1.2.2_CE_file no: 1-UniversityCBCS/ECS implementation Circular (2021-22)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
DEPARTMENT OF CIVIL ENGINEERING

CIRCULAR

Dt. 05.08.2021

Following are elective courses offered for Civil Engineering students in various semesters.

	Professional Elective I	
19APE0101	Building Planning and bye-laws	
19APE0102	Water Harvesting and Conservation	
19APE0103	Cost Effective Housing Techniques	
19APE0104	Green Buildings	
19APE0105	Photogrammetric Survey	
	Open Elective I (Inter Disciplinary Elective I)	
19APE0416	Sensor Networks	
19APC0521	Artificial Intelligence	
19APC0323	Operations Research	
	Professional Elective II	
19APE0106	Subsurface Investigation and Instrumentation	
19APE0107	Prestressed Concrete	
19APE0108	Advanced Structural Analysis	
19APE0109	Railways, Airport, Docks & Harbor Engineering	
19APE0110	Finite Element Methods	
	Open Elective II (Inter Disciplinary Elective II)	
19AHSMB01	Managerial Economics and Financial Analysis	
19AOE0301	Management Science	
19AHSMB02	Entrepreneurship Development	
	Humanities Elective I	
19AOE9901	English for Research writing skills	
19AHE9911	Environmental waste Management	
19AHE9902	Principles of EffectivePublic Speaking	
	Professional Elective III	
19APE0111	Ground Improvement Techniques	
19APE0112	Watershed and River Basin Management	
19APE0113	Engineering Materials for Sustainability	
19APE0114	Air pollution and quality control	
19APE0115	Bridge Engineering	
	Professional Elective IV	
19APE0116	Repairs and Rehabilitation of Structures	
19APE0117	Intelligent transportation systems	
19APE0118	Hydro Power Engineering	
19APE0119	Industrial Waste & Waste-Water Engineering	
19APE0120	Construction Technology and Project Management	

Students of Civil engineering department can choose a subject from each set whenever they face the CBCS/Electives in their journey.

HOD.-CE
HEAD
Dept. of Civil Engg.
AITS, Tirupati-517 520

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity
❖ Creative Arts
❖ Universal Human Values
❖ Literary
❖ Proficiency Modules
❖ Lectures by Eminent People
❖ Visits to local Areas
❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science course	20ABS9901	Algebra and Calculus	3	0	0	3	30	70	100
2	Basic Science course	20ABS9905	Engineering Chemistry	3	0	0	3	30	70	100
3	Humanities and Social science	20AHS9901	Communicative English	3	0	0	3	30	70	100
4	*Engineering Science Courses	20AES0304	Engineering Workshop Practice	1	0	4	3	30	70	100
5	Engineering Science Courses	20AES0501	Problem Solving and Programming	3	0	0	3	30	70	100
6	Humanities and Social science LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100
7	Basic Science course (LAB)	20ABS9910	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
Total credits							19.5	240	560	800

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science courses	20ABS9906	Differential Equations and Vector Calculus	3	0	0	3	30	70	100
2	Basic Science courses	20ABS9903	Engineering Physics	3	0	0	3	30	70	100
3	Engineering Science Courses	20AES0202	Basics of Electrical and Electronics Engineering	3	0	0	3	30	70	100
4	Engineering Science Courses	20AES0509	Basics of Python Programming	3	0	0	3	30	70	100
5	Engineering Science Courses	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
6	Engineering Science Courses (LAB)	20AES0204	Basics of Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
7	Basic Science course (LAB)	20ABS9908	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0510	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
9	Mandatory course (AICTE suggested)	20AMC9902	Constitution of India	2	0	0	0	30	-	30
Total credits							19.5	270	560	830

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits	Schemeof Examination (Max. Marks)		
				L	T	P	C		CIE	SEE	Total
1	Basic Science courses	20ABS9913	Probability & Statistics, Partial differential equations	3	0	0	3		30	70	100
2	Professional core course	20APC0101	Mechanics of Materials	3	0	0	3		30	70	100
3	Professional core course	20APC0102	Surveying	3	0	0	3		30	70	100
4	Professional core course	20APC0103	Fluid Mechanics	3	0	0	3		30	70	100
5	Humanities and social science	20AHSMB01	Managerial Economics and Financial Analysis	3	0	0	3		30	70	100
6	Professional core courses (LAB)	20APC0104	Strength of Materials Lab	0	0	3	1.5		30	70	100
7	Professional core courses (LAB)	20APC0105	Surveying Lab	0	0	3	1.5		30	70	100
8	Professional core courses (LAB)	20APC0106	Fluid Mechanics Lab	0	0	3	1.5		30	70	100
9	Skill Oriented Course*	20APC0107	Basics of CAD	1	0	2	2		100	-	100
10	Mandatory course (AICTE suggested)	20AMC9903	Environmental Studies	2	0	0	0		30	-	30
Total credits								21.5	370	560	930

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science courses	20ABS9922	Mathematical Modelling and optimization techniques	3	0	0	3	30	70	100
2	Professional core course	20APC0108	Strength of Materials	3	0	0	3	30	70	100
3	Professional core course	20APC0109	Hydraulic Engineering	3	0	0	3	30	70	100
4	Professional core course	20APC0110	Structural Analysis-I	3	0	0	3	30	70	100
5	Professional core course	20APC0111	Concrete Technology	3	0	0	3	30	70	100
6	Humanity Science Courses	20AHS9905	Universal Human Values	3	1	0	3	30	70	100
7	Professional core courses (LAB)	20APC0112	Hydraulic Machinery Lab	0	0	3	1.5	30	70	100
8	Professional core courses (LAB)	20APC0113	Concrete Technology Lab	0	0	3	1.5	30	70	100
9	Professional core courses (LAB)	20APC0114	Computer-aided Civil Engineering Drawing Lab	0	0	3	1.5	30	70	100
10	**Skill Oriented Course***	20APC0115	Land survey with 2D drafting /Soft skills	1	0	2	2	100	-	100
Total credits							24.5	370	630	1000
Internship (Mandatory) 2 Months during summer vacation										
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4	30	70	100

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Semester V (third year)

Sl. No.	Category	Course Code	Course Title	L	T	P	C	CIE	SEE	Total
				Hours per week			Credits	Scheme of Examination (Max. Marks)		
1	Professional core course	20APC0116	Soil Mechanics	3	0	0	3	30	70	100
2	Professional core course	20APC0117	Building Technology	3	0	0	3	30	70	100
3	Professional core course	20APC0118	Engineering Geology	3	0	0	3	30	70	100
4	Open Elective course / Job Oriented Elective	20APE0417	Sensor Networks	3	0	0	3	30	70	100
		20APC0323	Operations Research							
		20AOE0301	Management Science							
5	Professional Elective courses	20APE0101	Structural Analysis-II	3	0	0	3	30	70	100
		20APE0102	Water Harvesting and Conservation							
		20APE0103	Cost Effective Housing Techniques							
6	Professional core courses (LAB)	20APC0119	Soil Mechanics Lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0120	Engineering Geology Lab	0	0	3	1.5	30	70	100
8	**Skill Oriented Course***	20APC0121	Building planning & Drawing Lab	1	0	2	2	100	-	100
9	Mandatory course (AICTE suggested)		Professional Ethics and Human Values	2	0	0	0	30	-	30
	Summer Internship 2 months (Mandatory) after second Year (to be evaluated during V semester			0	0	0	1.5	50	-	50
	Total credits						21.5	390	490	880
	Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4	30	70	100

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Semester VI (third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Professional core course	20APC0122	Environmental Engineering	3	0	0	3	30	70	100
2	Professional core course	20APC0123	Highway Engineering	3	0	0	3	30	70	100
3	Professional core course	20APC0124	Foundation Engineering	3	0	0	3	30	70	100
4	Open Elective course / Job Oriented Elective	OEC	Basic research Research in technical education Research Ethics and Plagiarism Personality development Entrepreneurship development	3	0	0	3			100
5	Professional Elective courses	20APE0104	Design and Drawing of Reinforced concrete Structures	3	0	0	3	30	70	100
		20APE0105	Intelligent Transport System							
		20APE0106	Remote Sensing and GIS							
6	Professional core courses (LAB)	20APC0125	STAAD Lab	0	0	3	1.5	30	70	100
7	Professional core courses (LAB)	20APC0126	Environmental Engineering lab	0	0	3	1.5	30	70	100
8	Professional core courses (LAB)	20APC0127	Highway Engineering Lab	0	0	3	1.5	30	70	100
9	**Skill Oriented Course***	20APC0128	Basics of Remote Sensing and GIS lab	1	0	2	2	100	-	100
10	Mandatory course (AICTE suggested)	20AMC9901	Biology for Engineers	2	0	0	0	30	-	30
	Total credits						21.5	370	560	930
	Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			4	0	0	4	30	70	100
	Industrial/ Research Internship (Mandatory) 2 Months during summer vacation									

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20ABS9913	Probability & Statistics, Partial Differential Equations	3	0	0	3

Course Outcomes:

1) Apply discrete and continuous probability distributions
2) Design the components of a classical hypothesis test
3) Infer the statistical inferential methods based on small and large sampling tests
4) Find the general solution of the PDEs bearing applications
5) Differentiation and integration of complex functions used in engineering problems To equip the students to solve application problems in their disciplines.

Unit I: Probability
probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

Unit II: Testing of Hypothesis
Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.

Unit III: Small Sample Tests
Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), χ^2 - test for goodness of fit.

Unit IV: Applications of Partial Differential Equations
Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates.

