	-	-	2	3	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: BASICS OF COMMUNICATION SYSTEMS
 Category: OE
 Course Code: 19A46HT
 Year: III B.Tech
 Semester: II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
4	0	0	3

Course Objectives: This course will able to

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Learn the concepts of random process and various types of noise.
- Analyze pulse modulation and sampling techniques.

Unit 1 : **AMPLITUDE MODULATION** 10

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television

Unit 2 : **ANGLE MODULATION** 10

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

Unit 3 : **RANDOM VARIABLES & PROCESS** 10

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions.

NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth

Unit 4 : **NOISE IN ANALOG MODULATION** 10

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM

Unit 5 : **DIGITAL REPRESENTATION OF ANALOG SIGNALS** 10

DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse- Code Modulation: Sampling, Quantization, Encoding, Regeneration,

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Artificial Intelligence
Category : OE
Course Code : 19A56IT
Year : III Year
Semester : II Semester (Offered to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

1. To comprehend the building blocks of AI in terms of intelligent agents.
2. To understand the main approaches of artificial intelligence such as heuristic search, game search and logical inference.
3. To know how decision theory and planning is processed on the agents.
4. To verify the different types of objects in uncertain world for an agent
5. To identify the solution in uncertain knowledge with reasoning.

Unit 1 : *Introduction to Artificial Intelligence* 9

Introduction to AI, History of AI, Emergence of Intelligent Agents, Intelligent Agents: PEAS-Representation for an Agent, Types of Agents, Types of Agent Environments, Concept of Rational Agent, Structure of Intelligent agents, Defining the Problem as a State Space Search, Problem Characteristics.

Unit 2 : *Problem Solving* 12

Solving problems by searching, Problem Formulation, Uninformed Search Techniques- DFS, BFS, Iterative Deepening, Comparing Different Techniques, Informed search methods – heuristic Functions, Hill Climbing, Simulated Annealing, A*, Performance Evaluation. Constrained Satisfaction Problems: Constraint Satisfaction Problems like – map Coloring, Crypt Arithmetic, Backtracking for CSP, Local Search.

Unit 3 : *Knowledge and Reasoning* 9

A knowledge Based Agent, Introduction To Logic, Propositional Logic, Reasoning in Propositional logic, First Order Logic: Syntax and Semantics, Extensions and Notational Variation, Inference in First Order Logic, Unification, Forward and Backward chaining, Resolution.

Unit 4 : *Knowledge Engineering and Planning* 11

Knowledge Engineering: Ontology, Categories and Objects, Mental Events and Objects.

Planning: Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning.

Uncertain Knowledge and Reasoning: Uncertainty, Acting Under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Belief Networks, Simple Inference in Belief Networks, Fuzzy Logic.

Prescribed Text Books:

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 2nd Edition, Pearson Publication.
2. Rich, E. and Knight, K., *Artificial Intelligence*, Tata McGraw-Hill.
3. Reference Books:
4. George Luger, *AI-Structures and Strategies for Complex Problem Solving*, 4/e, 2002, Pearson Education.
5. Robert J. Schalkoff, *Artificial Intelligence: an Engineering approach*, McGraw Hill, 1990.
6. Patrick H. Winston, *Artificial Intelligence*, 3rd edition, Pearson.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the importance of artificial Intelligence in real world environment	L2
2. Apply the artificial intelligence algorithms for problem solving	L3
3. Analyze the various reasoning and knowledge representation techniques	L4
4. Solve the problems using classification and planning techniques	L3
5. Apply knowledge and reasoning techniques in uncertain environment for obtaining solution	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56IT.1	3	3				3			3	2		2
19A56IT.2	3	3	3	3		3	2		3			2
19A56IT.3	3	3	3	3		3			3	2		
19A56IT.4	3	3	3	3	1	3	2		3			
19A56IT.5	3	3	3	3		3			3			

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Cyber Security
Category : OE
Course Code : 19A56JT
Year : III B.Tech (CE, ME)
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- Remember Cyber Security architecture principles
- Compare different classes of attacks
- Understand about cybercrime with mobile and wireless devices
- Apply tools and methods used in cybercrime
- Understand about cyber security and social media marketing.

Unit 1 : INTRODUCTION: 10

Cybercrime:

Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, The Legal Perspectives, Indian Perspectives, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens

Cyber offenses:

Introduction of Criminal Planning and Criminal Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

Unit 2 : CYBERCRIME MOBILE AND WIRELESS DEVICES: 10

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit 3 : TOOLS AND METHODS USED IN CYBERCRIME: 9

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft(ID Theft)

Unit 4 : CYBERCRIMES AND CYBER SECURITY: 9

Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

Unit 5 : UNDERSTANDING COMPUTER FORENSICS: 10

Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics

Prescribed Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

Reference Text Books:

1. Information Security, Mark Rhodes, Ousley, MGH.
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press

Web References:

- 1.https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm

Course Outcomes

Student will be able to

Blooms Level of Learning

2. Remember Cyber Security architecture principles L1
3. Compare different classes of attacks L2
4. Understand about cybercrime with mobile and wireless devices L2
5. Apply tools and methods used in cybercrime L3
6. Understand about cyber security and social media marketing L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56JT.1	3	3	3	-	3	-	-	3	-	-	3	-
19A56JT.2	-	3	-	3	-	3	-	-	3	-	-	3
19A56JT.3	3	-	-	3	-	-	3	3	-	3	-	3
19A56JT.4	3	3	3	-	3	-	-	-	-	-	3	3
19A56JT.5	-	-	3	3	3	-	-	-	3	-	3	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Engineering Geology Lab
 Category : PC
 Course Code : 19A162L
 Year : III B.Tech
 Semester : II

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- To identify the mega-scopic types of Ore minerals & Rock forming minerals.
- To identify the mega-scopic types of Igneous, Sedimentary, Metamorphic rocks.
- To identify the topography of the site & material selection.

List of experiments:

1. Study of physical properties and identification of rock forming minerals.
2. Study of physical properties and identification of ore forming minerals.
3. Megascopic identification of common igneous rocks.
4. Megascopic identification of common sedimentary rocks.
5. Megascopic identification of common metamorphic rocks.
6. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
7. Simple structural geology problems.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Study of physical properties and identification of minerals referred under theory.	L5
2. Megascopic description and identification of rocks referred under theory.	L5
3. Microscopic study of rocks.	L5
4. Interpretation and drawing of sections for geological maps showing tilted beds, faults, uniformities etc.	L5
5. Simple Structural Geology problems.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A162L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A162L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A162L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A162L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3
19A162L	1	-	-	-	-	2	-	-	3	-	-	3	-	-	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: ENVIRONMENTAL ENGINEERING LAB
 Category : PC
 Course Code : 19A163L
 Year : III
 Semester : II

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course enables the students to Experimental design, procedures and analysis through material related to environmental engineering.

assess water quality and quantifying water resources.

Analyse the results which provide information on pH, conductivity, calcium, magnesium, phosphate and hardness.

Use these instruments also for experiments on environmental engineering experiments that are directly linked to ongoing research in the department and that shed light on the challenges faced by engineers to provide clean, safe drinking water.

List of experiments:

1. Determination of Acidity and Alkalinity
2. Determination of Chlorides
3. Determination of Dissolved Oxygen
4. Estimation of Sulphates
5. Determination of pH and Estimation of Conductivity
6. Determination of Turbidity
7. Estimation of Hardness of water by EDTA Titration Method
8. Determination of Available Chlorine in Bleaching Powder, Residual Chlorine, Break Point Chlorination and Chlorine Demand
9. Optimum Coagulant Dose by Jar Test Apparatus
10. Determination of Total solids, settleable solids, dissolved solids and volatile Solids.
11. Determination of Dissolved Oxygen(DO) and Biochemical Oxygen Demand(BOD)
12. Determination of Ammonia-nitrogen and Nitrates.
13. Estimation of Phosphates

Course Outcomes:

Student will be able to	Blooms Level of Learning
<ul style="list-style-type: none"> • Operate analytical equipment (e.g. pH meter, spectrophotometer) and experimental devices (e.g., bench-scale water turbine) to gain useful information. 	L5
<ul style="list-style-type: none"> • Understand and conduct experiments used for water quality assessment and hydraulic measurement. 	L2 & L5
<ul style="list-style-type: none"> • Critically assesses the quality of analytical data provided for environmental parameters. 	L3

- Design and test a lab experiment based on preliminary observations and data.

