

Annamacharya Institute of Technology and Sciences, Tirupati
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)

CIVIL ENGINEERING (CE)

I B. Tech – I Semester

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

I B. Tech – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BSC	19ABS9901	Algebra and calculus	3	1	0	4	30	70	100
2	BSC	19ABS9903	Engineering Physics	3	0	0	3	30	70	100
3	ESC	19AES0501	Problem solving and programming	3	1	0	4	30	70	100
4	HSC	19AHS9901	Communicative English-I	2	0	0	2	30	70	100
PRACTICAL										
5	BSC	19ABS9908	Engineering Physics Lab	0	0	3	1.5	30	70	100
6	ESC	19AES0503	Problem solving and programming Lab	0	0	4	2	30	70	100
7	HSC	19AHS9902	Communicative English-I Lab	0	0	2	1	30	70	100
8	LC	19ALC0301	Engineering Workshop	0	0	2	1	30	70	100
Total							18.5	240	560	800

I B. Tech – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BSC	19ABS9906	Differential Equations and Vector Calculus	3	1	0	4	30	70	100
2	BSC	19ABS9905	Engineering Chemistry	3	0	0	3	30	70	100
3	ESC	19AES0202	Basics of Electrical and Electronics Engineering-I	3	0	0	3	30	70	100
4	ESC	19AES0502	Data Structures	3	0	0	3	30	70	100
PRACTICAL										
5	ESC	19AES0301	Engineering Graphics Lab	1	0	4	3	30	70	100
6	BSC	19ABS9910	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
7	ESC	19AES0204	Basics of Electrical and Electronics Engineering -I Lab	0	0	3	1.5	30	70	100
8	ESC	19AES0504	Data Structures Lab	0	0	3	1.5	30	70	100
9	LC	19ALC0101	Civil Engineering Workshop	0	0	2	1	30	70	100
Total							21.5	270	630	900

II B. Tech –I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BSC	19ABS9913	Probability & Statistics, PDE and Complex Variables	3	0	0	3	30	70	100
2	HSC	19AHS9903	Communicative English II	2	0	0	2	30	70	100
3	PCC	19APC0101	Mechanics of Materials	3	0	0	3	30	70	100
4	PCC	19APC0102	Surveying	4	0	0	4	30	70	100
5	PCC	19APC0103	Fluid Mechanics	3	0	0	3	30	70	100
6	PCC	19APC0104	Building Materials and Construction	2	0	0	2	30	70	100
7	MC	19AMC9901	Biology for Engineers	2	-	-	-	30	-	30
PRACTICAL										
8	HSC	19AHS9904	Communicative English Lab II	0	0	2	1	30	70	100
9	PCC	19APC0105	Strength of Materials Lab	0	0	3	1.5	30	70	100
10	PCC	19APC0106	Surveying Lab	0	0	4	2.0	30	70	100
TOTAL							21.5	300	630	930

II B. Tech – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BSC	19ABS9915	Transform Techniques and Numerical Methods	3	0	0	3	30	70	100
2	ESC	19AES0509	Basics of Python Programming	2	0	0	2	30	70	100
3	PCC	19APC0107	Strength of Materials	3	0	0	3	30	70	100
4	PCC	19APC0108	Hydraulic Engineering	3	0	0	3	30	70	100
5	PCC	19APC0109	Structural Analysis – I	3	0	0	3	30	70	100
6	PCC	19APC0110	Concrete Technology	3	0	0	3	30	70	100
7	MC	19AMC9903	Environmental Studies	2	-	-	-	30	-	30
PRACTICAL										
8	ESC	19AES0510	Basics of Python Programming Lab	0	0	2	1.0	30	70	100
9	PCC	19APC0111	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5	30	70	100
	PCC	19APC0112	Concrete Technology Lab	0	0	3	1.5	30	70	100
11	PRC	19APR0101	Socially Relevant Project (15 Hrs/Sem)	0	0	1	0.5	50	-	50
TOTAL							21.5	350	630	980

III B. Tech – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CI E	SE E	Tota l
THEORY										
1	PCC	19APC0113	Soil Mechanics	3	1	0	4	30	70	100
2	PCC	19APC0114	Design of Reinforced Concrete Structures	3	1	0	4	30	70	100
3	PCC	19APC0115	Engineering Geology	2	0	0	2	30	70	100
4	PCC	19APC0116	Structural Analysis –II	3	0	0	3	30	70	100
5	PEC		Professional Elective I	2	0	0	2	30	70	100
		19APE0101	Building Planning and bye-laws							
		19APE0102	Water Harvesting and Conservation							
		19APE0103	Cost Effective Housing Techniques							
		19APE0104	Green Buildings							
19APE0105	Photogrammetric Survey									
6	OEC		Open Elective I (Inter Disciplinary Elective I)	2	0	0	2	30	70	100
		19AOE0401	Sensor Networks							
		19APC0521	Artificial Intelligence							
		19APC0323	Operations Research							
7	MC	19AMC9904	Professional Ethics and Human values	2	-	-	-	30	-	30
PRACTICAL										
8	PCC	19APC0117	Soil Mechanics Lab	0	0	3	1.5	30	70	100
9	PCC	19APC0118	Computer-aided Civil Engineering Drawing Lab	0	0	3	1.5	30	70	100
10	PEC	19APC0119	Engineering Geology Lab	0	0	2	1	30	70	100
11	PRC	19APR0102	Socially Relevant Projects (15Hrs/Sem)	0	0	1	0.5	50	-	50
TOTAL							21.5	350	630	980