Unit V: Complex Variables
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Complex integration, Cauchy theorem (without proof), Cauchy integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues, Cauchy residue theorem (without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References:

1. S.Chand ,Engineering Mathematics-II,III &IV by Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0101	Mechanics of Materials	3	0	0	3

Course Outcomes:
1: Understand the system of forces on bodies.
2: Determine the centroid and moment of inertia for different cross-sections.
3: Understand the concepts of stress, strain, generalized Hooke's law, elastic modulii
4: Develop shear force and bending moment diagrams for different load cases.
5: Compute the slope and deflection of simple beams

UNIT - I
Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams and Equations of Equilibrium of Coplanar Systems, support reactions for simply supported beam.

UNIT - II
Centroid and Center of Gravity: Introduction – Centroids of rectangular, triangular, circular, I, L and T sections. **Area moment of Inertia**: Introduction – Definition of Moment of Inertia of rectangular, triangular, circular, I, L and T sections - Radius of gyration, perpendicular axis theorem and parallel axis theorem.

UNIT – III
Simple Stresses and Strains:
Types of stresses and strains – Hooke's law – Stress – strain diagram for mild steel – working stress – Factor of safety – lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of Varying section – Composite bars – Temperature stresses.

UNIT – IV
Shear Force and Bending Moment:
Definition of beam – types of beams – Concept of Shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and over changing beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – point of contra flexure – Relation between S.F, B.M and rate of loading at section of a beam.

UNIT – V
Deflection of Beams: Uniform bending – slope, deflection and radius of curvature - Determination of slope and deflection for cantilever and simply supported beams under point loads and U.D.L. -Mohr's theorems – Moment area method –Conjugate beam method.

TEXT BOOKS:
1. R.K Bansal, Engineering Mechanics, Lakshmi Publications.
2. R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd.
3. R. Subramanian, Strength of Materials, Oxford University Press.

REFERENCES:
1. S.S. Bhavakatti, Engineering Mechanics, New Age Publishers.

Year : II B.Tech   Semester: I   Branch of Study: CE and ME

Subject Code:20ABS9913	Subject Name: Probability & Statistics, PDE	L	T	P	Credits
		3	0	0	3

Course Outcomes:

1) Understand the concepts of Central Tendency, Correlation, Regression concepts.
2) Apply discrete and continuous probability distributions
3) Design the components of a classical hypothesis test for large samples.
4) Infer the statistical inferential methods based on small sampling tests.
5) Find the general solution of the PDEs bearing applications

Unit I: Descriptive statistics :
Measures of Central tendency, Measures of Variability (spread or variance), correlation. correlation coefficient, rank correlation, regression coefficients, method of least squares. regression lines   [10H]

Unit II: Probability
probability axioms, addition law and multiplicative law of probability, conditional probability. Baye's theorem, random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.
[12H]

Unit III: Testing of Hypothesis
Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.[8H]

Unit IV: Small Sample Tests
Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit.   [8H]

Unit V: Applications of Partial Differential Equations
Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates   [12H]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons. 2006.

References:

1. S.Chand ,Engineering Mathematics-II by Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO4	PO1: Knowledge of Engineering fundamentals	1.2	1.2.2
CO5	PO2: First principles of mathematics	2.4	2.4.1

1 (C. Jay Shy)

2 (Dr.R vijayalakshmi)

Somata
(Dr.V.K.Somasekhar Srinivas)

3 (Dr C. Veeresh)

4 (Dr. E. Manjoolatha)

(Dr. P. Lavanya)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0102	Surveying	3	0	0	3

Course Outcomes:
1: Understand basic principles of surveying, Prismatic compass
2: Understand basic concepts of leveling and contouring and Theodolite survey
3. Understand Computation of Areas and Volumes
4: Understand and able to set the curves on field.
5: Understand modern techniques in the survey systems.

UNIT – I:
Basics of Surveying: Definition, principles and classification of surveying - Principles of chain survey – Types of chains - Tape corrections – types of Ranging - Construction and working of prismatic compass – Types of bearing - Declination, local attraction.

UNIT – II:
Levelling - Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method.
Contouring- Characteristics and uses of Contours - methods of contour surveying, interpolation and sketching of Contours.
Theodolite Surveying*:* Measurement of horizontal and vertical angles-reiteration and repetition methods.

UNIT – III:
Computation of Areas and Volumes: Areas - Determination of areas consisting of irregular   boundary and regular boundary - Volume- trapezoidal and prismoidal formula-
 Determination of volume of earth work in cutting and embankments.

UNIT – IV:
Curves: Types of curves and their necessity, elements of simple circular curve, setting out of simple horizontal circular curves-problems.
Construction surveys: Introduction-setting out of buildings-highways culverts.

UNIT – V:
Modern Field Survey Systems:
EDM and Total Station: Measurement principle of EDM - EDM instrument characteristics - Accuracy in EDM - Total station – Introduction – Advantages - Types and applications of total station - Field procedure.
Differential Global Positioning System (DGPS): Introduction - Working principle - DGPS receivers - Applications of DGPS.

Text Books:
1. Arora, K.R. I, Surveying, Vol-I, II and II, Standard Book House, 2015.
2. C. Venkatramaiah, Text Book of Surveying, Universities Press Pvt Ltd, Hyderabad. Revised Edition 2011.
3. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying (Vol – 1,2 &3), by – Laxmi Publications (P) Ltd., New Delhi.
4. N.N. Basak, Surveying and Levelling- Tata McGraw-Hill Education, 2017.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
AK20 Regulations
(Autonomous)
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CIVIL ENGINEERING (CE)

References :

1. Manoj K., Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.
2. Madhu N., Sathikumar, R. and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. Chandra A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
4. Anji Reddy M., Remote sensing and Geographical information system, B.S. Publications, 2001.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: II   Semester: I

Subject Code	Subject Name	L	T	P	Credits
20APC0103	Fluid Mechanics	3	0	0	3

Course Outcomes:

1: Understand basic characteristics and behavior of fluids
2: Understand concepts of fluid statics, different equipment and their applications stability of floating bodies
3: Understand fundamentals of fluid kinematics and Differentiate types of fluid flows
4: Understand and apply experiments with different equipments under fluid flow
5: Estimate Energy losses in pipelines and Determine flow characteristics Through closed conduits.

UNIT – I:

Basic concepts and definitions: Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Newton law of viscosity, Kinematic and dynamic viscosity; variation of viscosity with temperature,; vapor pressure, surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT – II:

Fluid statics: Fluid Pressure: Pressure at a point, Pascal's law, and pressure variation with temperature. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. Pressure gauges, Hydrostatic pressure force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT – III:

Fluid kinematics: Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three -dimensional continuity equations in Cartesian coordinates.

UNIT – IV:

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter, orifice meter; Momentum principle; Forces exerted by fluid flow on pipe bend; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number;

UNIT -V:

Analysis of Pipe Flow: Energy losses in pipelines; Friction factor for pipe flow, Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length- Pipes in series and parallel

Text Books:

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi.
2. K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill.

REFERENCES:

1. N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
2. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House
3. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
4. K. Subramanya, Open Channel flow, Tata Mc.Grawhill Publishers

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: **II**   Semester: **I**

Subject Code	Subject Name	L	T	P	Credits
	Managerial Economics and Financial Analysis	3	0	0	3

Course Outcomes:
- Understand the fundamentals of Economics and Managerial economics viz., Demand, Production, cost, revenue and markets.
- Apply the Concept of Production cost and revenues for effective Business decision
- Analyze how to invest their capital and maximize returns.
- Evaluate the capital budgeting techniques.
- Define the concepts related to financial accounting and management and able to develop the accounting statements and evaluate the financial performance of business entity.

UNIT – I Managerial Economics

Introduction – meaning, nature, meaning, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT – II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT III Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations-Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT IV Capital Budgeting

Introduction to Capital, Sources of Capital. Short-term and Long-term Capital : Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARP.), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems).

UNIT V Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.
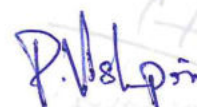
Textbooks:
1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019
3.

Reference Books:
1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New AgeInternational, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, NewDelhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage,2013.

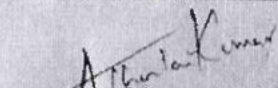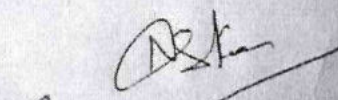# ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All branches of Engineering)	L	T	P	C
			0	0	

Course Outcomes (CO):

CO1: Understand the fundamentals of Economics and Managerial economics viz., Demand, Production, cost, revenue and markets.
CO2: Apply the Concept of Production cost and revenues for effective Business decision
CO3: Analyze how to invest their capital and maximize returns.
CO4: Evaluate the capital budgeting techniques.
CO5: Define the concepts related to financial accounting and management and able to develop the Accounting statements and evaluate the financial performance of business entity.

UNIT - I	Managerial Economics

Introduction – meaning, nature, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT - II	Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III	Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

UNIT - IV	Capital Budgeting

Introduction to Capital, Sources of Capital. Short-term and Long-term Capital : Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems).

UNIT - V	Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

(Dr. K. Harilha)

(Dr. S. KISHORE)
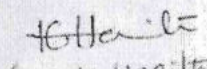
(A. THULASI KUMAR)

(Dr. N. Chandrika)

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
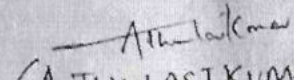2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
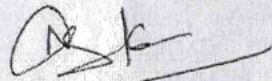4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage,2013.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting.