L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A163L.1	2	-	-	-	-	-	-	-	3	-	2	3			
19A163L.2	-	-	-	-	-	-	-	-	3	3	-	3			
19A163L.3	2	-	-	-	-	-	-	-	3	3	3	3			
19A163L.4	2	-	-	-	-	-	-	-	-	3	-	3			

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Civil Engineering

Title of the Course Professional Communication Skills Lab
 Category BS
 Course Code 19AC62L
 Year III Year
 Semester II Semester
 Branch CE, ME, CSE & AIDS

Lecture Hours Tutorial Hours Practical Credits
 - - 3 1.5

Résumé Preparation – structure, formats and styles – planning - defining career objective - projecting one’s strengths and skills - creative self-marketing–sample resumes - cover letter

Interview Skills- concept and process - pre-interview planning – preparation - body language - answering strategies – frequently asked questions

Group Discussion –communicating views and opinions – discussing – intervening – agreeing and disagreeing –asking for and giving clarification - substantiating - providing solution on any given topic across a cross-section of individuals - modulation of voice and clarity - body language – case study

Oral Presentations (Individual& Team) – collection of data from various sources –planning, preparation and practice – attention-gathering strategies - transitions – handling questions from audience

Listening Comprehension – listening for understanding - responding relevantly

Learning Resources: AECS Lab Manual prepared by Dept of HS, AITS Rajampet

Course Outcomes:

Student will be able to

- | | Blooms Level of Learning |
|---|--------------------------|
| 1. express himself/herself fluently in social and professional contexts | L4 |
| 2. demonstrate effective presentation skills | L4 |
| 3. face interviews confidently | L3 |
| 4. participate in meetings effectively | L4 |
| 5. listen actively for better understanding | L4 |

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19AC62L1										3		3			
19AC62L2										3		3			
19AC62L3										3		3			
19AC62L4										3		3			
19AC62L5										3		3			

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Transportation Engineering

Category : PC

Course Code : 19A171T

Year IV

Semester I

Lecture Hours/Week	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

1. It deals about the history of highway development, surveys and classification of roads.
2. To study about the geometric design of highways, traffic characteristics and design of intersections
3. To know about the pavement materials and design.

Unit-1: (9hrs)

HIGHWAY DEVELOPMENT AND PLANNING: Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation. Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

Unit-2: (9hrs)

Geometric design of highways:- Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients Vertical curves., problems.

Unit-3: (12hrs)

TRAFFIC ENGINEERING: Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; Road Accidents-Causes and Preventive measures Accident Data Recording – Condition Diagram and Collision Diagram, problems

INTERSECTION DESIGN: Types of Intersections –Types of Grade Intersections- Channelization: Objectives – Traffic Islands and Design criteria-Types of Grade Separated Intersections- Rotary Intersection –Concept of Rotary and Design Criteria.

Unit-4: (8hrs)

Pavement Materials and Mix Design: Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements.

Unit 5: (10 hrs)

PAVEMENT DESIGN: Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavement components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

Prescribed text Books:

1. Highway Engineering – S.K.Khanna&C.E.G.Justo, Nemchand& Bros., 7th edition (2000).
2. Highway Engineering Design – L.R.Kadiyali and Lal- Khanna Publications.
3. A Text book of Transportation Engineering by S.P.Chandola, S.Chand Publications, New Delhi.

Reference Books:

1. Highway Engineering – S.P.Bindra ,DhanpatRai& Sons. – 4th Edition (1981)
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna publications – 6th Edition – 1997.
3. Introduction to Transportation Engineering by James.H.Banks, Tata Mc.Grawhill Edition, New Delhi
4. Traffic and Highway Engineering Nicholas.J.Garber&Lester A.Hoel
5. High way engineering by Paul .H.Wright& Karen K.Dixon,wileyindia limited.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. To Plan highway networks, carry out surveys involved in planning, highway alignment, and highway geometrics.	L1, L2
2. To design Geometric, horizontal and vertical curves	L4, L5
3. To understand the various traffic management plans	L1
4. To understand pavement materials	L2
5. To design flexible and rigid pavements	L4, L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A171T.1	3	-	-	-	-	2	-	-	-	3	-	3
19A171T.2	-	-	-	2	-	-	-	-	-	2	-	3
19A171T.3	-	3	2	-	-	1	-	-	-	2	-	3
19A171T.4	-	2	2	-	-	-	-	-	-	3	-	3
19A171T.5	-	-	2	-	-	1	-	-	-	3	-	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: **Estimation, Costing and Valuation**
 Category : PC
 Course Code : 19A172T
 Year : IV B.Tech
 Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- Will have a basic knowledge on methods and types of estimation and its merits and demerits
- Have knowledge on specifications and tendering process for contracts.
- Will have the ability to understand the types, formation, terms and conditions in contracts and arbitration.
- Will have the knowledge of rate analysis of different item of work and MB and bill of quantities.
- Will able to value a property, price escalation recommendations and auditing

Unit 1 : Introduction to Estimation and Standards Specification 10

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

Standards Specifications: Standard specifications for different items of building construction

Unit 2 : Estimation of Buildings 10

Estimation Of Buildings: Detailed Estimates of Buildings- Different items of works in building – Principles of taking out quantities – Detailed measurement form – Estimate of RCC building - Long wall - Short wall method and Centre line method

Unit 3 : Earthwork Estimation 10

Roads: Estimate of bituminous and cement concrete - Estimate of earthwork - Estimate of pitching of slopes - Estimate of earthwork of road from longitudinal sections - Estimate of earthwork in hill roads.

Canals: Earthwork in canals – Different cases – Estimate of earthwork in irrigation channels

Unit 4 : Contracts and Tenders, Valuation 9

Contracts and Tenders: Contracts – Types of contracts – Contract Documents– Conditions of contract – Types of Tenders – Requirement of Tendering.

Valuation: Valuation of buildings. Necessity - Different terms used in valuation and their meaning - Different methods of building valuation and rent fixation - Outgoings – Depreciation - Methods for estimating cost depreciation

Unit 5 : Rate Analysis and Reinforcement Estimation 8

Rate Analysis : Working out data for various items of work over head and contingent charges - Task or out – Turn work – Labour and materials required for different works - Rates of materials and labour - Schedule of Rates - Preparing analysis of rates for the following items of work: Concrete, RCC Works, Brick work in foundation and super structure, plastering, CC flooring, whitewashing.

Reinforcement Estimation: Reinforcement bar bending and bar requirement schedules.

Prescribed Text Books:

1. Estimating and costing in Civil Engineering –Dutta B.N & Dutta S UBS Publishers & Distributors Pvt. Company, Lucknow 1986.
2. Rangwala, S.C., Elements of Estimating and Costing, Professional practice, Charotar Publishing House, Anand

Reference Text books:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2004
2. Birdie G.S. "A text book on estimating and costing" — Dhanpat Rai and Sons, New Delhi.
3. Jagannathan G, Getting more at less cost – The Value Engineering Way, Tata McGraw Hill, New Delhi, 1992.
4. Patil, B.S., Civil Engineering Contracts, Vol. – I, Orient Longman Publication, 1998.
5. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria & Sons, New Delhi. Chandola, S.P. and Vazirani, Estimating and Costing, Khanna Publication.