III B. Tech – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PCC	19APC0120	Foundation Engineering	3	0	0	3	30	70	100
2	PCC	19APC0121	Transportation Engineering	3	0	0	3	30	70	100
3	PCC	19APC0122	Remote Sensing and GIS	3	0	0	3	30	70	100
4	PEC		Professional Elective II	3	0	0	3	30	70	100
		19APE0106	Subsurface Investigation and Instrumentation							
		19APE0107	Prestressed Concrete							
		19APE0108	Advanced Structural Analysis							
		19APE0109	Railways, Airport, Docks & Harbor Engineering							
19APE0110	Finite Element Methods									
5	OEC		Open Elective II (Inter Disciplinary Elective II)	3	0	0	3	30	70	100
		19AOEMB01	Managerial Economics and Financial Analysis							
		19AOE0301	Management Science							
		19AOEMB02	Entrepreneurship Development							
6	HSC		Humanities Elective I	3	0	0	3	30	70	100
		19AOE9901	English for Research writing skills							
		19AHE9911	Environmental waste Management							
		19AHE9902	Principles of Effective Public Speaking							
7	MC	19AMC9902	Constitution of India	2				30		30
PRACTICAL										
8	PCC	19APC0123	Remote Sensing and GIS Lab	0	0	3	1.5	30	70	100
9	PCC	19APC0124	Transportation Engineering lab	0	0	3	1.5	30	70	100
10	PRC	19APR0104	Industrial Training/ Internship/Research Projects in National Laboratories/Academic Institutions *	0	0	0	0	-	-	-
11	PRC	19APR0103	Socially Relevant Projects (15 hrs / semester)	0	0	1	0.5	50	-	50
TOTAL							21.5	350	630	980

IV B. Tech – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CI E	SE E	Total
THEORY										
1	PCC	19APC0125	Estimation, Costing and Valuation	4	0	0	4	30	70	100
2	PCC	19APC0126	Design and Drawing of Steel Structures	2	0	0	2	30	70	100
3	PCC	19APC0127	Environmental Engineering	3	0	0	3	30	70	100
4	PCC	19APC0128	Water Resources Engineering -II	2	0	0	2	30	70	100
5	PEC		Professional Elective III	2	0	0	2	30	70	100
		19APE0111	Ground Improvement Techniques							
		19APE0112	Watershed and River Basin Management							
		19APE0113	Engineering Materials for Sustainability							
		19APE0114	Environmental Impact Assessment							
		19APE0115	Bridge Engineering							
6	PEC		Professional Elective IV	2	0	0	2	30	70	100
		19APE0116	Repairs and Rehabilitation of Structures							
		19APE0117	Intelligent transportation systems							
		19APE0118	Hydro Power Engineering							
		19APE0119	Industrial Waste & Waste-Water Engineering							
		19APE0120	Infrastructure Planning and Management							
PRACTICAL										
7	PCC	19APC0129	Structural Design and Drawing Lab	0	0	3	1.5	30	70	100
8	PCC	19APC0130	Environmental Engineering Lab	0	0	2	1			100
9	PRC	19APR0105	Socially Relevant Projects (15 hrs / semester)	0	0	1	0.5	50	-	50
10	PRC	19APR0106	Survey Camp/ Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	0	0	2	1	50	-	50
TOTAL							19.0	310	490	800

IV B. Tech – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	OEC		Open Elective III (MOOC)	3	0	0	3			
		19AOE0303	Optimization Techniques							
		19AES0505	Internet of Things							
		19AOEMB03	Intellectual Property Rights							
2	PEC		Professional Elective V	3	1	0	3			
		19APE0121	Structural Health Monitoring							
		19APE0122	Elements of Earth Quake Engineering							
		19APE0123	Advanced Structural Design							
		19APE0124	Civil Infrastructure for Smart City Development							
		19APE0125	Building Information Modeling							
3	PRC	19APR0107	Technical Seminar	0	0	0	0	50	0	50
4	PRC	19APR0108	Project II	0	0	14	9	60	140	200
TOTAL							15	110	140	250

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Year : I

Semester : I

Branch of Study : Common to all

Subject Code:19ABS9901	Subject Name: Algebra & Calculus	L T P 3 0 0	Credits:3
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Course Outcomes:

1. Develop the use of matrix algebra techniques that is needed by engineers for practical applications
2. Utilize mean value theorems to real life problems
3. Familiarize with functions of several variables which is useful in optimization
4. Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems
5. Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

Unit I : Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Unit II : Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

Unit III: Multivariable calculus

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit IV: Double Integrals

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.

Unit V: Multiple Integrals and Special Functions

Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. Dr.T.K.V Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N Prasad, Mathematics – 1, S.Chand publications.

2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO 2	PO1:Apply the knowledge of mathematics	1.1	1.1.1
CO 3	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO 4	Po2 : analyse complex engineering problems	2.1	2.1.3
CO 5	Po2 : analyse complex engineering problems	2.1	2.1.3

Year : I

Semester : I

Branch of Study : ME & CE

Subject Code:19ABS9903	Subject Name: Engineering Physics	L T P 3 0 0	Credits:3
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Course Outcomes:

1. Explain physics applied to solve engineering problems
2. Apply the principles of acoustics in designing of buildings
3. Explains the applications of ultrasonics in various engineering fields
4. Apply electromagnetic wave propagation in different Optical Fibers and the concepts of lasers in various applications.
5. Explains the concepts of dielectric and magnetic materials and Identify the sensors for various engineering applications

Unit I : Mechanics

Basic laws of vectors and scalars – rotational frames-conservative forces- $F=-\text{grad}V$, torque and angular momentum-Newton's laws in inertial and linear accelerating non-inertial frames of reference-rotating frame of reference with constant angular velocity-qualitative explanation of Foucault's pendulum-rigid body-angular velocity vector-center of mass-gravitation and Kepler's Law (Qualitative).

Unit II : Crystallography And Ultrasonics

Crystallography – Introduction – Space Lattice – Unit Cell – Lattice Parameters – Bravais Lattice – Crystal Systems – Packing Fractions of SC, BCC and FCC. X-Ray Diffraction – Bragg's Law – Powder Method.

Ultrasonics-Introduction, Properties and Production by magnetostriction & piezoelectric methods - acoustic grating-Non Destructive Testing-pulse echo system through transmission and reflection modes-A,B and C-scan displays, Medical applications.

Unit III: Dielectric and Magnetic Materials

Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations: Electronic , Ionic, Orientation Polarizations (Qualitative)-Frequency dependence of polarization-Lorentz (internal) field-Clausius-Mosottiequation-Applications of Dielectrics. Introduction-Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of Magnetic materials-Domain Concepts of ferromagnetism – Hysteresis – soft and hard magnetic materials-Magnetic device applications.