(DR. K. Haaitha)

(Dr. S. KISHORE)

(A. THULASI KUMAR)

(Dr. N. Chandrika)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0104	Strength of Materials Lab	0	0	3	1.5

Course Outcomes:

1: Determine the properties of material
2: Determine the compressive strength of wood or concrete
3: Examine the Polygon law of Co-planar forces and principle of moments
4: Solve the Reactions at the supports.
5: Determine the bending and deflection of beam

LABORATORY EXPERIMENTS:

1. Support reactions test on simply supported beam
2. Bell Crank Lever test
3. Tension test .
4. Bending test on (Steel/Wood) Cantilever beam.
5. Bending test on simply supported beam.
6. Torsion test.
7. Hardness test.
8. Compression test on Open coiled springs
9. Compression test on Closely coiled springs
10. Compression test on wood/ concrete
11. Izod / Charpy Impact test on metals
12. Shear test on metals
13. Continuous beam – deflection test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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CIVIL ENGINEERING (CE)

AK20 Regulations

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0105	Surveying Lab	0	0	3	1.5

Course Outcomes:

1: Understand basic principles of plane table surveying and fly leveling.
2: Understand basic concepts of theodolite survey and trigonometric leveling
3: Understand basic concepts of total station
4: Uunderstand the components of simple curve and able to set the curve on field.
5: Understand modern techniques in the survey systems.

LIST OF FIELD WORKS:

1. Chain Survey: Finding the area of a given boundary
2. Plane table survey: Finding the area of a given boundary
3. Compass Survey: Determining the Horizontal Angles and Area
4. Fly levelling: Height of the instrument method and rise and fall method.
5. Measurement of Horizontal and vertical angle by Theodolite
6. Determination of height of building using Theodolite
7. Total Station: Determination of Remote height and distance.
8. Total Station: Determination of area.
9. Total Station: Preparation of contour maps for small area
10. Stake out using total station

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CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0106	Fluid Mechanics Lab	0	0	3	1.5

Course Outcomes:

    1. Verify Bernoulli's theorem
    2. Calibrate flow measuring devices such as Venturimeter, orifice meter and notch
    3. Determine friction factor in pipes
    4. Determine minor losses in the pipes
    5. Determination of Coefficient of discharge for orifice and mouth piece

LABORATORY EXPERIMENTS

    1. Verification of Bernoulli's equation.
    2. Calibration of Venturimeter
    3. Calibration of Orifice meter
    4. Determination of Coefficient of discharge for a small orifice by constant head method.
    5. Determination of Coefficient of discharge for an external mouth piece by variable head method.
    6. Calibration of contracted Rectangular Notch
    7. Calibration of contracted Triangular Notch
    8. Determination of friction factor

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CIVIL ENGINEERING (CE)

Year: II   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20AMC9903	Environmental Studies	0	0	3	1.5

Course Outcomes:

1. Students get sufficient information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
2. Students realize the need to change their approach, so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
3. Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
4. . Interpretation of different types of environmental pollution problems and designing of new solid waste management techniques usage
5. To get knowledge on various environmental acts and to engage all the students life - long learning of rain water harvesting

UNIT – I

Multidisciplinary Nature of Environmental Studies: Introduction – Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy resources – Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.
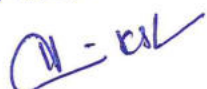
Water resources: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources.

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Causes, effects and its control measures of : Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people – Case studies – Environmental ethics: Issues and possible solutions – Climate

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI

(Autonomous)

Year: I B.Tech   **AK 20 Regulations**

Semester: I   **Branch: Common to All**

Subject Code	Subject Name	L	T	P	Credits
20AMC9903	Environmental Studies	3	0	0	0

Course Outcomes

1. Students get sufficient information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
2. Students realize the need to change their approach, so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
3. Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
4. Interpretation of different types of environmental pollution problems and designing of new solid waste management techniques usage
5. To get knowledge on various environmental acts and to engage all the students life - long learning of rain water harvesting

UNIT – I   18Hr

Multidisciplinary Nature of Environmental Studies: Introduction – Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy resources – Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources.

UNIT – II   20Hr

Ecosystems: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III   10Hr

Environmental Pollution: Definition, Causes, effects and its control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

UNIT – IV   15Hr

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people – Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies–Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Public awareness.

UNIT – V   10Hr

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

P. K
(Dr. P. Lavanya)   S. Vanitha   N. Hari Krishna   K. M. Prasad
(S. VANITHA)

Dr. B. Ramachandra

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

REFERENCES:

1. Environmental studies by R.Rajagopalan, Oxford University Press.

2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.

3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO:1	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:2	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:3	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:4	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:5	PO1:Apply the knowledge of Basic science	1.2	1.2.1

(Dr. P. Lavanya)

Dr. B. Ramachandra

C.S.VANITHA

N.Hari-krishna

K.M.Prasu

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Year: **II**   Semester: **II**

Subject Code	Subject Name	L	T	P	Credits
20ABS9922	Mathematical Modeling & Optimization Techniques	3	0	0	3

Course Outcomes:

1. Know about the classifications and stages of mathematical modelling.
2. Understand building of mathematical models.
3. Study the behaviour of mathematical models.
4. Formulate a linear programming problem and solve it by various methods.
5. Give an optimal solution in assignment jobs, give transportation of items from sources to destinations.

Unit I: Introduction to Modelling, Building Models, Studying Models

What is mathematical modelling? What objectives can modelling achieve? Classifications of models Stages of modelling . Systems analysis- Making assumptions- Flow diagrams- Choosing mathematical equations.

Unit II: Studying Models

Equations from the literature- Analogies from physics-Data exploration, Dimensionless form - Asymptotic behaviour- Sensitivity analysis - Modelling model output

Unit III: Linear programming problems(LPP)

Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

Unit IV: Transportation & Assignment Problem

Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Travelling salesman problem.

Unit V: Game Theory

Formulation of games, Two person-Zero sum game, Mini max and Max min Principle, games with and without saddle point, Rules of dominance, Solving a 2x2 game using graphical method.
TEXT BOOKS:

1. Mathematical Modeling: by Majid Jaberi-Douraki and Seyed M. Moghadas
2. Operations Research , S.D. Sharma.

REFERENCES:

1. Mathematical Models in Applied Mechanics A.B. Tayler
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.

Online Learning Resources:
https://people.maths.bris.ac.uk/~madjl/course_text.pdf

AK20 Regulations

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change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies– Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Public awareness.

UNIT – V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

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2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

Year : II B.Tech   Semester: II   Branch of Study: CE

Subject Code: 20ABS9922	Mathematical Modeling & Optimization Techniques	L T P 3 0 0	Credits 3

Course Outcomes:

1. Know about the classifications and stages of mathematical modelling.
2. Understand building of mathematical models.
3. Formulate a linear programming problem and solve it by various methods.
4. Give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
5. Apply the game theory concepts in solving problems related to Game theory.

Unit I: Introduction to Modelling, Building Models, Studying Models
What is mathematical modelling? What objectives can modelling achieve? Classifications of models Stages of modelling . Systems analysis- Making assumptions- Flow diagrams- Choosing mathematical equations.   [8H]

Unit II: Studying Models
Equations from the literature- Analogies from physics-Data exploration, Dimensionless form - Asymptotic behaviour- Sensitivity analysis - Modelling model output   [8H]

Unit III: Linear programming problems(LPP)
Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.   [10H]

Unit IV: Transportation & Assignment Problem
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Travelling salesman problem.   [12H]

Unit V: Game Theory
Formulation of games, Two person-Zero sum game, Mini max and Max min Principle. games with and without saddle point, Rules of dominance, Solving a 2x2 game using graphical method.
                                                                            [12H]

Text Books:

1. Mathematical Modeling: by Majid Jaberi-Douraki and Seyed M. Moghadas
2. Operations Research , S.D. Sharma.

References:

1. Mathematical Models in Applied Mechanics A.B. Tayler
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO2: Identify, formulate and analyze complex engineering problems	2.3	2.3.2
CO2	PO2: Identify, formulate and analyze complex engineering problems	2.3	2.3.2
CO3	PO2: Identify, formulate and analyze complex engineering problems	2.2	2.2.2
CO4	PO2: Identify, formulate and analyze complex engineering problems	2.2	2.2.2
CO5	PO2: Identify, formulate and analyze complex engineering problems	2.2	2.2.2

1. C. Jay

3.

2.

Dr. R vijayalakshmi

4.

Dr. E. Manjoolatha

[Dr. V.K. Samajechan Srjnivas]

(Dr. P. Lavanya)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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CIVIL ENGINEERING (CE)

AK20 Regulations

Year: II   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0108	Strength of Materials	3	0	0	3

Course Outcomes:

1: Identify critical planes in two dimensional stress systems
2: Compute slopes and deflections of beams with different boundary conditions
3: Determine shear stresses for different shapes.
4: Analyze members under torsion, combined torsion and bending moment for determination of energy absorption
5: Determine the Load carrying capacity of column by using different approaches

UNIT – I

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/Y = E/R$ – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hallow), I, T, Angle and Channel Sections – Design of simple beam sections.

UNIT – II

Shear Stresses: Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Combined bending and shear.
Combined Direct and Bending stresses: Introduction-eccentric loading – columns with eccentric loading – symmetrical columns with eccentric loading about one axis –about two axes – Unsymmetrical columns with eccentric loading – limit of eccentricity.

UNIT – III

Columns and Struts: Introduction – classification of columns – Axially loaded compression members – Euler's crippling load theory – derivation of Euler's critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula.