Course Outcomes:

Student will be able to

Blooms Level of Learning

- The students will get a diverse knowledge of estimating, costing and professional practice, which will be use full in tackling real life problems. L4
- Write specification for various items of civil works. L2
- Analyze different types of contracts, tender document for building &valuation L4
- Undertake rate analysis of civil engineering works L4
- Evaluate the actual value of any property. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19A172T.1	2	1	-	-	-	3	-	-	-	-	2	-	-	-
19A172T.2	2	1	-	-	-	3	-	-	-	-	2	-	-	-
19A172T.3	2	1	-	-	-	3	-	-	-	-	2	-	-	-
19A172T.4	2	1	-	-	-	3	-	-	-	-	2	-	-	-
19A172T.5	2	1	-	-	-	3	-	-	-	-	2	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: **Sustainable Construction Methods**
 Category : PE
 Course Code : 19A17AT
 Year : IV B.Tech
 Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- To get a comprehensive overview of materials used for sustainable buildings.
- To understand the effects of technology on materials and the way they are used with respect to sustainability.
- To study and understand the properties of sustainable building materials used in construction and understand the importance of bio materials and green building materials.

Unit 1 : SUSTAINABLE BUILDING 8

Sustainable building systems and environmental impacts - 5Es of sustainability - Scales and program diversity of buildings – Stages of environmental assessment and intervention - Whole life costing and Life cycle analysis – Carbon foot print – Integrated design approach — Sustainable materials, old and new - Cultural context, holistic building traditions and invention - Cradle to Cradle – Bio mimicry – Resource abundance by design - Recycling and reuse

Unit 2 : GREEN BUILDING MATERIALS AND TECHNOLOGY 10

Introduction, green building product and materials - Product selection criteria: concrete, eco block, insulated concrete forms(ISF), hydra form, prefabs / structural insulating panels, cellulose insulation, adobe, rammed earth, earth sheltered and recycled materials - Bio materials : Properties, application, specification and standards(Indian and International) - Bio materials from industrial waste, mining waste, mineral waste, agricultural waste.

Unit 3 : INNOVATIVE USE OF MATERIALS 10

Use of waste materials such as paper, glass bottles, tires, shipping containers - Use of post consumer and industrial waste such as fly-ash, bags, building demolition waste – use of salvaged materials from flooring, columns, beams, timber, glass, etc.

Unit 4 : SUSTAINABLE CONSTRUCTION TECHNIQUES 9

Alternative construction techniques such as SMB, CSEB, and steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, ferro-cement walls etc., - Case studies

Unit 5 : INTRODUCTION TO SUSTAINABLE BUILDING MATERIALS 8

Introduction to sustainable building materials, qualities, use, examples - Natural building materials, locally available and locally manufactured materials, bio materials - Salvaged and recycled materials - Non toxic materials: low VOC paints, coating and adhesives.

Prescribed Text Books:

1. Sustainable Building - Design Manual Pt 1 & 2,
2. The Energy and Resources Institute, TERI, 2004
3. Ross Spiegel.G, Green Building Materials A Guide to Product Selection and Specification, 3rd Edition by, John Wiley & Sons, 2010

Reference Text books:

1. Jagadish. K.S. Alternative Building Materials and Technologies, New age International Pvt Ltd Publishers, 2008
2. Traci Rose Rider, Stacy Glass, Jessica McNaughton, Understanding Green Building Materials, W.W.Norton and Company, 2011
4. Johan van Lengen, The Barefoot Architect: A Handbook for Green Building, Shelter Publication, 2008

Course Outcomes:

Student will be able to

Blooms Level of Learning

- A thorough understanding on designing green buildings. L4
- The student will develop a concern for the protection of the natural environment and gain an understanding of techniques for sustainable development applied to urban design, planning and architecture. L2
- Examine the green building rating systems and its contribution to sustainability. L4
- Appraise appropriateness and sustainability of materials for construction projects. L3
- Aware of legislative mechanisms for environmental protection. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19A173AT.1							3						1	3
19A173A.T.2							3						1	3
19A173AT.3							3						1	3
19A173AT.4							3						1	3
19A173AT.5							3						1	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Repair & Rehabilitation of Structure
Category : PE
Course Code : 19A17BT
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

1. To learn various distress and damages to concrete and masonry structures
2. To understand the importance of maintenance of structures
3. To study the various types and properties of repair materials
4. To assess the damage to structures using various tests
5. To learn the importance and methods of substrate preparation
6. To learn various repair techniques of damaged structures corroded structures
7. To learn various methods of strengthening of concrete structured elements.

Unit 1 : 8
Introduction : Repair, Rehabilitation of structures, causes of damage in structures, dilapidation, quality assurance and quality control, Inspection; Structural appraisal and Economic appraisal.

Unit 2 : 10
Serviceability and durability of concrete: permeability, thermal properties, cracking, effects due to climate, corrosion, deterioration of concrete, Serviceability of Structures.

Unit 3 : 10
Materials for Repair : Special mortars, and concretes; concrete chemicals, corrosion inhibitors, coating for steel and concrete, use of chemicals for repair.

Unit 4 : 9
Repair Techniques : Surface repair; surface preparation, application of repair material; strengthening and stabilization: Strengthening of beams, columns, slabs, cathodic protection, repair of fire damaged structures & structures in marine environment, Techniques for arresting leakages.

Unit 5 : 8
Concrete assessment using various non destructive tests, repair & condition assessment.

Prescribed Text Books:

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K. 1991.
2. Handbook on Repairs and Rehabilitation of RCC buildings - CPWD, Government of India.
3. RT.Allen and S.C. Edwards, Repair of concrete Structures, Blaikie and sons, UK, 1987.
4. Concrete microstructure, Properties and materials - P Kumar Mehta and Paulo J. M. Monterio.

5. MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi, 1992
6. Santha Kumar, A.R.Training Course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras, July, 1992.

Reference Text books:

1. Raikar, R.N.learning from failures – deficiencies in Design, construction and service – R&D centre (SDCPL), Raikar Bhavan, Bombay, 1987.
2. N.Palaniappan, Estate Management, Anna Institute of Management, Madras Sep. 1992.
3. F.K.Garas, J.L.Clarke, GST Armor, Structural Assessment, Butterworths, UK April 1987.
4. A.R. Santha kumar, Concrete chemicals – Theory and applications, Indian society for construction Engineering and Technology, Madras. 1993 (In press)
5. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.
6. Structural Sensing, Health Monitoring, and Performance Evaluation by D.Huston CRC Press.
7. Structural Health Monitoring by Daniel Balageas, Claus-Peter Fritzen and Alfredo Güemes – ISTE, WILEY Co-publisher.
8. Structural Health Monitoring of Large Civil Engineering Structures by Hua-Peng Chen - Yi-Qing Ni - WILEY Publications.

Course Outcomes:

Student will be able to

Blooms Level of Learning

Identify and define all the terms and concepts associated with deterioration of concrete structures.

L4

Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.

L2

Develop a know how of the Concrete repair industry equipped with variety of repair materials and techniques.

L4

Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

L5

CO-PO Mapping:

OE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A173BT.1			2					2				1		2	3
19A173BT.2			2					2				1		2	3
19A173BT.3			2					2						2	3
19A173BT.4			2					2				1		2	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course	Construction project planning & systems
Category	PE
Course Code	19A17CT
Year	IV Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To enable the student to be aware of construction planning, scheduling, construction methods and equipment basics.
- The student must be able to Plan and organize the construction site and resources, Project Monitoring & Control.

Unit 1 9

Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

Unit 2 9

Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Unit 3 9

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Unit 4 9

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction.

Unit 5 9

Project Monitoring & Control- Supervision, record keeping, periodic progress reports and periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Prescribed Text Books:

1. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., Construction Technology, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011

Reference Books:

1. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.
2. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
3. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Course Outcomes:

Student will be able to

Blooms Level of Learning

CO1. A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project scheduling.

L2 &L4

CO2. An understanding of modern construction practices.

L2

CO3. An understanding of modern construction equipment's.

L2

CO4. A basic ability of planning, organizing and resources maintaining in construction site.

L4

CO5. A basic ability to plan, control and monitor construction projects with respect to time and cost.