Unit IV: Lasers and Fiber Optics

Introduction-Characteristics of Laser – Spontaneous and Stimulated emission of radiation-Einstein's coefficients-Population inversion-Pumping Mechanisms -He- Ne laser, Nd-YAG laser-Semiconductor laser-Applications of laser.

Introduction to Optical Fibers – Total Internal Reflection-Construction of optical fibers, Critical angle of propagation – Acceptance angle – Numerical Aperture-Classification of fibers based on Refractive index profile & modes – Propagation of electromagnetic wave through optical fiber-importance of V number-Block Diagram of Fiber optic Communication system-Medical Applications.

Unit V: Nanomaterials

Introduction – Significance of nanoscale and types of nanomaterials – Physical properties, optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches, ball mill, chemical vapour deposition and sol-gel – Applications of nanomaterials.

Textbooks:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy”. A Text book of Engineering Physics”-S.Chand Publications, 11th Edition 2019
2. Shatendra Sharma, Jyotsna Sharma, “ Engineering Physics”, Pearson Education, 2018

References:

1. K.Thyagarajan “Engineering Physics”, -Mc Graw Hill Publishing Company Ltd, 2016
2. MKVarma “Introduction to Mechanics”-Universities Press-2015.
3. D.K. Bhattacharya and A.Bhaskaran, “Engineering Physics”-Oxford Publications-2015
4. Ian R Sinclair, Sensor and Transducers, 3rd eds, 2001, Elsevier (Newnes)

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

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Year : I

Semester : I

Branch of Study : Common to All

Subject Code:19AES0501	Subject Name: Problem Solving and Programming	L 3	T 1	P 0	Credits: 3
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Course outcomes: Student should be able to

1. Create interactive visual programs using Scratch.
2. Develop flowcharts using raptor to solve the given problems.
3. Develop Python programs for numerical and text based problems
4. Develop graphics and event based programming using Python
5. Develop Python programs using beautiful Pythonic idiomatic practices

Unit – 1: Visual Programming through Scratch and App Inventor

Introduction to programming concepts with scratch, Scratch environment, sprites looks and motion, Angles and directions, repetition and variation, changing costumes, adding background, Input/Output, variables and operators. Working with sounds and sprite communication and creating stories, App Generation.

Unit – 2: Flowchart design through Raptor

Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems(section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems(section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

Unit – 3 : Introduction to Python

Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/Output statements, Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

Unit – 4 : Data Structures and Idiomatic Programming in Python

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

Unit – 5 : Event driven Programming

Turtle Bar Chart, Event Driven programming. Key press events, Mouse events, timer events.

Text Book:

<https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf>

<https://nostarch.com/scratchplayground>

<http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce-e3aa315888a1/scratchreferenceguide14.pdf>

<https://raptor.martincarlisle.com/>

<http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>

https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf

<http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO3: Design/Development of Solutions	3.1	3.1.4
CO2	PO3: Design/Development of Solutions	3.1	3.1.4
CO3	PO2: Problem analysis	2.2	2.2.2
CO4	PO2: Problem analysis	2.2	2.2.2
	PO3: Design/Development of Solutions	3.1	3.1.4
CO5	PO3: Design/Development of Solutions	3.1	3.1.4

Year : I

Semester : I

Branch of Study : Common to All

Subject Code: 19AHS9901	Subject Name: Communicative English I	L T P 2 0 0	Credits:2
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- 1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English**
- 2. Formulate sentences using proper grammatical structures and correct word forms**
- 3. Speak clearly on a specific topic using suitable discourse markers in informal discussions.**
- 4. Write summaries based on global comprehension of reading / listening texts.**
- 5. Produce a coherent paragraph interpreting a figure/graph/chart/table.**

Unit 1 : Technology With a Human Face - Schumacher

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests;

introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Unit 2: I have three vision for India: Presidential Speech by Abdul Kalam

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Unit 3: The Gold Frame by RK. Laxman

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Unit 4: To be, or not to be by William Shakespeare

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends / patterns/relationships, communicate processes or display complicated data.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms.

Unit 5: The Accompanist by Anitha Desai

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension.

Writing: Writing structured essays on specific topics using suitable claims and evidences

Grammar and Vocabulary: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO6: Engineer and Society	6.1	6.1.1
CO 2	PO10: Communication	10.1	10.1.1
CO 3	PO9: Individual and Teamwork	9.2	9.2.1
CO 4	PO10: Communication	10.1	10.1.1
CO 5	PO10: Communication	10.3	10.3.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year : I Semester : I Branch of Study : Common to ME & CE

Subject Code:19ABS9908	Subject Name: Engineering Physics Lab	L T P 0 0 3	Credits:1.5
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Course Outcomes:

1. Operate various optical instruments and Estimate wavelength of laser and particles size using laser
2. Estimate the susceptibility and related magnetic parameters of magnetic materials and plot the intensity of the magnetic field of circular coil carrying current with distance
3. Evaluate the acceptance angle of an optical fiber and numerical aperture and determine magnetic susceptibility of the material and its losses by B-H curve
4. Identify the type of semiconductor i.e., n-type or p-type using Hall effect
5. Apply the concepts of sensors for various applications

List of Experiments

1. Determination of wavelength of LASER light using diffraction grating.
2. Determination of particle size using LASER.
3. Determination of spring constant of springs using Coupled Oscillator.
4. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
5. Determination of Dielectric constant of dielectric material using charging and discharging of capacitor.
6. Magnetic field along the axis of a circular coil carrying current.
7. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
8. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
9. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
10. Measurement of magnetic susceptibility by Gouy's method
11. Determination of ultrasonic velocity in liquid (Acoustic grating)
12. Determination of pressure variation using Strain Guage sensor
13. Determination of temperature change using Strain Guage sensor.
14. Determination of pressure variations using optical fiber sensors.
15. Determination of temperature changes using optical fiber sensors.