UNIT – IV

Torsion: Theory of pure torsion – Assumptions and Derivation of Torsion formula for circular shaft – Torsional moment of resistance – Polar section modulus – power transmission through shafts – Combined bending and torsion.

UNIT – V

Compound Stresses and Strains: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, and its applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain.
Theories of Failures: Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

TEXT BOOKS:

R.K Bansal, Engineering Mechanics, Lakshmi Publications.
R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd.
R. Subramanian, Strength of Materials, Oxford University Press.

REFERENCES:

S.S. Bhavakatti, Engineering Mechanics, New Age Publishers.
S. Timoshenko, D.H. Young and J.V. Rao, Engineering Mechanics, Tata McGraw-Hill Company.
Sadhu Singh, Strength of Materials, Khanna Publishers 11th edition 2015.

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CIVIL ENGINEERING (CE)

Year: II   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0109	Hydraulic Engineering	3	0	0	3

Course Outcomes:

1: Understand Laminar Flow and Turbulent flow through plates

2: Understand different formulae on open channel flow and design open-channel flow systems.

3: Understand the concepts of varying flow in pipes and Measure discharge and velocity

4: Understand hydrodynamic force of jets different vanes and design Pelton wheel, Francis and Kaplan turbine

5: Understand principles of centrifugal pumps and Calculate losses and efficiencies of centrifugal pumps

UNIT – I:

Laminar & Turbulent flow in pipes: Laminar Flow- Laminar flow through: circular pipes. Stoke's law, Measurement of viscosity. Turbulent Flow-Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability.,

UNIT – II:

Uniform flow in Open Channels: Open Channel Flow-Comparison between open channel flow and pipe flow, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Chezy's formula, Manning's formula. Computation of Uniform flow.

UNIT – III:

Non-Uniform flow in Open Channels: Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification.

UNIT – IV:

Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency.

Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design – efficiency - Draft tube: theory - characteristic curves of hydraulic turbines.

UNIT -V:

Centrifugal pumps: Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Dimensional analysis and hydraulic similitude.

TEXT BOOKS:

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House

2. D. S. Kumar Fluid Mechanics & Fluid Power Engineering, Kataria & Sons.

REFERENCES:

1. Rajput, Fluid mechanics and fluid machines , S. Chand & Co

2. K. Subramanya, Open channel Flow, Tata McGraw Hill.

3. Srinivasan, Open channel flow by, Oxford University Press

4. Banga & Sharma, Hydraulic Machines, Khanna Publishers.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APC0110	Structural Analysis-I	3	0	0	3

Course Outcomes:
1. Apply energy theorems for analysis of indeterminate structures
2. Analyze indeterminate structures with yielding of supports
3. Analyze beams using slope deflection distribution method
4. Analyze beams using moment distribution methods
5. Analyze the Determinate and Indeterminate trusses

UNIT – I

Fixed Beams: Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies-Analysis of fixed beams - uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load and combination of loads – Shear force and Bending moment diagrams – effect of sinking of support, effect of rotation of a support.

UNIT – II

Slope-Deflection Method: Introduction- derivation of slope deflection equation- application to continuous beams with and without settlement of supports.

UNIT – III

Moment Distribution Method: Introduction to moment distribution method- application to continuous beams with and without settlement of supports.

UNIT – IV

Energy Theorems: Strain energy – Resilience – Gradual, Sudden and impact loadings – simple applications. Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force – Castigliano's first theorem -Deflections of simple beams (Determinate beams).

UNIT – V

Analysis of Determinate and Indeterminate Trusses: Analysis of Determinate trusses by method of joints - Analysis of Indeterminate trusses with single degree internal and external indeterminacy – Castigliano's theorems.

Text Books:
1. S.S. Bhavikatti, "Structural Analysis", Volume 1 and 2, Vikas Publishing House, Pvt. Ltd.
2. S. Ramamurtham, "Theory of Structures", Dhanpat Rai Publishing Company (p) Ltd, 2009
3. C. S. Reddy, "Basic Structural Analysis", Tata McGraw Hill

References:
1. Timoshenko & Young, "Theory of Structures", Tata McGraw Hill
2. S. B. Junarkar, "Structural Mechanics" Vol I & II, Charotar Publishers
3. C. K. Wang, "Intermediate Structural Analysis", McGraw Hill

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0111	Concrete Technology	3	0	0	3

Course Outcomes: After the completion of the course student should be able to
1. Understand various ingredients of concrete and their role.
2. Examine knowledge on the fresh and hardened properties of concrete.
3. Know the engineering properties and non-destructive testing methods of normal concrete.
4. Understand the durability problems and remedial measure in the concrete.
5. Design of concrete mixes using BIS methods.

UNIT I
Cement& admixtures: Portland cement – Chemical composition - Properties of Bogue's compounds – Hydration, Setting of cement – Tests on physical properties – Different grades of cement. Admixtures: Types of admixtures – mineral and chemical admixtures.

UNIT - II
Aggregates, water & manufacture of concrete: Classification of aggregate – Particle shape & texture-properties of aggregate – Specific gravity, Bulk density, adsorption & moisture content of aggregate – Bulking of sand –Deleterious substance in aggregate - Alkali aggregate reaction – Sieve analysis – Fineness modulus –Grading of Aggregates - Quality of mixing water–Steps in manufacture of concrete –Curing.

UNIT – III
Fresh Concrete: Workability – Factors affecting workability – Measurement of workability by slump test, compaction factor test and Vee-Bee test – Segregation & bleeding
Hardened Concrete: Water / Cement ratio – Abram's Law – Compression test –Flexure test – Splitting test - Factors affecting strength – Relation between compression and tensile strength

UNIT - IV
Non-destructive testing: Non-destructive testing methods - UPV and Rebound Hammer tests.
Elasticity, Creep & Shrinkage: – Static Modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Shrinkage – types of shrinkage.

UNIT – V
Mix Design: Factors in the choice of mix proportions – Quality Control of concrete – Proportioning of concrete mixes by various methods – BIS method of mix design.
Durability of concrete: Durability concept - Permeability of concrete - Methods to increasing durability of concrete.

TEXT BOOKS:
1. Concrete Technology by M.S. Shetty. – S. Chand & Co.; 2004
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford university Press, New Delhi
3. Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
REFERENCES:
1. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
2. Concrete: Micro structure, Properties and Materials – P.K. Mehta and J.M. Monteiro, Mc-Graw Hill Publishers
IS Codes:
IS 383, IS 516, IS 10262 – 2019

II B.Tech   Branch Common to all

Subject Code 20AHS9905	Subject Name Universal Human Values	L 3	T 1	P 0	Credit: 3

Course Objectives

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

UNIT – 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values
- 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 fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill 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 II: Understanding Harmony in the Human Being - Harmony in Myself!

- 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.

1. P .... (Dr. P ....)   2. P. ....   3. Dr. ....   4. G. ....   5. ....

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 III: **Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship.**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment 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 IV: **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment 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.

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- V: **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.

Course Outcomes:

On completion of this course, the students will be able to

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. 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.

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 kantak, 1999.
2. A. 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. FSchumacher. "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)

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO 1	**PO 7: Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development	7.1	7.1.2
CO 2	**PO 7: Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development	7.1	7.1.2
CO 3	**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	8.1 8.2	8.1.1 8.2.2
CO 4	**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	8.1 8.2	8.1.1 8.2.2
CO5	**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	8.1 8.2	8.1.1 8.2.2

1. P. (CorP Lavanya)

2. P. Kirti

3.

4. G. Aruna

5. Kshela

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0112	Hydraulic Machinery Lab	0	0	3	1.5

Course Outcomes:

1. Able to determine minor losses in pipes
2. Understand the concept of formation of hydraulic jump
3. Determine the performance of hydraulic turbine and pumps under different working conditions

LABORATORY EXPERIMENTS
1. Study of Hydraulic jump
2. Impact of jet on vanes
3. Performance test on Pelton wheel turbine.
4. Performance test on Francis turbine.
5. Efficiency test on single stage centrifugal pump.
6. Efficiency test on Multi stage centrifugal pump.
7. Efficiency test on reciprocating pump.
8. Determination of Coefficient of loss of head in minor losses(Pipe fittings)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APC0113	Concrete Technology Lab	0	0	3	1.5

Course Outcomes:
1. Determine the properties of cement as per IS specifications.
2: Determine the properties of aggregates as per IS specifications.
3: Determine the properties of fresh concrete as per IS specifications.
4: Determine the properties of hardened concrete as per IS specifications.
5: Determine the strength of concrete using Rebound hammer method.

List of Experiments
1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity and soundness of cement.
4. Compressive strength of cement mortar.
5. Workability test on concrete by compaction factor, slump and Vee-bee.
6. Compressive strength, Tensile strength and Young's modulus of concrete.
7. Specific Gravity and Water Absorption of Coarse aggregate.
8. Bulking of Fine aggregate.
9. Specific Gravity and Water Absorption of fine aggregate.
10. Grain size distribution of coarse aggregate and fine aggregate
11. Non-Destructive testing on concrete (for demonstration)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: II   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0114	Computer-aided Civil Engineering Drawing Lab	0	0	3	1.5

Course Outcomes:
1. Understand the concepts and basics of CAD
2. Understand the building plan elevation and section drawings
3. Understand the building components drawings

LIST OF THE EXPERIMENTS

1. Introduction to computer aided drafting and Practice exercises on CAD Commands

2. Drawing of plans for Single storey buildings

3. Drawing of plans for Multi storey buildings

4. Development of sections and elevations for Single storey buildings

5. Development of sections and elevations for Multi storey buildings

6. Detailing of building components like doors, windows

7. Development of building components roof trusses

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

AK20 Regulations

Year: III　　　　　　　　　　　　　　　　　　　　　**Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APE0101	Structural Analysis - II	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Analyse the behaviour of arches through different methods of analysis
2. Analyze the frames using slope deflection and moment distribution method
3. Analyze the beams and frames using Kani's method
4. Analyze the beams using Matrix method
5. Analyze the beams using plastic analysis

UNIT –I

ARCHES : Three hinged arches, Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature.