L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
19A173CT.1	-	2	3	-	-	-	-	-	-	-	-	3	-	2	3
19A173CT.2	-	2	3	-	-	-	-	-	-	-	-	3	-	2	3
19A173CT.3	-	2	3	-	-	-	-	-	-	-	-	3	-	2	3
19A173CT.4	-	2	3	-	-	-	-	-	-	-	-	3	-	2	3
19A173CT.5	-	2	3	-	-	-	-	-	-	-	-	3	-	2	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Sustainable Engineering & Technology
Category : PE
Course Code : 19A17DT
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will enable the students

1. To have an increased awareness among students on issues in areas of sustainability.
2. To understand the role of engineering and technology within sustainable development.
3. To know the methods, tools, and incentives for sustainable product-service system development.
4. To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

Unit 1 : 8
Sustainability- Introduction, Need for sustainability, Concept of sustainability, social, environmental and economic sustainability concepts. Sustainable development, Engineering for sustainable development, Threats for sustainability, Low Impact development techniques.

Unit 2 : 10
Tools for sustainability, Life cycle assessment, procedure for LCA, case studies. ISO 14000, bio mimicking, responsibility of industries, industrial ecology, industrial symbiosis, cleaner production, clean development mechanism. Environment Impact Assessment, Procedures of EIA in India, Environmental auditing, Case studies in environmental sustainability.

Unit 3 : 10
Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification. Methods for increasing energy efficiency of buildings, Sustainable cities, Sustainable transportation, Case studies in sustainable engineering. L2
Energy sources: Basic concepts-Conventional and non-conventional, solar energy, solar thermal systems, solar photo voltaic systems, Fuel cell.

Unit 4 : 9
Water pollutants- sources, persistent pollutants, Rain water harvesting, water quality standards, sustainable wastewater treatment methods, Energy from wastewater.
Solid waste - sources, effects of solid waste pollutants, leachate, Hazardous wastes, e wastes, plastic wastes, Radioactive wastes, Zero waste concept, 3R concept, waste to energy concept.

Unit 5 : 8
Wind energy, Small hydro plants, Biomass: types of biogas plants, bio fuels, Energy derived from oceans, tides and waves, Geothermal energy. Energy conservation, Integration of alternate energy sources. Air pollution- sources of air pollution, vehicular and industrial, types of air pollutants, Effects of air pollutants. Global environmental issues, Resource degradation, Desertification, wetland reclamation, Climate change, Ozone layer depletion, Carbon credits and carbon trading, carbon foot print. Examples for projectwork:.

Prescribed Text Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London,
2. Introduction to Environmental Engineering: special indian edition, Mackenzie Davis, David Cornwell, Amazon.com.
3. Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge.

4. EIA Guidelines, Notification of Govt of India, Environment Impact Assessment, 2006.
5. Text book for Environmental studies, Erach Bharucha, UGC, NewDelhi, ebook, colleges at.du.ac.in /UG/ Environmental %20 Studies_ebook.pdf
6. Garg HP, J Prakash, Solar Energy: Fundamentals and Applications, Tata McGraw Hill
7. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.

Reference Text books:

1. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications- Rating System, TERI PUBLICATIONS – GRIHA Rating System, LEEDS Publications
2. Systems Analysis for Sustainable Engineering: Theory and Applications, Ni bin Chang, Amazon.com
3. John W Twidell and Anthony D Weir, Renewable Energy Resources, English Language Book 27 Society (ELBS) 1996.
4. D P Kothari, K C Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India.
5. S.S Purohit , Green Technology-An approach for sustainable environment, Agrobios publication
6. Mihelcic, J. R. and Zimmerman, J. B., Environmental Engineering, Wiley Publishers.
7. Brennen, D. Sustainable Process Engineering, Pan Stanford Publishers.

Course Outcomes:

Student will be able to

Blooms Level of Learning

- | | |
|--|----|
| 1. Understand the different types of environmental pollution problems and their sustainable solutions. | L2 |
| 2. Work in the area of sustainability for research and education. | L4 |
| 3. Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course. | L2 |

CO-PO Mapping:

PE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A174A.1			2					2				1		2	3
19A174A.2			2					2				1		2	3
19A174A.3			2					2						2	3
19A174A.4			2					2				1		2	3

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Advanced Environmental Engineering
Category : PE
Course Code : 19A17ET
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will enable the students

- To know about various advanced water treatment techniques
- Knowledge of Environmental Issues In India

Unit 1 : (9 hrs)

ENVIRONMENTAL ISSUES IN INDIA: Forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc. environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, Land pollution, Greenhouse emissions, Environmental issues and Indian law, Conservation, Specific issues.

Unit 2 : (10 hrs)

BIOLOGICAL ENVIRONMENT: Community health-significance, disease transmission, Health Education, occupational health, hazards, plan prevention and control, Water borne disease.

STREAM SANITATION: Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's, Dissolved Oxygen Model; Zones of Self-purification; Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.

Unit 3 : (10 hrs)

ADVANCED INDUSTRIAL WASTE WATER TREATMENT: Introduction to Industrial Wastewater treatments. Sugar Plant: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal. Dairy Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal. Pulp and Paper Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal

Unit 4 : (7 hrs)

SOIL & AGRICULTURAL POLLUTION: Top soil, pollution, parameter of soil analysis, remedial measures, related disease. Green construction & Eco renovation, CO₂ Pollution and Global Warming, Compact Fluorescent Lights (CFLs), radiation /nuclear/radioactive pollution.

Unit 5 : (10 hrs)

ADVANCED TREATMENTS IN AIR POLLUTION CONTROL: Sources and Classification of Air Pollution, Natural contaminants; Particulate matter; Aerosols; Gaseous pollutants.

Meteorology And Air Pollution: Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behavior; Gaussian Dispersion Model; Plume rise; Wind rose.

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Environmental Impact Assessment & Life Cycle Assessment
Category : PE
Course Code : 19A17FT
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

1. To learn the concept and methodology of EIA and its documentation.
2. To understand the analysis techniques used in LCA.

Unit 1 : (12hrs)

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; General Framework for Environmental Impact Assessment, Characterization and site assessment

Environmental Management Covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant).

Unit 2 : (6 hrs)

Rapid and comprehensive EIA: Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis; Socioeconomic aspects, measures of effectiveness of pollution control activities.

Unit 3 : (6 hrs)

Socio Cultural Environment: Public participation- resettlement and rehabilitation; Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement – procedures.

Unit 4 : (10 hrs)

Documentation of EIA Environmental management Plan- Post Project monitoring- Environmental Audit- Life cycle Assessment –EMS – case studies in EIA.

Environmental Audit: Cost Benefit Analysis; Resource Balance, Energy Balance & Management Review; Operational Control; Case Studies on EIA.

Unit 5 : (9 hrs)

Life Cycle Assessment: Introduction to LCA, Impact assessment, Ecological risk and human risk, Eco-system impacts and un-certainty analysis, Applications of LCA, Case-studies of product LCA, Case studies of process LCA, Limitations of LCA, LCA project study.

Prescribed Text Books:

1. Environmental Impact Assessment, Canter R.L.; McGraw Hill International.
2. Environmental Life Cycle Analysis, Ciambone D.F., CRC Press

Reference Text books:

1. Environmental Impact Analysis Handbook, Rau J.G. and Wooten D.C. (Ed), McGraw Hill Book Company.-1980

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: TRANSPORTATION ENGINEERING LAB
 Category : PC
 Course Code : 19A171L
 Year : IV
 Semester : I

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	3

- Course Objectives:** This course will able to
1. To learn the principles and procedures of testing of highway materials
 2. Student should be able to understand the different road aggregates
 3. Comprehend the basic properties of bituminous & aggregate materials.
 4. Student should be able to understand aggregate & its engineering behavior

List of experiments:

I.ROAD AGGREGATES:

1. Aggregate Crushing Value
2. Aggregate Impact Test
3. Specific Gravity and Water Absorption
4. Attrition Test
5. Abrasion Test
6. Shape Tests

II.BITUMINOUS MATERRIALS:

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

Course Outcomes:

Student will be able to	Blooms Level of Learning
To Perform quality control tests on pavements and pavement material	L3
To recognize the knowledge about different physical properties of aggregatesby performing different test on road aggregates.	L3
To understand the different important engineering properties of road materiallike aggregate and binding materials	L1
Student knows the techniques to characterize various pavement materialsthrough relevant tests.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A171L	3	2							2	3	1	
19A171L	3		2		2					2		3
19A171L	3	3					2			2		
19A171L	3	2						2	2	3	1	2

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Structural Analysis and Design lab-II
 Category : PC
 Course Code : 19A175L
 Year : **IV**
 Semester : **I**

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	3

Course Objectives:

1. To learn the applications and basics of ETABS.
2. Enable to design and analysis RCC and steel structures.
3. Analyse RC and steel structures under earth quake loads.