References:

1. S. Balasubramanian, M.N.Srinivasan, "A Text book of Practical Physics"-S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php-VirtualLabs>, Amrita University.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 4: Conduct Investigations of complex problems	4.3	4.3.3
CO 2	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 3	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 4	PO 4: Conduct Investigations of complex problems	4.3	4.3.2
CO 5	PO 4: Conduct Investigations of complex problems	4.3	4.3.2

Year : I

Semester : I

Branch of Study : Common to All

Subject Code: 19AES0503	Subject Name: Problem Solving and Programming Lab	L T P 0 0 3	Credits: 1.5
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Course outcomes: Student should be able to

1. Create interactive visual programs using Scratch.
 2. Develop flowcharts using raptor to solve the given problems.
 3. Develop Python programs for numerical and text based problems
 4. Develop graphics and event based programming using Python
 5. Develop Python programs using beautiful Pythonic idiomatic practices
-
1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
 2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
 3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3 matrix.
 4. Construct flowcharts to
 - a. calculate the maximum, minimum and average of N numbers
 - b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
 5. Construct flowcharts with separate procedures to
 - a. calculate simple and compound interest for various parameters specified by the user
 - b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
 6. Construct flowcharts with procedures to
 - a. generate first N numbers in the Fibonacci series
 - b. generate N Prime numbers
 7. Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive)
 8. Design a flowchart to perform Binary search on list of N sorted numbers(Iterative and recursive)
 9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
 10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
 11. Design a Python script to determine if a given string is a Palindrome using recursion
 12. Design a Python script to sort numbers specified in a text file using lists.
 13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format($0 \leq YYYY \leq 9999$, $1 \leq MM \leq 12$, $1 \leq DD \leq 31$) following the leap year rules.
 14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
 15. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.($0 \leq HH \leq 23$, $0 \leq MM \leq 59$, $0 \leq SS \leq 59$)
 16. Design a Python Script to find the value of (Sine, Cosine, Log, PI, e) of a given number using infinite series of the function.

17. Design a Python Script to convert a given number to words
18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports(Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.

Text Book:

<http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO3: Design/Development of Solutions	3.1	3.1.4
CO2	PO3: Design/Development of Solutions	3.1	3.1.4
CO3	PO2: Problem analysis	2.2	2.2.2
CO4	PO2: Problem analysis PO3: Design/Development of Solutions	2.2 3.1	2.2.2 3.1.4
CO5	PO3: Design/Development of Solutions	3.1	3.1.4

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year I

Semester I

Branch of Study: Common to All

Subject Code 19AHS9902	Subject Name Communicative English I Lab	L T P 0 0 3	Credits:1.5
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Course Outcomes:

CO1. Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit acceptable etiquette essential in social and professional settings.

CO5: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

Unit 2

1. JAM
2. Small talks on general topics
3. Debates

Unit 3

1. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

Unit4

1. Asking for Information and Giving Directions
2. Information Transfer
3. Non-verbal Communication – Dumb Charade

Unit 5

1. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

List of COs	PO No. and keyword	Competency	Performance Indicator
CO 1	PO10: Communication	10.2	10.1.1
CO 2	PO10: Communication	10.3	10.3.1
CO 3	PO10: Communication	10.2	10.2.1
CO 4	PO 9: Individual & Team Work	9.2	9.2.1
CO 5	PO10: Communication	10.2	10.2.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

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

Subject Code	Subject Name	L	T	P	Credits
19ALC0301	Basic Engineering Workshop	0	0	3	1.5

Course Outcomes:

- CO: 1 Apply wood working skills in real world applications.
- CO: 2 Build different parts with metal sheets in real world applications.
- CO: 3 Apply fitting operations in various applications.
- CO: 4 Apply different types of basic electric circuit connections.
- CO: 5 Demonstrate soldering and brazing.

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint
- b) Mortise and Tenon joint
- c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit b) Dovetail fit
- c) Semi-circular fit d) Bicycle tyre puncture and change of two wheeler tyre

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series b) Two way switch c) Godown lighting
- d) Tube light e) Three phase motor f) Soldering of wires

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 2: Problem analysis	2.3	2.3.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year : I B.Tech

Semester: II Sem

Branch of Study: ME & CE

Subject Code 19ABS9906	Subject Name: Differential Equations and Vector Calculus	L 3	T 0	P 0	Credits: 3
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Course Outcomes:

1. Apply the mathematical concepts of ordinary differential equations of higher order.
2. solve the differential equations related to various engineering fields .
3. Identify solution methods for partial differential equations that model physical processes .
4. interpret the physical meaning of different operators such as gradient, curl and divergence .
5. estimate the work done against a field, circulation and flux using vector calculus .

UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT II: Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems

UNIT III: Partial Differential Equations – First order

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT IV: Multivariable Calculus (Vector differentiation)

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities

UNIT V: Multivariable Calculus (Vector integration)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Text Books and Reference Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.

References:

1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmi publication,2008

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering Knowledge	1.1	1.1.1
CO 2	PO2: Problem Analysis	2.1	2.1.3
CO 3	PO1: Engineering Knowledge	1.1	1.1.1
CO 4	PO1: Engineering Knowledge	1.1	1.1.1
CO 5	PO2: Problem Analysis	2.1	2.1.3

Annamacharya Institute of Technology and Sciences::Tirupati

Year : I

Semester : II

Branch of Study : ME & CE

Subject Code:19ABS9905	Subject Name: Engineering chemistry	L T P 3 0 0	Credits:3
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Course Outcomes:

1. Differentiate between hard water and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially
2. Understand the electrochemical sources of energy
3. Demonstrate the corrosion prevention methods and factors affecting corrosion
4. Explain the preparation, properties, and applications of thermoplastics & thermosettings, elastomers & conducting polymers.
5. Explain calorific values, octane number, refining of petroleum and cracking of oils
6. Explain the manufacturing of portland cement and concrete formation
7. Summarize the application of SEM, TEM and X-ray diffraction in surface characterization
8. Explain the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures

Unit 1: Water Technology

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Unit 2: Electrochemistry and Applications:

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, environmental factors (pH, temperature, DO) affecting corrosion rate, Pourbaix diagrams for iron and aluminium, protection – corrosion inhibitors with specific examples, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Unit 3: Polymers and Fuel Chemistry:

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Thermoplastics and Thermo-sets, Elastomers – applications with specific examples.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, refining of petroleum, liquid fuels, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

Unit 4: Cement and Concrete Chemistry:

Introduction to building materials – Portland cement, constituents, manufacturing process-raw materials for manufacturing process, reactions below 1300 °C and reactions between 1300 and 1450 °C, reactions during cooling, grinding or storage, chemical equations, phases of cement clinker (alite, belite, aluminate and ferrite), reactivity of clinker phases, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ration (AR), chemistry of setting and hardening of cement (hydration, hydrolysis, equations), scheme of concrete formation, admixtures for concrete improvement – retarders, accelerators, air-entraining agents, grinding agents, super plasticizers, dispersants, etc.

Unit 5: Surface Chemistry and Applications:

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, characterization of surface by physicochemical methods (SEM, TEM, X-ray diffraction), solid-gas interface, solid-liquid interface, adsorption isotherm, BET equation (no derivation), calculation of specific surface area of solids, numerical problems, functionalization of surface of nanomaterials– applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Text books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heinemann, 1992.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1:Engineering knowledge	1.2	1.2.1
CO 2	PO1:Engineering knowledge	1.4	1.4.1
CO 3	PO1:Engineering knowledge	1.2	1.2.1
CO 4	PO1:Engineering knowledge	1.2	1.2.1
CO 5	PO2: Problem Analysis	2.4	2.4.4
CO 6	PO1:Engineering knowledge	1.4	1.4.1
CO 7	PO2: Problem Analysis	2.4	2.4.4
CO 8	PO2: Problem Analysis	2.4	2.4.4

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

Year: I

Semester: II

Branch of Study: CE,ME & CSE

Subject Code	Subject Name	L	T	P	Credits
19AES0202	Basics of Electrical & Electronics Engineering-I	3	0	0	3

Course Outcomes: Students should be able to

CO 1: Apply concepts of KVL/KCL in solving DC circuits

CO 2: Illustrate working principles of induction motor - DC Motor

CO 3: Identify type of electrical machine based on their operation

CO 4: Describe operation and characteristics of diodes and transistors.

CO 5: Make use of diodes and transistors in simple, typical circuit applications.

CO 6: Understand operation of basic op-amp circuits.

PART-A (Electrical Engineering)

UNIT-I: DC & AC Circuits:

Electrical circuit elements (R - L and C) - Kirchoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

UNIT-II: DC & AC Machines:

Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator - principle and operation of DC Motor - Performance Characteristics of DC Motor - Speed control of DC Motor - Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only]

UNIT-III: Basics of Power Systems:

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations - Typical AC Power Supply scheme - Elements of Transmission line - Types of Distribution systems: Primary & Secondary distribution systems.

Text Books:

1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" - S.Chand - 2018.

References:

1. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
3. C.L. Wadhwa - "Generation Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International Publications.

PART-B (Electronics Engineering)

UNIT-I: Analog Electronics

Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED.

BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications

Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

UNIT II: Digital Electronics

Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems, combinational circuits - adders, multiplexers, decoders; introduction to sequential circuits, flip flops, shift register, binary counter

UNIT III: Communication Systems

Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).

Text Books:

1. D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited
2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

References:

1. R. Muthu subramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education, Reprint 2012.
2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th edition. 2008.

Note: This table also should be in portrait only

CO	PO	CI	PI
CO1	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO2	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO3	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO4	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO5	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO6	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

Year : I

Semester : II

Branch of Study : Common to All

19AES0502	Data Structures	L 3	T 1	P 0	Credits: 3
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Course Outcomes:

1. Understand the importance of AI and concepts of Machine Learning algorithms and their limitations.
2. Develop Chatbots based on the requirements.
3. Analyse complex problems involving image processing, such as quality control, visual surveillance, multimodal human-machine interfaces, and image compression.
4. Understand the application of Reinforcement Learning
5. Understand smart solutions for various domains

Unit I: Introduction to Artificial Intelligence

Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning Conceptual introduction to **Machine Learning**: Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, Deep Learning, Reinforcement Learning, Linear Regression. Conceptual introduction to **Natural Language Processing**: Natural language Understanding, Sentiment Analysis, Segmentation and recognition. Conceptual introduction to **Speech Recognition & Synthesis**: Speech Fundamentals, Speech Analysis, Speech Modeling, Speech Recognition, Speech Synthesis, Text-to-Speech Conceptual introduction to **Image Processing & Computer Vision**: Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Segmentation, Edge Detection, Optical Character Recognition, Feature Detection & Recognition

Unit II: BOT Technologies and Virtual Assistants:

Chatbots: Introduction to a Chatbot, Architecture of a Chatbot. NLP in the cloud, NL Interface, How to Build a Chatbot, Transformative user experience of chatbots, Designing elements of a chatbot, Best practices for chatbot development. NLP components. NLP wrapper to chatbots. Audiobots and Musicbots.

Virtual Assistants: Architecture of a Virtual Assistant.

Unit III: Image Processing & Computer Vision :

Image - Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Face recognition, Instance recognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications -- Feature extraction, Shape identification. Face detection,.

Applications: Automation, Agriculture[Crop and Soil Monitoring, Grading farm produce, Predictive Analytics], Retail and Retail Security[Amazon Go], Autonomous vehicles,

Unit IV: Reinforcement Learning

Introduction to Reinforcement Learning, Game Playing [Deep Blue in Chess, IBM Watson in Jeopardy, Google's DeepMind in AlphaGo], Agents and Environment, Action-Value Function, Deep Reinforced Learning

Applications : Robotics, Gaming, Diagnostic systems, Virtual Assistants

Unit V: Smart Applications

Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities.