UNIT – II

SLOPE-DEFLECTION & MOMENT DISTRIBUTION METHOD: Analysis of single bay, single storey, portal frame including side sway– Stiffness and carry over factors – Distribution factors – Analysis of single storey portal frames – including Sway.

UNIT - III

KANI'S METHOD: Analysis of continuous beams – including settlement of supports and single bay, single storey portal frames with side sway by Kani's method.

UNIT –IV

FLEXIBILITY & STIFFNESS METHODS: Flexibility methods, Introduction, application to continuous beams including support settlements-Introduction to stiffness method and its application application to continuous beams including support settlements.

UNIT – V

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.

TEXT BOOKS:

1. S. S. Bhavikatti, "Structural Analysis", Volume 1 and 2, Vikas Publishing House, Pvt. Ltd.
2. S. Ramamurtham, "Theory of Structures", Dhanpat Rai Publishing Company (p) Ltd, 2009
3. C. S. Reddy, "Basic Structural Analysis", Tata McGraw Hill

REFERENCES:

1. Timoshenko & Young, "Theory of Structures", Tata McGraw Hill
2. S. B. Junarkar, "Structural Mechanics" Vol I & II, Charotar Publishers
3. C. K. Wang, "Intermediate Structural Analysis", McGraw Hill

AK20 Regulations

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

UNIT V

Contemporary Management:

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card.

Textbooks:

1. A.R Aryasri, "Management Science", TMH, 2013

2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

References:

1. Koontz & Weihrich, "Essentials of Management", 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 1: Engineering knowledge	1.4	1.4.1
CO 2	PO 2: Problem analysis	2.1	2.1.3
CO 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO 4	PO 2: Problem analysis	2.1	2.1.2
CO 5	PO 1: Engineering knowledge	1.4	1.4.1

Year: III **Semester : I** **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
20AOE0301	Management Science	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts & principles of management and designs of organization in a practical world.

CO: 2 Apply the knowledge of Work-study principles & Quality Control techniques in industry.

CO: 3 Analyze the concepts of HRM in Recruitment, Selection and Training & Development.

CO: 4 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.

CO: 5 Create Modern technology in management science

UNIT I

Introduction to Management:

Management - Concept - Nature - Functions – Levels - Evolution of Management Thought - Taylor's Scientific Theory - Henry Fayol's principles - Elton Mayo's Human relations - Leadership styles - Autocratic leadership - Democratic & Free rein leadership.

Organizational Designs: Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization.

UNIT II

Operations Management:

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study. **Material Management** - Objectives – Inventory classification - Inventory Techniques - EOQ-ABC Analysis

Marketing Management: Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III

Human Resources Management (HRM):

HRM - Definition and Meaning - Managerial and Operative functions - Evolution of HRM - Job Analysis & Job Evaluation - Human Resource Planning (HRP) Process/Procedure- Employee Recruitment Process - Employee Selection Process and Tests in Employee Selection - Employee Training and Development - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV

Strategic Management:

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - SWOT Analysis

Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Text Books:

1. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers
2. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
3. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013

Reference Books:

1. Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011
2. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
3. Operations Research, Wagner, PHI Publications , 2nd edition.
4. Operations Research, S.R.Yadav, A.K.Malik, Oxford, 2015

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CO 1	PO 1: Engineering knowledge	1.4	1.4.1
CO 2	PO 2: Problem analysis	2.1	2.1.3
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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: III   Semester: I   Branch of Study: Common to all

Subject Code	Subject Name	L	T	P	Credits
20APC0323	Operations Research	3	0	0	3

Course Outcomes:

CO: 1   Able to create mathematical models of the real-life situations and capable of obtaining best solution using Graphical Method and Simplex Method

CO: 2   To implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP and Assignment problems

CO: 3   Knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition

CO: 4   Able to represent any project in the form of a network and estimate the parameters like Project Completion Time

CO: 5   Applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems

UNIT I Introduction to OR and Linear Programming-1 OR definition– Classification of Models –Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions.

UNIT II Linear programming-2: Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; OptimalityTesting. Special Cases -Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

UNIT III Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies– Dominance Principle–Graphical Method, Algebraic methods, sub matrices method.

UNIT IV
Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern (Service Pattern), Queue Discipline Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length.
Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models & n jobs – m Machines models.

UNIT V Dynamic Programming: Introduction – Bellman's Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP.
Replacement Models: Introduction –Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

References:

1. Ghatak A and Thyagarajan K. (1998) Introduction to Fiber Optics; Cambridge University Press: Cambridge, UK.
2. Barthorpe, R.J. and Worden, K. (2009) Sensor Placement Optimization. *Encyclopaedia of Structural Health Monitoring*, Boller, Chang and Fujino (ed.), John Wiley & Sons, Chichester, UK.

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CO: 1	PO 1: Engineering Knowledge	1.4	1.4.1
CO: 2	PO 2: Problem Analysis	2.4	2.4.3
CO: 3	PO 2: Problem Analysis	2.4	2.4.3
CO: 4	PO 3: Design/Development of solutions	3.4	3.4.2
CO: 5	PO 3: Design/Development of solutions	3.4	3.4.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: III   **Semester: I**   **Branch of Study: CE**

Course Code	Course Title	L	T	P	Credits
20APE0417	Sensor Networks	3	0	0	3

Course Outcomes: Students will be able to
CO1. Understand the concepts of Converters and Sensor data acquisition systems
CO2: Understand the concepts of Sensor Measurements in Structural Monitoring
CO3: Understand the concepts of commonly used sensing technologies and algorithms
CO4: Understand the concepts of Piezoelectric transducers for assessing and monitoring infrastructures
CO5: Understand the concepts of Fiber optic sensors for assessing and monitoring infrastructures

Unit-1 Sensor data acquisition systems and architectures

Introduction, General measurement system, Analog-to-digital converter architectures-Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC Digital-to-Analog conversion-Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Data acquisition systems-Analog Systems-Digital Systems

Unit-II Sensors and Sensing Technology for Structural Monitoring

Introduction, Sensor Types, Sensor Measurements in Structural Monitoring- Structural Responses- Environmental Quantities- Operational Quantities- Typical Quantities for Bridge Monitoring- Fibre Optic Sensors- Classification of Fibre Optic Sensors- Typical Fibre Optic Sensors in SHM- Fibre Optic Sensors for Structural Monitoring- Wireless Sensors- Components of Wireless Sensors- Field Deployment in Civil Infrastructure-Case Study

Unit-III Commonly used sensors for civil infrastructures and their associated algorithms

Introduction, commonly used sensing technologies- Displacement-Strain-Acceleration-Environment- Prevalence of commonly used sensors in SHM systems- Associated algorithms- Displacement sensors- Strain gages- Accelerometers- Environmental measurements- Examples of continuous monitoring systems

Unit-IV Piezoelectric transducers for assessing and monitoring civil infrastructures

Introduction, Principle of piezoelectricity, Piezoelectric materials and the fabrication of piezoelectric transducers, Piezoelectric transducers for SHM applications, Bonding effects, Limitations of piezoelectric transducers, SHM techniques using piezoelectric transducers

Unit-V Fiber optic sensors for assessing and monitoring civil infrastructures

Introduction, Optical fiber concepts, Sensing mechanisms, Sensor packaging, Cables, connectors, and splicing, Common optical fiber sensors- Coherent interferometers, Low-coherence interferometers, Fabry-Perot interferometers, Fiber Bragg gratings, Brillouin and Raman scattering distributed sensors

Text Books:
1. "Sensor Technologies for Civil Infrastructures", Volume 1 Sensing Hardware and Data Collection Methods for Performance Assessment **Woodhead Publishing in Civil and Structural Engineering** Ming L. Wang Jerome P. Lynch Hardcover ISBN: 9780857094322

2. "Wireless Sensor Networks for Civil Infrastructure Monitoring: A Best Practice Guide" ICE Publishing **David Rodenas-Herráiz, Kenichi Soga, Paul R A Fidler** and **Nicholas de Battista**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0118	Engineering Geology	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Understand principles of engineering geology.
2. Understand properties of various rocks and minerals
3. Understand the suitability of sites for various civil engineering structures.
4. Understand geological strata in the analysis and design the civil engineering structures.
5. Understand the concept of remote sensing and GIS.

UNIT – I
Introduction:

Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition. Weathering, erosion and denudations process on earth material and natural agencies, Geological work of wind, river underground water and glaciers Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group; Feldspar Group; Kaolin; Asbestos; Carbonate Group ; Gypsum; Mica Group; Ore minerals - Iron ores; pyrite; Chlorite

UNIT – II
Petrology:

Definition of rock - Rock forming processes - Geological classification of rocks - Dykes and sills, common structures and textures - Megascopic study, Chemical and Mineralogical Composition of rock (Granite, Gabbro, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Tuff, Felsite, Gneiss, Schist, Quartzite, Breccia, Marble, Porphyries, Charnockite and Slate).