List of experiments:

1. Basics of Structures ,About the ETABS & their applications in detail
2. Analysis and design of RC/steel beams with different loadings and supports.
3. Analysis and design of multi bay multi storied 2-D RC/ steel portal frame
4. Analysis and design of steel Trusses
5. Analysis and design of multi bay multi storied 3-D RC portal frame
6. Analysis & design for RC multi storied Buildings with dead loads & super imposed loads
7. Design & analysis of stair case for Multi storied Building.
8. Earthquake load application to RC structures along with the design for different load combinations.
9. Earthquake load application to steel structures along with the design for different load combinations.

Course Outcomes:

Student will be able to

Blooms Level of Learning

- | | |
|---|----|
| 1. Outline the importance ETABS in Analyzing the structures. | L3 |
| 2. Learn the tools useful for modeling, analyzing, designing a structures. | L3 |
| 3. Analyze & Design a Building for different loading conditions coming on to the structure. | |

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A175L	3	2							2	3	1	
19A175L	3		2							2		
19A175L	3	3					2			2		

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Advanced Transportation Engineering
Category : PE
Course Code : 19A18AT
Year : IV B.Tech
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- This course imparts the students' knowledge of planning, design, construction and maintenance of railway tracks
- To have knowledge in Airport planning and design with the prime focus on runway and taxiway geometrics
- To acquire knowledge on site investigation for location and planning of harbors.

Unit 1 : (9hrs)

Introduction to Railways in India: Role of Indian Railways in National Development – Railways for Urban Transportation – Modern developments- LRT & MRTS, tube railways, high speed tracks.
Alignment- basic requirements and factors affecting selection, Component parts of a railway track - requirements and functions - Typical cross-section.

Unit 2 : (9hrs)

Permanent Way: Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks, Sleepers – Functions, Materials, Density , Ballast less Tracks.

Geometric design of railway track: Horizontal curves, radius – super elevation -cant deficiency - transition curves - gradients - different types -Compensation of gradients

Unit 3 : (12hrs)

Railway operation and control: Points and Crossings – Design features of a turnout – Details of station yards and marshaling yards – Signaling, interlocking of signals and points - Principles of track circuiting – Control systems of train movements – ATC, CTC – track circuiting.

Maintenance:-Introduction to track maintenance, Items of track maintenance, packing and over hauling, screening

Railway accidents: Human and system contribution to catastrophic accidents, Human Factors in Transport Safety.

Unit 4 : (8hrs)

Tunnel Engineering: Tunnel - sections - classification - tunnel surveying -alignment, transferring center, grade into tunnel – tunnel driving procedure - shield method of tunneling, compressed air method, tunnel boring machine, Tunnel lining, ventilation - lighting and drainage of tunnels.

Unit 5 :

(12hrs)

INTRODUCTION TO AIR PORT ENGINEERING: Factors affecting airport site selection – Surveys for site selection – Aircraft characteristics and their influence on design elements – Planning of Terminal area – Typical Airport layouts.

RUNWAY AND TAXIWAY DESIGN: Orientation of runway – Use of wind rose diagram – Runway length and corrections to be applied – Numerical examples for computation of runway length – Geometric elements of runway – Design standards and specifications – Geometric design of Taxiways – Standards and specifications – Runway lighting system.

Prescribed Text Books:

1. Mundrey J. S, Railway Track Engineering, Tata McGraw Hill, 2009
2. Rangawala, S.C. , Railway Engineering, Charotor Publishing House
3. Rao G. V, Principles of Transportation and Highway Engineering, Tata McGrawHill, 1996
4. Srinivasan,R.,Harbour,Dock & Tunnel Engineering,Charotor Publishing House, 28e,2016
5. Airport Engineering by Rangwala
6. Air Transportation Planning & design – Virendhra Kumar & Statish Chandhra – Gal Gotia Publishers (1999).

Reference Text books:

1. Bindra, S.P., A course in Docks and Harbour Engineering, Dhanpat Rai& Sons
 2. Chandra, S. and Agarwal, M.M. ,Railway Engineering, Oxford University Press,New Delhi, 2008
 3. Saxena, S. C and Arora, S. P, Railway Engineering, Dhanpat Rai& Sons, 7e, 2010
- Subhash C. Saxena, Railway Engineering, Dhanpat Rai& Sons

Course Outcomes:

Student will be able to	Blooms Level of Learning
understand the importance of railway and their factors	L1,L2
design geometric design, horizontal and vertical curves	L4,L5
understand the Railway operation ,maintenance and control	L1
understand various procedures for construction activities related to tunnel structures	L2
understand the airport factors & design runway and taxiway of airport	L1,L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A181T.1			3									2	2		
19A181T.2			3									2	2		
19A181T.3			3									2	2		
19A181T.4			3									2	2		
19A181T.5			3									2	2		

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: ADVANCED SURVEYING

Category : PE

Course Code : 19A18BT

Year : IV YEAR

Semester : II SEMESTER

Lecture Hours/Week	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

The main objectives of the course are:-

1. To make students aware with different advance surveying methodologies applied to carry out large scale survey works as modern instruments have largely changed the approach to survey works with the principles being same.
2. To prepare the students to handle the errors they are likely to come across any large scale survey works.

Unit-1: GEODETIC SURVEYING (8 Hours)

Geodetic Surveying, Principal & classification of triangulation system, Selection of base line and stations, Orders of triangulation-triangulation figures, Station marks and signals-marking signals, Examples on Phase error, Extension of base, reduction of centre, selection and marking of stations

Unit-2: THEORY OF ERRORS (10Hours)

types of errors, Definitions, Laws of accidental errors, laws of weights, Examples, Theory of least squares, Rules for giving weights and distribution of errors to the field observations, Normal Equations ,Determination of the most probable values of quantities Examples on most probable values of quantities

Unit-3: (12 Hours)

FIELD ASTRONOMY: Introduction & Instruments & purpose, Astronomical terms, Time & conversion of time, Abbreviations, Determination of azimuth , Latitude and longitude & Examples of azimuth , Latitude and longitude.

SPECIAL SURVEY INSTRUMENTS: Electromagnetic Distance Measurement, Electronics Theodolite, Total station, Site square, PentaGraph, Autoset Level, Transit level, Special Compasses, Brunton Universal Pocket Transit, Mountain Compass Transit

Unit-4: (16 Hours)

PHOTOGRAMMETRIC SURVEYING: principle, uses Aerial camera, aerial photographs Definitions, scale of vertical and tilted photograph Ground coordinates, ground control, examples on scale, Displacements and errors, Examples on Displacement and errors, Procedure of aerial survey, Examples on flight planning, Photomaps and mosaics. Difference between Mosaic & Map, Stereoscopes, Parallax bar, Examples on Parallax bar

Unit V: (8 Hours)

REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM: Introduction, principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation, Digital image processing, Global positioning system ,Types, Applications of GPS, Method of operation ,System Segmentation Integration of remote sensing and GIS, applications in civil engineering.