Textbooks:

1. Tom Markiewicz & Josh Zheng, Getting started with Artificial Intelligence, Published by O'Reilly Media, 2017
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach

Reference Books:

1. Aurélien Géron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017
2. Build an AI Assistant with Wolfram Alpha and Wikipedia in Python. <https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe>
3. Tom Markiewicz & Josh Zheng, Getting started with Artificial Intelligence, Published by O'Reilly Media, 2017

Map POs with CIs and PIs:

Course Outcome	PO no and Keyword	Competency Indicator	Performance Indicator
CO1	PO1:Apply	1.1 1.4	1.1.1 1.1.2 1.1.4
CO2	PO1:Apply	1.1 1.4	1.1.1 1.1.2 1.1.4
CO3	PO2:Formulate	2.1	2.1.1 2.1.2 2.1.3
CO4	PO4:Research-based Knowledge	4.1	4.1.1 4.1.2 4.1.3
CO5	PO5:Create & Apply	5.1 5.3	5.1.1 5.1.2 5.3.1 5.3.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: I

Semester: II

Branch of Study: Common to all Braches

Subject Code	Subject Name	L	T	P	Credits
19AES0301	Engineering Graphics and Design	1	0	3	2.5

Course Outcomes:

Students should be able to

1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyse the Algorithms (L4)
5. Develop Algorithm for Sorting large files of data (L3)

Unit-1:Introduction

Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, How fast can we sort, Merge sort, Heap sort

Unit – 2: Stack, Queue and Linked lists

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

Unit – 3 :Trees

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B-Trees: BTrees, B + Trees.

Unit – 4 : Graphs and Hashing

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

Unit – 5: Files and Advanced sorting

File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization. Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed “Fundamentals of Data Structures in C”, 2nd Edition, University Press, 2007.
2. Alan L. Tharp, “File Organization and Processing”, Wiley and Sons, 1988.

Reference Books:

1. D. Samanta, “Classic Data Structures”, 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Peter Bras, “Advanced Data Structures”, Cambridge University Press, 2016
3. Richard F.Gilberg, Behrouz A.Forouzan, “Data Structures A Pseudo code Approach with C”, Second Edition, Cengage Learning 2005.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 5: Problem analysis	5.1	5.1.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year I

Semester II

Branch of Study: ME & CE

Subject Code 19ABS9910	Subject Name ENGINEERING CHEMISTRY LAB	L T P 0 0 3	Credits:1.5
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Course Outcomes:

1. Determine the cell constant and conductance of solutions
2. Prepare advanced polymer materials
- 3 Determine the physical properties like surface tension, adsorption and viscosity
4. Estimate the Iron and Calcium in cement
5. Calculate the hardness of water

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of viscosity of polymer solution using survismeter
8. Determination of percentage of Iron in Cement sample by colorimetry
9. Estimation of Calcium in port land Cement
10. Preparation of nanomaterials
11. Adsorption of acetic acid by charcoal
12. Determination of percentage Moisture content in a coal sample

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 4: Conduct Investigations of complex problems	4.3	4.3.3
CO 2	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 3	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 4	PO 4: Conduct Investigations of complex problems	4.3	4.3.2
CO 5	PO 4: Conduct Investigations of complex problems	4.3	4.3.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: I

Semester: II

Branch of Study: CE,ME &CSE

Subject Code	Subject Name	L	T	P	Credits
19AES0204	Basics of Electrical & Electronics Engineering Lab – I	0	0	3	1.5

Course Objectives: Students should be able to

CO1: Verify Kirchoff's Laws & Superposition theorem for dc supply

CO2: Analyze the performance of AC and DC Machines by testing.

CO3: Study I – V Characteristics of PV Cell & Perform speed control of dc shunt motor

CO4: Ability to operate diodes for finding V-I Characteristics.

CO5: Ability to construct and operate rectifiers without & with filters

CO6: Ability to construct and operate BJT & FET Characteristics.

List of Experiments:

PART-A

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Open circuit characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Brake test on 3 - Phase Induction Motor.
7. Brake test on DC Shunt Motor

PART-B

1. PN Junction Diode Characteristics.
2. Zener Diode Characteristics.
3. Rectifiers (With and Without Filter).
4. BJT Characteristics (CB Configuration).
5. BJT Characteristics (CE Configuration).
6. FET Characteristics (CS Configuration).

Table: Course Outcomes (CO), Programme Outcomes (PO), Competency Indicator (CI) and Performance Indicator (PI) Mapping

CO	PO	CI	PI
CO1	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO2	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO3	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO4	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO5	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year I

Semester II

Branch of Study: Common to All

19AES0504	Data Structures Lab	L 2	T 1	P 0	Credits: 3
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Course Outcomes:

6. Understand the importance of AI and concepts of Machine Learning algorithms and their limitations.
7. Develop Chatbots based on the requirements.
8. Analyse complex problems involving image processing, such as quality control, visual surveillance, multimodal human-machine interfaces, and image compression.

Experiments:

1. Supervisely - Perform Data Labelling for various images using object recognition

Experiment Outcomes:

- Understand supervised learning for various datasets of images using Pattern Recognition.

2. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons

Experiment Outcomes:

- Manage image databases using detection tools for classification.
- Build different applications using Image Processing & Computer Vision.

3. Teachable Machine - In Browser Object Recognition through Brain.JS

Experiment Outcomes:

- Understand Image Recognition through Brain.JS

4. Liv.ai - App for Speech recognition and Synthesis through APIs

Experiment Outcomes:

- Summarize applications of Speech Recognition and Synthesis.

5. Building a Chatbot using AWS Lex, Pandora bots

Experiment Outcomes:

- Develop bots, chatbots, audiobots, music bots

6. Configure an existing Neural Network by manipulating various parameters involved

Experiment Outcomes:

- Understand different Neural Networks by various parameters.

7. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

Experiment Outcomes:

- Build an AI Assistant with Wolfram Alpha and Wikipedia in Python

8. Build a Convolutional Neural Network for Cat vs Dog Image Classification

Experiment Outcomes:

- Build CNN for different images Classification

References :

Pytorch:

<https://pytorch.org/>

<https://github.com/pytorch>

Keras:

<https://keras.io/>

<https://github.com/keras-team>

Theano:

<http://deeplearning.net/software/theano/>

<https://github.com/Theano/Theano>

Cafee2:

<https://caffe2.ai/>

<https://github.com/caffe2>

Deeplearning4j:

<https://deeplearning4j.org/>

Scikit-learn:<https://scikit-learn.org/stable/>

<https://github.com/scikit-learn/scikit-learn>

Deep Learning.Ai:

<https://www.deeplearning.ai/>

OpenCv:

<https://opencv.org/>

<https://github.com/qqwweee/keras-yolo3>

YOLO:

<https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/>

nVIDIA: CUDA

<https://developer.nvidia.com/cuda-math-library>

Map POs with CIs and PIs:

Course Outcome	PO no and Keyword	Competency Indicator	Performance Indicator
CO1	PO1:Apply	1.1	1.1.1
		1.4	1.1.2 1.1.4
CO2	PO3:Design/Develop	3.1	3.1.1 3.1.2 3.1.3 3.1.4 3.1.5
		3.4	3.4.1 3.4.2 3.4.3
		5.1	5.1.1
		5.3	5.1.2 5.3.1 5.3.2
		4.1	4.1.1 4.1.2 4.1.3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: I

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19ALC0101	Civil Engineering Workshop	0	0	3	1.5

Course outcomes:

CO1: Able to determine Setting out of a building

CO2: Understand the concept of Construct a wall of height 50 cm

CO3: Determine the Computation of Centre of gravity and Moment of inertia

CO4: Determine the Plastering and Finishing of wall

CO5: Examine the Casting and testing of Fly ash Blocks

LABORATORY EXPERIMENTS

- 1) Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.
- 2) Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
- 3) Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.
- 4) Installation of plumbing and fixtures like Tap, T-Joint, Elbow, Bend, Threading etc;
- 5) Plastering and Finishing of wall
- 6) Application of wall putty and painting a wall
- 7) Preparation of cement Fly ash Blocks and testing for compressive strength

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO2	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO3	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO4	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1
CO5	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
	PO2: Problem analysis	2.2	2.2.1
		2.3	2.3.1

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES :: TIRUPATI
AUTONOMOUS
AK 19 Regulations**

Year : II B.Tech

Semester: I

Branch of Study: CE and ME

SubjectCode:19ABS9913	Subject Name: Probability & Statistics, PDE, Complex Variables	L	T	P	Credits
		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.

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	PO 2: First principles of mathematics.	2.1	2.1.3
CO5	PO 2: First principles of mathematics	2.4	2.4.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

(AUTONOMOUS)

AK 19 Regulations

B. Tech II Year

Semester : I

Branch : Common to all

Subject Code: 19AHS9903	Subject Name: Communicative English II	L T P 2 0 0	Credits:2
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Course Outcomes

At the end of the course, the learners will be able to

1. Prioritize information from reading texts after selecting relevant and useful points
2. Paraphrase short academic texts using suitable strategies and conventions
3. Make formal structured presentations on academic topics using PPT slides with relevant graphical elements
4. Participate in group discussions using appropriate conventions and language strategies
5. Prepare a CV with a cover letter to seek internship/ job
6. Collaborate with a partner to make presentations and Project Reports

Syllabus

Unit 1

(10 hrs)

Listening : Listening for presentation strategies and answering questions on the speaker, audience, and key points.

Speaking: Formal presentations using PPT slides without graphic elements.

Reading: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style.

Writing: Paraphrasing; using quotations in writing; using academic style - avoiding colloquial words and phrases.

Grammar and Vocabulary: Formal/academic words and phrases.

Unit 2

(10 hrs)

Listening: Following an argument/ logical flow of thought; answering questions on key concepts after listening to extended passages of spoken academic discourse.

Speaking: Formal presentations using PPT slides with graphic elements.

Reading: Understand formal and informal styles; recognize the difference between facts and opinions.

Writing: Formal letter writing and e-mail writing (enquiry, complaints, seeking permission, seeking internship); structure, conventions and etiquette.

Grammar and Vocabulary: Phrasal prepositions; phrasal verbs.

Unit 3

10(hrs)

Listening: Identifying views and opinions expressed by different speakers while listening to discussions.

Speaking: Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.

Reading: Identifying claims, evidences, views, opinions and stance/ position.

Writing: Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.

Grammar and Vocabulary: Language for different functions such as stating a point, expressing opinion, agreeing/disagreeing, adding information to what someone has stated, and asking for clarification.

Unit 4:

(8 hrs)

Listening: Understanding inferences; processing of information using specific context clues from the text.

Speaking: Group discussion; reaching consensus in group work (academic context).

Reading: Reading for inferential comprehension.

Writing: Applying for internship/ job - Writing one's CV/Resume and cover letter.

Grammar and Vocabulary: Active and passive voice – use of passive verbs in academic writing.

Unit 5:

(8hrs)

Listening: Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.

Speaking: Formal team presentations on academic/ general topics using PPT slides.

Reading for Writing: Structure and contents of a Project Report; identifying sections in project reports; understanding the purpose of each section; significance of references.

Grammar and Vocabulary: Reinforcing learning; editing short texts; correcting common errors in grammar and usage.

***Course Materials would be compiled and provided to learners and teachers**

ReferenceBooks

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. Sample Web Resources
Grammar/Listening/Writing 1-language.com <http://www.5minuteenglish.com/>
<https://www.englishpractice.com/>

Grammar/Vocabulary

English Language Learning Online, <http://www.bbc.co.uk/learningenglish/>, <http://www.better-english.com/>, <http://www.nonstopenglish.com/>, <https://www.vocabulary.com/>, BBC Vocabulary Games, Free Rice Vocabulary Game

Reading

<https://www.usingenglish.com/comprehension/>, <https://www.englishclub.com/reading/short-stories.htm>, <https://www.english-online.at/>

Listening

<https://learningenglish.voanews.com/z/3613>, <http://www.englishmedialab.com/listening.html>

Speaking

<https://www.talkenglish.com/>, BBC Learning English – Pronunciation tips, Merriam-Webster – Perfect pronunciation Exercises

All Skills

<https://www.englishclub.com/>, <http://www.world-english.org/>,

<http://learnenglish.britishcouncil.org/>, Online Dictionaries, Cambridge dictionary online, MacMillan dictionary, Oxford learner's dictionaries

References:

1. www.pointblank7.in> News & Politics> Features dt. 15.05.2019
2. Learning English a Communication Approach by Orient Longman Pvt Ltd. Hyderabad , 2005.