UNIT – III
Structural Geology:

Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults unconformities, and joints – their important types. Their importance insitu and drift soils, common types of soils, their origin and occurrence in India

UNIT –IV
Geomorphology, hydrogeology and seismology:

Ground water, Water table - ground water exploration. site selection for dams and tunnels – analysis of failures in dams and tunnels - Seismic zones of India - Earth quakes, their causes and effects. Seismic waves, Richter scale. Landslides - causes and effects; Tsunami –causes and effects.

UNIT – V
REMOTE SENSING :

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

GEOGRAPHIC INFORMATION SYSTEM:

Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS.

TEXT BOOKS:
1. Engineering Geology by N.Chennkesavulu, Mc-Millan, India Ltd. 2005
2. Engineering Geology by Vasudev Kanthi, Universities Press, Hyderabad.
3. Remote Sensing and GIS by B.Bhatta, Oxford University Press,New Delhi

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

TEXT BOOKS:
1. Dr. N. Kumara Swamy & A. Kameswara Rao, Building Planning & Drawing, Charotar Publishers, Anand.
2. Dr. B.C. Punmia [2008], *Building construction*, Laxmi Publications (P) Ltd., New Delhi
3. Gurucharan Singh and Jagdish Singh [2009], *Building Planning Designing and scheduling*, Standard publishers Distributors

REFERENCES:
1. S.K. Duggal [2012], *Building materials*, New Age international (P) Ltd., New Delhi.
2. Bureau of Indian Standards, *National Building Code of India – 2005*, New Delhi.
3. M. Chakraborty, Civil Engineering Drawing, Third Edition, Bhakti Vedanta Book Trust.
4. S.C. Rangwala [2009], *Civil Engineering Drawing*, Charotar Publishing House

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
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CIVIL ENGINEERING (CE)

Year: III **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0117	**BUILDING TECHNOLOGY**	3	0	0	3

Course Outcomes: After the completion of the course student should be able to
1. Classify and understand the applications of basic building materials.
2. Understand the applications of advanced building materials
3. Explain the principles and methods of construction of building components
4. Understand the building services and principles of building planning.
5. Apply the principles and bye-laws in planning Residential buildings

UNIT I
BASIC BUILDING MATERIALS:
BRICKS: Composition of good brick earth – Methods of manufacturing of bricks– comparison between clamp burning and kiln burning – Testing of bricks.
WOOD: Seasoning of timber – Defects in timber.
OTHER MATERIALS: Properties and uses of glass, plastics, steel, aluminum, bitumen.

UNIT - II
ADVANCED BUILDING MATERIALS:
NANO MATERIALS: Introduction – Types and its applications.
SMART MATERIALS: Introduction - Types of smart materials and its applications.
MODERN BUILDING MATERIALS: Building products made of gypsum and their uses - GFRG.

UNIT – III
BUILDING CONSTRUCTION:
MASONRY: Bonds in brick masonry – Cavity & Partition walls.
FLOORS: Different types of floors – concrete, mosaic, terrazzo, tiled floors.
STAIRS: Terminology – Types of stairs.
SURFACE FINISHES: Plastering – Pointing – White washing, distempering and Painting – Damp proofing - Form work and scaffolding.

UNIT – IV
BUILDING SERVICES:
PLUMBING SERVICES: Different types of pipes – Pipe fitting.
PRINCIPLES OF BUILDING PLANNING: Introduction – Selection of site – Aspect, prospect, roominess, grouping, circulation, privacy, sanitation, elegance, economy, flexibility and practical considerations. Lighting and ventilation requirements.

UNIT – V
BUILDING BYE–LAWS AND REGULATIONs: Introduction – Objectives of building bye-laws – Principles underlying building bye-laws – Terminology – Floor area ratio (FAR), Floor space index (FSI) – Classification of buildings – Open space requirements – Built up area limitations – Height of the buildings – Wall thickness
PLANNING OF RESIDENTIAL BUILDINGS: Introduction – Minimum standards for various parts of the buildings – Bed room – Kitchen – Dining room – Bath room – Water closet.

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(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

REFERENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers.
3. Geotechnical Engineering Principles and Practices by Cuduto, PHI International.
4. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: III				Semester: I

Subject Code	Subject Name	L	T	P	Credits
20APC0116	Soil Mechanics	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Understand soil formation and determine the index properties of soil
2. Determine the coefficient of permeability and effective stress
3. Estimate stresses under various loading conditions and compaction characteristics.
4. Analyze the compressibility of the soils
5. Understand the strength of soils under various drainage conditions

UNIT – I
Introduction: Soil formation– Mass, volume relationships–moisture content – Specific Gravity-Field density by core cutter and sand replacement methods-Relative density.
Index Properties of Soils: Grain size analysis – consistency limits and indices – I.S. Classification of soils.

UNIT –II
Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability-layered permeability.
Effective Stress: Total, neutral and effective stresses – principle of effective stress - quick sand condition — Flow-nets: Characteristics and Uses.

UNIT –III
Stress Distribution in Soils: Boussinesq's and Westergaard's theories for point load, uniformly loaded pressure bulb and Newmark's influence chart.
Compaction: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

UNIT – IV
Consolidation: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil – coefficient of consolidation: square root time and logarithm of time fitting methods.

UNIT - V
Shear Strength of Soils: Importance of shear strength – Mohr's– Coulomb Failure theories – Direct shear test, Un-confined compressive strength and vane shear test– strength tests based on drainage conditions - critical void ratio

TEXT BOOKS:
1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt Ltd
3. Soil Mechanics and Foundation by by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
4. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
5. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

Subject Code 20AMC9901	Subject Name BIOLOGY FOR ENGINEERS	L 3	T 0	P 0	Credits 0

Course Outcomes:

1. Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
2. Explain about biomolecules, their structure, function and their role in the living organisms. How biomolecules are useful in Industry.
3. Brief about human physiology.
4. Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.
5. Know about application of biological principles in different technologies for the production of medicines and pharmaceutical molecules through transgenic microbes, plants and animals.

Unit I: Introduction to Basic Biology   (10 hrs)

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

Unit II: Introduction to Biomolecules   (10 hrs)

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit III: Human Physiology   (08 hrs)

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology   (08 hrs)

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

1) Dr. B. Ramachandra - ~~~

2) Dr. P. Lavanya - ~~

3) N. Hari krishna - ~~

4) K. M Prasuna - ~~

5) S. Vanitha - ~~

6) K. Sai Abhinav - ~~

Unit V: Application of Biology (10 hrs)

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus (COVID-2019), Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

Text books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 2	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 3	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 4	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 5	PO 1: Apply the knowledge of basic science	1.2	1.2.1

1) Dr. B. Ramachandra -

2) Dr. P. Lavanya -

3) N. Hari Krishna -

4) K. M. Prasena -

5) S. Vanitha -

6) K. Sai Abhiram -

Year: III

Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APC0127	Highway Engineering lab	0	0	3	1.5

Course Outcomes: After the completion of the course student should be able to
1. Asses properties of highway construction materials

LIST OF EXPERIMENTS
I. ROAD AGGREGATES:
1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test.
5. Shape tests

II. BITUMINOUS MATERIALS :
1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.

III TRAFFIC FIELD STUDIES
1. Traffic Volume Studies at Mid-block and Data Analysis
2. Traffic Volume Studies at Intersection and Data Analysis
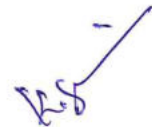
LIST OF EQUIPMENT:
1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometer.
4. Los angles Abrasion test machine
5. Length and elongation gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Penskey – Morten's apparatus
11. Relevant IS Codes

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III					Semester: II
Subject Code	Subject Name	L	T	P	Credits
20APC0126	ENVIRONMENTAL ENGINEERING LAB	0	0	3	1.5
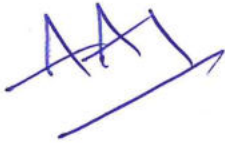
Course Objective:

The laboratory provides knowledge of estimating various parameters like PH, Chlorides, Sulphates, Nitrates in water. For effective water treatment, the determination of optimum dosage of coagulant and chloride demand are also included. The estimation status of Industrial effluents will also be taught in the laboratory by estimating BOD and COD of effluent

LIST OF EXPERIMENTS

1. Determination of pH and Turbidity
2. Determination of Conductivity and Total dissolved solids.
3. Determination of Alkalinity/Acidity.
4. Determination of Chlorides.
5. Determination and Estimation of total solids, organic solids and inorganic solids.
6. Determination of iron.
7. Determination of Dissolved Oxygen.
8. Determination of Nitrogen.
9. Determination of total Phosphorous.
10. Determination of B.O.D
11. Determination of C.O.D
12. Determination of Optimum coagulant dose.
13. Determination of Chlorine demand.
14. Presumptive coliform test.
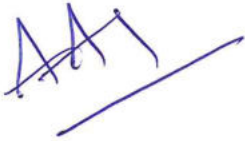
NOTE: At least 8 of the above experiments are to be conducted.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

REFERENCES:
1. Advanced Surveying : Total Station GIS and Remote Sensing – Satheesh Gopi – Pearson Publication.
2. Remote Sensing and its applications by LRA Narayana University Press 1999.
3. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications.
4. Remote sensing and GIS by M.Anji Reddy ,B.S.Pubiliications,New Delhi.
5. GIS by Kang – Tsung Chang, TMH Publications & Co.,

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

Year: III   Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APC0125	STAAD LAB	0	0	3	1.5

SOFTWARE:
1. STAAD PRO or Equivalent
EXCERCISIES:
1. 2-D Frame Analysis and Design
2. Steel Tabular Truss Analysis and Design
3. 3-D Frame Analysis and Design
4. Retaining Wall Analysis and Design
5. Simple tower Analysis and Design
6. One Way Slab Analysis & Design
7. Two Way Slab Analysis & Design
8. column Analysis & Design

TEXT BOOK:
1. computer Aided Design Lab Manual by Dr.M.N.Sesha Prakash And Dr.C.S.Suresh

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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CIVIL ENGINEERING (CE)

Year: III   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APE0102	Water Harvesting and Conservation	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Appreciate the importance of movement of ground water
2. Understand the methods of Water Harvesting
3. Understand water recovery and reuse
4. Understand the principles of Watershed Management and its importance in sustainability
5. Understand soil and water conservation

UNIT – I

Origin, Occurrence & Movement of Groundwater:-Introduction-sources of ground water – Hydro geological Cycle – Infiltration – natural openings in rocks – zones of aeration , saturation and water table – classification of ground water – laboratory and field methods of sampling ground water- aquifers – aquifuges- aquicludes – aquitards – ill effects due to lowering of water table -Artificial recharge.