Text Books:

1. Agor, R. Advanced Surveying, Khanna Publishers, New Delhi
2. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
3. Remote sensing and Image interpretation by T.M Lillesand,. R.W Kiefer and J.W Chipman, 5th edition, John Wiley and Sons India

Reference Books:

1. Duggal, S. K., Surveying Vol. I & II, Tata Mcgraw Hill, New Delhi
2. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi
3. Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications
4. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Gruh
5. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi
6. Basak, N.N., Surveying and Levelling, Tata Mcgraw Hill, New Delhi
7. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi
8. Roy, S.K., Fundamentals of Surveying, Prentice Hall India, New Delhi

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. a diverse knowledge of geodetic surveying practices applied for real life problems. The students will get good commends on the types of errors in surveying & good knowledge to eliminate types of errors.	L1,L4
2. understand field astronomy & Vasthu. The students will learn to work with various surveying equipments, like Theodolite, Total station, etc.in order to apply the theoretical knowledge to carryout practical field work	L1,L3
3. insight into methods used to determine geographic data, in both theory (methods and mathematical basis) and practical use. student has knowledge of the principles of spatial analysis, interpolation and geostatistics.	L1,L4
4. Analyse the principles and components of photogrammetry and remote sensing. Describe the process of data acquisition of satellite images and their characteristics. Explain the concepts and fundamentals of GIS. Compute knowledge of remote sensing and GIS in different civil engineering applications.	L5
5. GIS application in water resources.	L6

Mapping of COs & POs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
19A181B.1	1	-	-	-	-	3	-	-	-	3	-	1	1	-	-
19A181B.2	-	3	-	3	-	3	-	-	1	3	-	1	-	3	3
19A181B.3	-	-	-	3	-	3	-	2	1	3	-	1	-	-	3
19A181B.4	-	3	3	3	-	3	-	-	-	3	-	1	-	3	3
19A181B.5	-	-	-	-	-	3	-	-	-	3	-	1	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course: Remote Sensing and GIS
Category : PE
Course Code : 19A18CT
Year : IV B.Tech
Semester : II

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- To possess knowledge of Remote Sensing techniques and its application in natural resource management and Civil Engineering.

Unit 1 : (9hrs)

Introduction to Photogrammetry: Principle and types of aerial photographs, stereoscopy, Map Vs Mosaic, ground control, Parallax measurements for height, determinations.

Unit 2 : (9hrs)

Remote Sensing – I: Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units.

Remote Sensing – II: Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

Unit 3 : (9hrs)

Geographic Information System: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Types of data representation: Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

Unit 4 : (9hrs)

GIS Spatial Analysis: Computational Analysis Methods(CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

Unit 5 : (9hrs)

Water Resources Applications-I: Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development and Watershed Characteristics.

Water Resources Applications – II: Reservoir sedimentation, Fluvial Geomorphology, water resources management and monitoring, Ground Water Targeting, Identification of sites for artificial Recharge structures, Drainage Morphometry, Inland water quality survey and management, water depth estimation and bathymetry.

Prescribed Text Books:

Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

Principals of Geo physical Information Systems – Peter ABurragh and RachaelMc Donnell, Oxford Publishers 2004

Bhatta. B (2008), Remote Sensing and GIS, Oxford University Press

Reference Text books:

Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yongng, Prentice Hall (India) Publications.

Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU KAKINADA 2001, B.S.Publications.

GIS by Kang – tsungchang, TMH Publications & Co.,

Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications

Course Outcomes:

Student will be able to

Blooms Level of Learning

- The principles and components of photogrammetric and remote sensing. L1
- Procedure of data acquisition of satellite images and their characteristics. L2
- Raster and vector data and modeling of GIS. L4
- GIS methods and data storage related to the topography of earth surface. L5
- GIS application in water resources. L6

CO-PO Mapping:

OE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A181CT.1	1	1	-	1	-	-	-	2	1	-	1	-			
19A181CT.2	2	-	1	1	2	-	-	1	1	2	1	1			
19A181CT.3	-	2	-	1	-	-	-	1	1	-	1	1			
19A181CT.4	-	-	-	-	-	-	-	1	1	1	1	1			
19A181CT.5	3	-	-	1	-	-	-	1	1	2	1	1			

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES RAJAMPET
(AN AUTONOMOUS INSTITUTION)**

Title of the Course	Battery Energy Storage Systems
Category	OE
Course Code	19A28DT
Year	IV B. Tech
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical
3	1	-

Course Objectives:

1. To enable the student to understand the need for Energy Storage.
2. To learn sufficient knowledge about various Energy Storage Technologies.
3. To deal with grid connected Battery Energy Storage System.
4. To study the Challenges, Risk and Policy of Battery Energy Storage System.

Unit I: Introduction to Energy Storage for Power Systems

Emerging needs for Electrical Energy Storage -Role of Energy Storage Systems-Applications. Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical-Efficiency of Energy Storage Systems.

Unit II: Energy Storage Technologies

Storage Types - Components of a Battery Energy Storage System (BESS) - Energy Storage System Components -Grid Connection for Utility-Scale BESS Projects -Battery Chemistry Types -Lead-Acid (PBA) Battery - Nickel-Cadmium (Ni-Cd) Battery-Lithium-Ion (Li-Ion) Battery.

Unit III: Grid Applications of Battery Energy Storage Systems

Scoping of BESS Use Cases - General Grid Applications of BESS -Technical Requirements - Round-Trip Efficiency - Response Time - Lifetime and Cycling - Sizing - Operation and Maintenance.

Unit IV: Challenges and Risks

Grid Tariff Applications and Licensing Issues -Battery Safety - Challenges of Reducing Carbon Emissions - Battery Recycling and Reuse Risks -Examples of Battery Reuse and Recycling - Reuse of Electric Vehicle Batteries for Energy Storage - Recycling Process.

UNIT V: Policy Recommendations

Frequency Regulation - Renewable Integration -Distribution Grids -Transmission Grids - Peak Shaving and Load Leveling - Microgrids

Text Books:

1. YongpingZhai. *Handbook on Battery Energy Storage System* Asian Development Bank.2018.
2. James M. Eyer, Joseph J.Iannucci and Garth P. Corey .*Energy Storage Benefits and Market Analysis*, Sandia National Laboratories, 2004.
3. Jim Eyer, Garth Corey”, *Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide*, Report, Sandia National Laboratories, Feb 2010.

Reference Books:

1. Doughty, D. H., and E. Peter Roth. 2012. A General Discussion of Li Ion Battery Safety. *Electrochemical Society Interface* 21 (2): 37–44. DOI: 10.1149/2.F03122if.
2. Electric Power Research Institute (EPRI). 2010. *Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits*. Palo Alto, California, US. <http://large.stanford.edu/courses/2012/ph240/doshay1/docs/EPRI.pdf>
3. Enel Green Power. 2016. *Integrating Renewable Power Plants with Energy Storage*. 7 June. <http://www.iefc.unibocconi.it/wps/wcm/connect/29b685e1-8c34-4942-8da3-6ab5e701792b/Slides+Lanuzza+7+giugno+2016.pdf?MOD=AJPERES&CVID=1le7w78>.
4. Initial Operating Experience of the La Ola 1.2-MW Photovoltaic System. Sandia National Laboratories Report SAND2011-8848. Kane, Mark. 2015. Bosch Cooperates With BMW And Vattenfall In Second Life Battery Project. *Inside EVs* 9 February. <https://insideevs.com/bosch-cooperates-with-bmw-and-vattenfall-in-second-lifebattery-project/>

Course outcomes: At the end of the course the student will be able to

1. Understanding the need of the Energy Storage Systems.
2. Study and Analyse the function of each storage Technology, its Types.
3. Explore the Battery Energy Storage applications in Renewable energy systems and in Smart grid.
4. Study the Challenges, Risk and Policy recommendation of Battery Energy Storage Systems.

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	2	1
19A28DT .1	2	-	-	1	-	-	1	-	1	-	-	-	1	-
19A28DT .2	2	2	1	1	-	-	1	-	-	-	-	-	1	-
19A28DT .3	2	1	1	1	-	-	1	-	2	-	-	-	1	1
19A28DT .4	2	1	1	1	-	-	2	-	1	-	-	-	2	1

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES RAJAMPET
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Title of the course : System modeling and Simulation

Category : OE

Course code : 19A28ET

Year : IV B.Tech

Semester : II Semester

Lecture Hours	Tutorial Hours	Practical Hours	Credits
3	-	-	3

Course Objectives

- To understand the basic system concepts and definitions of system.
- Techniques to model and to simulate various systems.
- To analyze a system and to make use of the information to improve the performance

Unit 1: Introduction to simulation models 10 hrs

Basic Simulation Modeling, Systems, Advantages and disadvantages of simulation, Models and Simulation, Discrete Event Simulation, Simulation of Single Server Queuing System, Simulation of Inventory System, Alternative approach to Modeling and Simulation

Unit-2: Simulation software 10 hrs

Comparison of Simulation Packages with Programming Languages, Classification of Software, Desirable Software Features, General Purpose Simulation Packages – Arena, Extend and Others, Object Oriented Simulation, Examples of Application Oriented Simulation Packages.

Unit-3: Building simulation models and time driven simulation models 08 hrs

Guidelines for Determining Levels of Model Detail, Techniques for Increasing Model Validity and Credibility, Modeling Time Driven Systems: Modeling Input Signals, Delays, System Integration, Linear Systems, Motion Control Models, Numerical Experimentation.

Unit-4: Exogenous signals and events and Markov Process 12 hrs

Disturbance Signals, State Machines, Petri Nets & Analysis, System Encapsulation, MARKOV Process: Probabilistic Systems, Discrete Time Markov Processes, Random Walks, Poisson Processes, the Exponential Distribution, Simulating a Poisson Process, Continuous-Time Markov Processes.

Unit-5: Event driven models and system optimization:

Simulation Diagrams, Queuing Theory, characteristics of queuing system, Simulating Queuing Systems, Types of Queues, Multiple Servers, System Identification, Searches, Multidimensional Optimization, Modeling and Simulation Mythology.

Text Books:

1. System Modeling & Simulation, an Introduction – Frank L. Severance, John Wiley & Sons, 2001.
2. Simulation Modeling and Analysis – Averill M. Law, W. David Kelton, TMH, 3rd Edition, 2003.

Reference Book:

1. Systems Simulation – Geoffrey Gordon, PHI, 1978.

Course Outcomes:

1. Define basic concepts in Modeling and Simulation.
2. Understand the fundamental logic, structure, components and management of simulation modeling & demonstrate knowledge of how to use arena

3. Classify various simulation models and give practical examples for each category
4. Generate and test random number varieties and apply them to develop simulation models
5. Analyze output data produced by a model and test validity of the model.
6. Perform statistical analysis of output from terminating simulation.

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
19A28ET .1	3	3	3	3	3	3	3	3	3	3	3	-
19A28ET .2	3	3	3	3	3	3	3	3	3	3	1	-
19A28ET .3	3	3	3	3	3	3	3	3	3	3	3	-
19A28ET .4	3	3	3	3	3	3	3	3	3	3	3	-
19A28ET .5	3	3	3	3	3	3	3	3	3	3	3	-
19A28ET .6	3	3	3	3	3	2	-	2	2	2	2	2

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course : Optimization in Engineering
 Category : OEC
 Course Code : 19A38FT
 Year : IV Year
 Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

1. To enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operations research techniques to industrial applications.
2. To learn the fundamental techniques of Operations Research and to choose a suitable OR technique to solve problem

Unit 1 12

Linear Programming: Problem Formulation, Graphical solution, Simplex method, Artificial variables techniques -Two-phase method, Big-M method – Duality Principle

Unit 2 12

Transportation Mode: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy.

Assignment Model: Formulation, Optimal solution, Variants of Assignment Problem, Travelling Salesman problem.

Unit 3 09

Theory of Games: Introduction – minimax - maximin – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – m X 2, 2 X n & m x n games -Graphical method, Dominance principle

Unit 4 : 07

Waiting Lines: Introduction – single channel – Poisson arrivals – exponential service times – with infinite queue length models.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Queuing problems – advantages and disadvantages – Simulation languages.

Unit 5 : 08

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks

Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)**

Title of the Course : Total Quality Management
 Category : OEC
 Course Code : 19A38GT
 Year : IV Year
 Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To introduce the students, the basic concepts of Total Quality Management.
- To expose with various quality issues in Inspection.
- To gain Knowledge on quality control and its applications to real time.
- To know the extent of customer satisfaction by the application of various quality concepts.
- To understand the importance of Quality standards in Production.

Unit 1 Introduction 10

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Unit 2 Historical Review 09

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Unit 3 TQM Principles 08

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies

Unit 4 TQM Tools 09

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Prescribed Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2018, ISBN: 9789332534452
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Education., 2012, ISBN: 1259001415, 9781259001413
3. Joel E.Ross , Total Quality Management, Third Edition, CRC Press, 2017, ISBN: 9781351407786

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, NewAge International, 1996, ISBN-10: 8122416802.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993, ISBN: 9780471939672.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015, ISBN, 0070241147, 9780070241145.
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995, ISBN: 9780749415617.

Course Outcomes:

Student will be able to	Blooms Level of Learning
6. Develop an understanding on quality Management philosophies and frameworks.	L2
7. Adopt TQM methodologies for continuous improvement of quality.	L3
8. Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.	L4
9. Apply benchmarking and business process reengineering to improve management processes.	L3
10. Determine the set of indications to evaluate performance excellence of an organization.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37GT.1	2	-	-	-	-	2	2	-	-	-	2	1	-	-	-
19A37GT 2	2	2	-	2	-	2	-	-	-	1	2	1	-	-	-
19A37GT 3	1	2	-	2	-	-	-	1	1	1	2	1	-	-	-
19A37GT 4	1	-	-	-	-	1	-	-	-	-	2	1	-	-	-
19A37GT 5	1	-	-	-	-	-	-	-	-	-	2	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: INTRODUCTION TO DIGITAL DESIGN
Category : OE
Course Code : 19A48DT
Year : IV B.Tech
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To get the knowledge on Number Systems and codes.
- To gain the knowledge on Boolean algebra
- To acquire the knowledge of various circuits in Digital design

Unit 1 : **NUMBER SYSTEMS, CODES & BOOLEAN ALGEBRA** 11

Philosophy of number systems – r , $(r-1)$'s complement, representation of negative numbers, binary arithmetic, binary codes, error detecting & error correcting codes, hamming codes.

Boolean algebra: Fundamental postulates of Boolean algebra, Basic theorems and properties, digital logic gates, properties of XOR gate, universal gates.

Unit 2 : **SWITCHING FUNCTIONS AND THEIR MINIMIZATION** 10

Switching Functions-Canonical and Standard forms, algebraic simplification using Boolean theorems, two level & Multilevel Realization of Boolean Functions using Universal Gates.

Minimization: K-Map methods, Prime implicants, don't care combinations, Minimal SOP and POS forms, Tabular Method, Prime-Implicants chart, simplification rules.

Unit 3 : **COMBINATIONAL LOGIC DESIGN** 9

Design using conventional logic gates-Binary Adders, Subtractors, Ripple Adder, Magnitude comparator, Encoder, Decoder, Multiplexer, De-Multiplexer, Code converters..

Unit 4 : **SEQUENTIAL CIRCUITS** 9

Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode with examples), Basic flip-flops, Triggering and excitation tables, flip flop conversions, Steps in synchronous sequential circuit design, Design of modulo-N Synchronous counters – up/down counter.

Unit 5 : **FSM MINIMIZATION INTERCONNECTION** 6

Finite state machine- capabilities and limitations, Mealy and Moore models and their conversions. Minimization of completely specified sequential machines-Partition techniques.

Prescribed Text Books:

1. Morris Mano, *Digital Design*. Prentice Hall India, 3rdEd

2. ZVI Kohavi and Niraj K. Jha Switching & Finite Automata theory. Tata McGraw Hill, 3rdEd
Reference Text books:

1. Charles H. Roth, *Fundamentals of Logic Design*. Thomson Publications, 2004, 5thEd
2. Fletcher, *an Engineering Approach to Digital Design*. Prentice Hall India. Anand Kumar, *Switching Theory and Logic Design*. Prentice Hall India, 2008

Course Outcomes:

Upon completion of the course, students can

Blooms Level of Learning

- | | |
|---|----|
| 7. Understand different number systems conversions & Binary codes | L2 |
| 8. Simplify Boolean functions& realize them using digital logic gates | L5 |
| 9. Design various combinational & sequential circuits | L6 |
| 10. Design various combinational & sequential circuits | L2 |

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A48DT.1	2		2		2			1			2		3		
19A48DT.2	2	2	2			1		1			2		2	2	
19A48DT.3	2	2	2			1		1			2			3	
19A48DT.4	2	2	2			1		1			2			3	

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: INDUSTRIAL ELECTRONICS
Category : OE
Course Code : 19A48ET
Year : IV B.Tech
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- Power quality terminology, power quality issues, classification
- Different sources of power quality disturbances
- Harmonic distortion; Principles for controlling harmonics
- Power quality measuring equipment; Power quality monitoring standards
- Impact of distributed generation on power quality

Unit 1 : **INTRODUCTION TO POWER QUALITY** 8

Power Quality- definition, terminology, issues, evaluation procedure, responsibilities of the suppliers and users of electric power, power quality standards, CBEMA and ITI curves.