UNIT – II

Water Harvesting: Principles of water harvesting-methods of rainwater harvesting-design of rainwater harvesting structures-Purification Techniques for direct use- Harvesting of surface runoff-onsite detention basin - ponds - types - Recycling of harvested water

UNIT – III

Water Recovery and Reuse: Perspective on recycle and reuse- factors affecting the development of water reclamation and reuse criteria- elements/components of water reclamation and reuse criteria / guidelines- sewage irrigation- Waste water reclamation-waste water recharge for reuse – Treatment Requirements for Water Reuse-methods.

UNIT – IV

Sustainable Watershed Approach & Watershed Management Practices: Concept of watershed-Introduction to watershed management- Integrated water resources management- natural resources management-agricultural practices-integrated farming-Conjunctive use of water resources-Community participation-Watershed Management Practices in Arid and Semiarid Regions-Case studies-Short term and long term strategic planning.

UNIT – V

Soil and Water Conservation: Scope of soil and water conservation-Mechanics and types of erosion-their causes-Soil erosion control measures - bank protection-vegetative barriers-contour bund- contour trenches-contour stone walls-contour ditches-terraces-outlets and grassed waterways-Gully control structures - temporary and permanent - design of permanent soil conservation structures-Design of farm ponds and percolation ponds.
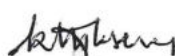
Text books:
1. Watershed Management by Murty, J.V.S, New Age Intl., New Delhi .
2. Water Resources Conservation and Management by Chatterjee, S. N.,Atlantic Publishers.
3. Ground Water by S.Ramakrishnan, SCITECH Publishers.

Reference books:
Advances in Soil and Water Conservation by Pierce, F.J. and Frye, W. W. (1998):, Ann Arbor Press, Michigan

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   Semester: I

Subject Code	Subject Name	L	T	P	Credits
20APE0103	Cost Effective Housing Techniques	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Apply the concept of housing techniques.
2. Understand housing programmes and projects.
3. Understand development and adoption of low cost housing technology
4. Understand low cost housing in rural areas
5. Understand housing in disaster prone areas

UNIT – I:-

Introduction to Housing: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT – II:-

Housing Programmes: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply , quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

UNIT – III:-

Development And Adoption Of Low Cost Housing Technology: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building
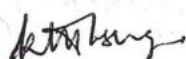
UNIT – IV:-

Alternative Building Materials for Low Cost Housing and Infrastructure Services in Rural Houses: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy.Rural Housing:Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing program
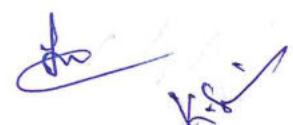
UNIT – V:-

Housing in Disaster Prone Areas: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement's of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

TEXT BOOKS
1. Hand book of Low Cost Housing by A.K.Lal – New Age International publishers.
2. Low Cost Housing – G.C. Mathur, IBH Publishers.
3. Housing in India by Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

REFERENCES:-

1. Disaster Management by Rajib Shaw, Universities Press, India.
2. Disaster Science and Management by Tushar Bhattacharya, TMH Publications.
3. Building Materials For Low –Income Houses – International Council For Building Research Studies And Documentation.
4. Modern Trends In Housing In Developing Countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai.
5. Properties of Concrete – Neville A.M. Pitman Publishing Limited, London.
6. Light Weight Concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0119	Soil Mechanics Lab	0	0	3	1.5

Course Outcomes: On the completion of the course, the students will be able to:
- Classify the soil based on IS Code.
- Determine the index properties of soil.
- Determine the engineering properties of soil.

LIST OF EXPERIMENTS

1. Determination of Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
2. a) Determination of Field density by core cutter method and
   b) Determination of Field density by sand replacement method
3. Determination of Specific gravity of soil
4. Determination of Grain size distribution by dry sieve analysis
5. Determination of Coefficient of Permeability of soil by constant and variable head test methods
6. Determination of OMC & MDD by Standard Proctor's Compaction Test
7. Determination of California Bearing ratio test
8. Determination of Unconfined compression test
9. Determination of Cohesion and internal friction by Direct shear test
10. Determination of Free swell index (FSI) test

REFERENCES:
Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::TIRUPATI
(Autonomous)
AK19 Regulations

B.Tech II,III Year

Semester: 1

Branch of Study: Common to all
MANDATORY COURSE

Subject Code 19AMC9904	Subject Name Professional Ethics And Human Values	L 3	T 0	P 0	Credits: 0

Course Outcomes:

1. It ensures students sustained happiness through identifying the essentials of human values and skills.

2. The students will understand the importance of Values and Ethics in their personal lives and professional careers.

3. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

4. Students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

5. Students can able to develop appropriate technologies and management patterns to create harmony in professional and personal life.

Syllabus
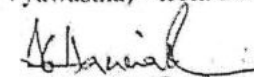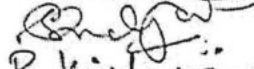
UNIT - I: 12hrs
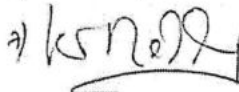
Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.

UNIT - II: 12hrs

Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   **Semester: I**

Subject Code	Subject Name	L	T	P	Credits
20APC0120	Engineering Geology Lab	0	0	3	1.5

Course Outcomes: After the completion of the course student should be able to
1. Study of physical properties and identification of minerals referred under theory.
2. Megascopic description and identification of rocks referred under theory.
3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, uniformities etc.
4. Simple Structural Geology problems.

LIST OF THE EXPERIMENTS

1. Description and identification of SIX minerals

2. Description and identification of Six (including igneous, sedimentary and metamorphic rocks)

3. Interpretation of a Geological map along with a geological section.

4. Simple strike and Dip problems.

TEXT BOOKS:-
1. Elementary Exercises in Geology by CVRK Prasad, Universities press.

UNIT – III:

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – IV:

Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.
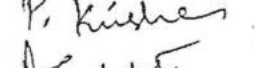
UNIT – V:
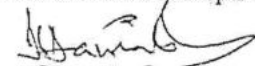
Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.

Text Books:

1.R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

2.Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Reference Books:

1.Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

2.Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA

3.Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S PritchaMichael J Rabins, 4e , Cengage learning, 2015.

4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

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5) G. Aruna

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO2	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO3	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO4	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO5	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1

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CIVIL ENGINEERING (CE)

Year: III   Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APC0122	**ENVIRONMENTAL ENGINEERING**	3	0	0	3

OUTCOMES: On completion of the course, the students will be able to:
- Identify the water demand and water characteristics.
- Apply the water treatment concept, methods, water distribution processes and operation.
- Carry out municipal water and wastewater treatment system operations and determine the sewage characteristics
- Prepare basic processes of designs of wastewater treatment plants.
- Design various sewage treatment plants and usage of solid wastes.

UNIT – I
INTRODUCTION: Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer.
WATER DEMAND AND QUANTITY STUDIES: Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Studies, Population Forecasting Studies.
QUALITY AND ANALYSIS OF WATER: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological. Impurities in water, Water borne diseases. Drinking water quality standards.

UNIT - II
WATER TREATMENT: Layout and general outline of water treatment units. Screening. Sedimentation - types of sedimentation tanks - design elements. Coagulation – coagulants – feeding arrangements – flocculation. Filtration – Classification of filters – working of slow and rapid gravity filters – design of filters – troubles in operation comparison of filters. Disinfection – theory of chlorination – chlorine demand, other disinfection practices – Miscellaneous treatment methods
WATER DISTRIBUTION: Distribution systems – Requirements, Layout of Water distribution systems - Design procedures- Hardy Cross and equivalent pipe methods.

UNIT – III
INTRODUCTION TO SANITATION: Systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- types of sewers,design of sewers, cleaning and ventilation of sewers. Engineered systems for solid waste management (reuse/ recycle energy recovery, treatment and disposal).
WASTE WATER COLLECTION AND CHARACTERSTICS: characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations.

UNIT IV
WASTE WATER TREATMENT: Layout and general outline of various units in a waste water treatment plant – Screens – grit chambers – skimming tanks – sedimentation tanks – biological treatment – trickling filters – standard and high rate – Construction and design of Oxidation ponds.

UNIT – V
SLUDGE TREATMENT: Sludge digestion – design of Digestion tank – septic tanks and Imhoff Tanks working principles and design – soak pits.

TEXT BOOKS:
1. Water supply and sanitary Engineering by G.S. Birdi, Dhanpat Rai & Sons Publishers.
2. Water Supply Engineering, Vol. 1, waste water Engineering, Vol. II, B.C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi
3. Environmental Engineering by Peavy, TMH Publishers.

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Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
CIVIL ENGINEERING (CE)

REFERENCS:

1. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Person Education.
2. Waste water treatment- concepts and design approach by G.L. Karia and R.A. Christian, Prentice Hall of India
3. Elements of environmental engineering by K.N. Duggal, S. Chand Publishers.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0122	Highway Engineering	3	0	0	3

Course Outcomes: After the completion of the course student should be able to
1. Understand the highway development and planning.
2. Understand the geometric design of highway.
3. Understand traffic studies and regulations.
4. Understanding the concept of intersections, interchanges.
5. Understanding the various pavement types and design.

UNIT-I
HIGHWAY DEVELOPMENT AND PLANNING: Highway development in India – Necessity for highway planning – Different Road development plans – Classification of roads – Road network patterns – Highway alignment – Factors affecting alignment – Engineering surveys – Drawings and reports.

UNIT-II
HIGHWAY GEOMETRIC DESIGN: Importance of geometric design – Design controls and criteria – Highway cross section elements – Sight distance elements – Stopping sight distance, Overtaking sight distance and intermediate sight distance – Design of horizontal alignment – Design of super elevation and extra widening – Design of transition curves – Design of vertical alignment – Gradients – Vertical curves.

UNIT-III
TRAFFIC ENGINEERING & REGULATIONS : Basic Parameters of Traffic-Volume, Speed and Density - Traffic Volume Studies - Data Collection and Presentation - Speed studies - Data Collection and Presentation - Parking Studies – On street & Off street Parking - Road Accidents - Causes and Preventive Measures - Accident Data Recording – Condition Diagram and Collision Diagrams - Traffic Signs – Types and Specifications – Road Markings - Need for Road Markings-Types of Road Markings - Design of Traffic Signals – Webster Method

UNIT-IV
INTERSECTION DESIGN: Conflicts at intersections – Channelisation: Objectives – Traffic islands and design criteria – Types of At grade intersections – Types of grade separated intersections – Rotary intersection – Concept of rotary and design criteria – Advantages and disadvantages of rotary intersection.

UNIT-V
PAVEMENT DESIGN: Types of pavements – Difference between flexible and rigid pavements – Pavement components – Sub grade, Sub base, Base and wearing course – Functions of pavement components – Design factors – Flexible pavement design methods – G.I method, CBR method, (as per IRC 37-2012) – Design of rigid pavements – Critical load positions – Westergaard's stress equations.\ (as per IRC 58-2002).

TEXT BOOKS:
1. Highway Engineering – S.K.Khanna & C.E.G.Justo, Nemchand & Bros., 7th edition (2000).
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna Publications – 6th Edition – 1997.

REFERENCES:
1. Principles of Traffic and Highway Engineering – Garber & Hoel, Cengage Learning.
2. Principles and Practices of Highway Engineering – Dr.L.R.Kadiyali and Dr.N.BLal - Khanna Publications.
3. Highway Engineering – S.P.Bindra , Dhanpat Rai & Sons. – 4th Edition (1981)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APC0124	Foundation Engineering	3	0	0	3

Course Outcomes: After the completion of the course student should be able to
1. Understand the principles and methods of Soil Exploration
2. Decide the suitability of soils and check the stability of slopes
3. Calculate lateral earth pressures and check the stability of retaining walls
4. Determine the bearing capacity of soil
5. Analyze and design the shallow and deep foundations

UNIT – I SOIL EXPLORATION:

Need – methods of soil exploration – boring and sampling methods – penetration tests – plate load test– planning of soil exploration programme, -preparation of soil investigation report.

UNIT – II SLOPE STABILITY:

Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish slip circle method, method of slices– Taylor's Stability Number.

UNIT – III EARTH PRESSURE THEORIES:

Active, Passive and at rest soil pressures Rankine's theory of earth pressure in cohesive and non-cohesive soils – Earth pressures in layered soils -Coulomb's earth pressure theory. Culmann's and Rebhann Graphical method for active case.
RETAINING WALLS: Types of retaining walls – stability of cantilever retaining walls.

UNIT – IV SHALLOW FOUNDATION

Types - choice of foundation – location and depth - safe bearing capacity – shear criteria – Terzaghi's method of bearing capacity- settlement criteria –plate load test – allowable settlements of structures.

UNIT - V 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 – negative skin friction

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt Ltd
3. Soil Mechanics and Foundation by by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
4 . Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors, Delhi.
5. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).

REFERENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors.
2. Principals of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers.
3. Geotechnical Engineering Principles and Practices by Cuduto, PHI International.
4. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi.

Year: III   **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APE0104	Design of Reinforced Concrete Structures	3	0	0	3

Course Outcomes: At the end of the course the student will able to
1. Understand the basic concepts of reinforced concrete analysis and design.
2. Understand the behaviour of beams.
3. Analyze and design of slabs and staircase
4. Analyze and design of columns
5. Analyze and design of footings

UNIT –I

Introduction: Concepts of RCC Design –Introduction to Working stress method - Limit State method – Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS: 456 – 2000.
Beams: Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections.

UNIT – II

Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.
Limit state design for serviceability for deflection, cracking and codal provision.

UNIT – III

Design of Two-way slabs and one way slab Using I S Coefficients.
Design of Stair case – Dog legged and Open well.

UNIT –IV

Short and Long columns –axial loads, uni-axial and biaxial bending I S Code provisions.

UNIT – V

Design of Footings – Design and drawing of isolated square footing, rectangular footing

NOTE : All the designs to be taught in Limit State Method
Following plates should be prepared by the students.
1. Reinforcement particulars of T-beams and L-beams.
2. Reinforcement detailing of continuous beams.
3. Reinforcement particulars of columns and footings.
4. Detailing of One way, two way and continuous slabs

TEXT BOOKS:
1. Building Material by S K Duggal – New Age International Publishers; Second Edition
2. Building Construction by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi
3. Building Materials by M.L.Gambhir, TMH Pubilishers.
4. A Textbook on Building Construction by S.K.Sharma, S.Chand Pubilishers.
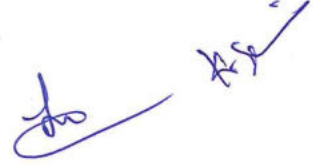
ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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CIVIL ENGINEERING (CE)

REFERENCES:

1. Building construction by W.B.Mckay, Vol.I, II, III & IV Pearson Publications, 2013 edition.
2. Building Construction by P.C. Varghese, Prentice-Hall of India private Ltd, New Delhi.
3. Building materials by P.C. Varghese, Prentice-Hall of India private Ltd, New Delhi
4. Building materials by S.C.Rangawala, Charotar Pubilishing House, Anand- INDIA.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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CIVIL ENGINEERING (CE)

Year: III **Semester: II**

Subject Code	Subject Name	L	T	P	Credits
20APE0105	**INTELLIGENT TRANSPORTATION SYSTEMS**	3	0	0	3

Course Outcomes: At the end of the course students will be able to

CO1: Understand the sensor technologies

CO2: Understand the communication techniques

CO3: Apply the various ITS methodologies

CO4: Understand the user needs

CO5: Define the significance of ITS under Indian conditions

UNIT - I

Introduction: Objectives- Advantages - Data Collection Techniques - Detectors – Automatic Vehicle Location - Automatic Vehicle Identification - Geographical Information Systems - Video Data Collection.

UNIT - II

Telecommunications in ITS: Importance of telecommunications in the ITS system - Information Management - Traffic Management Centers (TMC) - Vehicle–Road side communication – Vehicle Positioning System.

UNIT - III

ITS functional areas: Advanced Traffic Management Systems (ATMS) - Advanced Traveler Information Systems (ATIS) - Commercial Vehicle Operations (CVO) - Advanced Vehicle Control Systems (AVCS) - Advanced Public Transportation Systems (APTS) – Advanced Rural Transportation Systems (ARTS).

UNIT - IV

ITS User Needs and Services: Travel and Traffic management - Public Transportation Management - Electronic Payment - Commercial Vehicle Operations – Emergency Management - Advanced Vehicle safety systems - Information Management.

UNIT - V

Automated Highway Systems: Vehicles in Platoons – Integration of Automated Highway Systems - ITS Programs in the World – Overview of ITS implementations in developed countries - Case studies.

Text Books :

1. ITS Hand Book 2000: *Recommendations for World Road Association (PIARC),* Kan Paul Chen, John Miles.

2. Sussman, J. M., *Perspective on ITS*, Artech House Publishers, 2005.

3. *National ITS Architecture Documentation*, US Department of Transportation, 2007 (CDROM).

Reference Books :

1. Chowdhary, M.A. and A Sadek, *Fundamentals of Intelligent Transportation systems planning,* Artech House Inc., US, 2003.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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CIVIL ENGINEERING (CE)

Year: III   Semester: II

Subject Code	Subject Name	L	T	P	Credits
20APE0106	Remote Sensing and GIS	3	0	0	3

Course Outcomes: After the completion of the course student should be able to
1. Understand principles of aerial photography
2. Understand the concept of remote sensing
3. Understand the concept of GIS
4. Analyze the GIS spatial data
5. Apply the concepts of GIS in water resources

UNIT – I
INTRODUCTION TO PHOTOGRAMMETRY:
Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

UNIT – II
REMOTE SENSING :
Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. 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 – III
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 – IV
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 – V
WATER RESOURCES APPLICATIONS:
Land use/Land cover in water resources, Surface water mapping and inventory -Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

TEXT BOOKS:
1   Remote Sensing and GIS by B.Bhatta, Oxford University Press,New Delhi.
2   Fundamentals of remote sensing by Gorge Joseph , Universities press, Hyderabad