Unit 2 : **POWER QUALITY DISTURBANCES** 10

General classes of power quality problems- Impulsive and oscillatory transients. Long duration voltage variations - over voltage, under voltage, sustained interruption. Short duration voltage variations- interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance overview of mitigation methods.

Unit 3 : **FUNDAMENTALS OF HARMONICS** 10

Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indices. Harmonic sources from commercial and industrial loads. Effects of harmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, and devices for controlling harmonic distortion. Harmonic filter design and standards on harmonics.

Unit 4 : **POWER QUALITY MONITORING** 9

Power quality benchmarking, monitoring considerations, choosing monitoring locations, permanent power quality monitoring equipment, historical perspective of power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurement data, power quality monitoring standards.

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: Internet of Things
 Category : OE
 Course Code : 19A58ET
 Year : IV B.Tech
 Semester : II Semester (Offered to CE, EEE, ME & ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- To understand the terminology, technology and its applications of IoT.
- To know the concept of M2M (machine to machine) with necessary protocols.
- To memorize the software platforms which are used for developing the applications.
- To learn the concepts of python programming language which is used to develop the IoT projects.
- To know the hardware platforms which is necessary to develop the IoT applications.

Unit 1 :	Introduction to Internet of Things	8
	Introduction to Internet of Things, History of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates, Applications of IoT.	
Unit 2 :	IoT and M2M & IoT Platforms Design Methodology	7
	IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT. IoT Platforms Design Methodology: Introduction, IoT Design Methodology.	
Unit 3 :	The Wireless Embedded Internet	8
	Introduction to 6LoWPAN, The 6LoWPAN Architecture, The Basic 6LoWPAN Format, Addressing MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol, Contiki and uIPv6, Wireless RFID Infrastructure.	
Unit 4 :	IoT Systems-Logical Design Using Python	8
	Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages and File Handling.	
Unit 5 :	IoT Physical Devices and Endpoints	8
	What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.	

Prescribed Text Books:

5. Internet of Things, A Hands-On Approach, Arshdeep Bahga, Vijay Madiseti, University Press,2015.
6. 6LoWPAN: The WirelessEmbedded Internet, Zach Shelby and Carsten Bormann,Wiley publications, first edition,2009.(Unit III).

Reference Text books:

1. The Internet of Things Connecting Objects to the Web, Hakima Chaouchi,Wiley publications,2010.
2. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, Wiley 2014.
3. Enterprise IoT, A Definitive Handbook by Naveen Balani.

Course Outcomes:

Student will be able to

Blooms Level of Learning

- Understand the vision of IoT from a global context. L1
- Identify the difference between IoT and M2M communication. L3
- Determine the usage of 6LoWPAN and select the appropriate network protocols for IoT project. L4
- Create the IoT experiments with the help of Python programs. L5
- Design the IoT applications using Raspberry Pi kit. L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A58ET .1	-	-	-	3	3	3	1	1	-	-	-	1
19A58ET .2	-	-			3	-	-	-	-	1	-	-
19A58ET 3	-	-	3	3	3	-	-	-	-	-	-	-
19A58ET 4	-	-	3	3	-	-	-	-	-	-	-	-
19A58ET 5	1	1	3	3	3	3	-	-	-	-	-	-

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::RAJAMPET
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Title of the Course	Web Programming
Category	OE
Course Code	19A58FT
Year	IV B. Tech
Semester	II Semester (Common to CE, EEE, ME, ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will make the students

- Interpret and use HTML concepts in developing the web pages
- Use the CSS to design web pages.
- Interpret the JavaScript programming language
- Interpret the JavaScript framework using JQuery

Unit 1 : 9

Structuring Documents for the Web-A Web of Structured Documents, Introducing HTML5, Tags and Elements, Attribute Groups Core Attributes, Internationalization, Core Elements ,Basic Text Formatting, Understanding Block and Inline Elements, Grouping Content, Working with Lists, Text Processing tags, Links and Navigation :Basic Links, Understanding Directories and Directory Structures, Understanding URLs, Creating In-Page Links with the <a> Element.

Unit 2 : 9

Images, Audio, and Video, Tables, Forms
Images, Audio, and Video -Adding Images Using the Element, Using Images as Links Adding Flash, Video, and Audio to Your Web Pages Tables: Introducing Tables, Basic Table Elements and Attributes, adding a Caption to a Table, Grouping Sections of a Table, Nested Tables, Accessible Tables. Forms: Introducing Forms, creating a Form with the <form> Element, Form Controls, Creating Labels for Controls and the <label> Element, Structuring Your Forms with <fieldset> and <legend> Elements, Focus, Disabled and Read-Only Controls, Sending Form Data to the Server, Creating More Usable Form Fields.

Unit 3 : 9

Cascading Style Sheets, Introduction to XML
Cascading Style Sheets: Introducing CSS, Where You Can Add CSS Rules, CSS Properties Controlling Text, Text Formatting, Text Pseudo-Classes, Styling Text, Selectors Lengths, Introducing the Box Model, An Example Illustrating the Box Model, Links, Backgrounds, Lists, Tables, And Miscellaneous Properties.
Introduction to XML: Difference between HTML and XML, Basic structure and Syntax of XML Document, DTD, sample examples.

Unit 4 : 9

Learning JavaScript
Learning JavaScript-Introduction to JavaScript, How to Add a Script to Your Pages, comments in JavaScript, Create an External JavaScript ,The Document Object Model, JavaScript Programming console, General Programming Concepts, Variables, Operators, String Operators (Using + with Strings), Functions, Conditional Statements, Looping, Events, Built-in Objects.

Unit 5 : 9

Working with jQuery
Working with jQuery: introduction to jQuery, adding jQuery to Your Page, jQuery Basics, jQuery and the DOM, Managing Events with jQuery, Ajax with jQuery, jQuery UI.

Prescribed Text Books:

1. Beginning HTML and CSS Rob Larsen, Wrox Programmer to Programmer.

Reference Books:

1. JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley Publications
2. Web Design with HTML, CSS, JavaScript and jQuery Set, Jon Duckett, Wiley Publications
3. jQuery in Action, Bear Bibeault, Yehuda Katz, and Aurelio De Rosa, Third Edition, Manning Publications
4. <https://www.w3schools.com/>

Course Outcomes:

Student will be able to

Blooms Level of Learning

- | | |
|---|------------|
| 1. Interpret and Use the fundamental HTML markups when designing web pages. | L2, L3, L5 |
| 2. Use and design the web pages with images, audio, videos, tables and form controls. | L3, L5 |
| 3. Use cascading style sheets and XML concepts to design web pages | L3, L5 |
| 4. Interpret and use JavaScript concepts in designing web pages | L2, L3, L5 |
| 5. Interpret and use JQuery concepts in designing web pages. | L2, L3, L5 |

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A58FT.1	3	-	3	3	3	-	-	-	-	-	-	3	-	-	-
19A58FT.2	-	-	3	3	3	-	-	-	-	-	-	3	-	-	-
19A58FT.3	-	-	3	3	3	-	-	-	-	-	-	3	-	-	-
19A58FT.4	3	-	3	3	3	-	-	-	-	-	-	3	-	-	-
19A58FT.5	3	-	3	3	3	-	-	-	-	-	-	3	-	-	-