List of COs	PO no. and keyword	Competency Indicator:	Performance Indicator:
CO1.	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO2	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2
CO3.	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.2
CO4.	PO9-Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2	9.2.1 9.2.2 9.2.3
CO5.	PO10-Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2
CO6.	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: I

Branch of Study - CE

Subject Code	Subject Name	L	T	P	Credits
19APC0101	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 moduli

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 hanging 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.

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 & SCIENCES: TIRUPATI

Year: II

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0103	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, boiling point.

UNIT – II:

Fluid statics: Fluid Pressure: Pressure at a point, Pascal's law, and pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. Pressure gauges, Hydrostatic pressure and 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 & SCIENCES: TIRUPATI

Year: II

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0104	Building Materials & Construction	2	0	0	2

Course Outcomes:

1. To understand the basics conventional construction materials, properties and their uses
2. To know the modern building materials, properties and their uses
3. To understand the different metals and metal alloys used in construction
4. To understand the construction techniques such as masonry, plastering and formwork
5. To know the various building components and building finishes used in construction

UNIT – I

Basic Building Materials: Properties and characteristics of Basic building materials – **Stone:** characteristics of good building stone-specific uses of stones- **Bricks:** characteristics of good quality bricks manufacturing of bricks- **Wood:** - structure –properties – seasoning –**Cement:** Raw materials used, Process of Manufacturing, Chemical composition, Types of cement.

UNIT – II

Modern Building Materials Gypsum: properties of gypsum, building products made of gypsum and their uses, GFRG.

Plastics: classification-properties- use of plastic in construction- advantages of plastics – polypropylene fibers and its applications.

UNIT – III

Metal and metal alloys: Products made of ferrous and nonferrous metals, Aluminum alloys, Types and Uses, Anticorrosive treatment- steel fibers and its applications.

UNIT – IV

Mortars, Masonry and Form Work Types: Cement Mortars- Brick masonry – types – bonds; Stone masonry – types; Cavity wall & hollow block construction. Plastering- Pointing
Form work: Types, Requirements– Scaffolding

UNIT – V

Building Components: lintels- stair cases – types of floors, types of roofs – flat, curved, trussed; foundations – types; Damp Proof Course materials, types of paints and its applications.

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 PUBLISHERS.
4. A Textbook on Building Construction by S.K.Sharma, S.Chand Publishers.

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 Publishing House, Anand- INDIA.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AMC9901	Biology for Engineers	2	0	0	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

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

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

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

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

Unit V: Application of Biology

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, 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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
(AUTONOMOUS)

AK 19 Regulations

B. Tech II- Year

Semester : IV

Branch: Common to all

Subject Code 19AHS9904	Subject Name Communicative English II Lab	L T P 0 0 2	Credit:1
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Course Outcomes

1. Prioritize information from reading texts after selecting relevant and useful points.
2. Make formal structured presentations on academic topics using PPT slides with relevant graphical elements.
3. Participate in Group discussions using appropriate conventions and language strategies.
4. Paraphrase short academic text using suitable strategies and conventions.
5. Collaborate with a partner to make presentations and Project

Syllabus

Unit 1

Oral Presentation: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style. Listening for presentation strategies and answering questions- Formal presentations using PPT slides without graphic elements

Unit 2

Power point Presentation/Poster Presentation: Understand formal and informal styles; recognize the difference between facts and opinions. Following an argument/ logical flow of thought; answering questions, formal presentations using PPT slides with graphic elements.

Unit 3

Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position. Identifying claims, evidences, views, opinions and stance/ position. Identifying views and opinions expressed by different speakers while listening to discussions.

Unit4

Reading for inferential comprehension. Group discussion; reaching consensus in group work(academic context). Understanding inferences; processing of information using specific context clues from the text.

Unit 5

Formal team presentations on academic/ general topics using PPT slides-identifying sections in project reports; understanding the purpose of each section; significance of references.

References:

1. Effective Technical Communication, Rizvi, Tata McGraw-Hill Education 2007
2. A Practical Course in Effective English Speaking skills, J.K.Gangal, PHI Learning Pvt Ltd, 2012
3. A Course in Communication Skills, P.Kiranmai Dutt, Geetha Rajeevan, C.L.N.Prakash, 2008.
4. Technical Communication, Meenakshi Raman, Oxford University Press
5. Professional Communication Skills, Er.A.K.Jain, Pravin S.R.Bhatia, Dr.A.M.Sheikh, S.Chand & Company Ltd, 2001.

List of COs	PO No. and keyword	Competency Indicator:	Performance Indicator
CO1.	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO2.	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2
CO3.	PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2.	9.2.1 9.2.2 9.2.3
CO4.	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	10.3	10.3.1 10.3.2
CO5.	PO10 Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year -II

I - Semester -I

Branch of Study – CE

Subject Code	Subject Name	L	T	P	Credits
19APC0105	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 & SCIENCES: TIRUPATI

Year: II

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0106	Surveying Lab	0	0	4	2

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: Understand 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. Total Station: Determination of Remote height and distance.
7. Total Station: Determination of area.
8. Total Station: Preparation of contour maps for small area
9. Stake out using total station
10. Setting out of building using total station and curve setting

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Autonomous

AK 19 Regulations

Year : II

Semester : II

Branch of Study : CE and ME

Subject Code:19ABS9915	Subject Name: Transform Techniques and Numerical Methods	L 3	T 0	P 0	Credits:3
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Course Outcomes:

- 5) Apply the Laplace transform for solving differential equations (continuous systems)
- 6) Find the Fourier series of periodic signals
- 7) Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
- 8) Solve linear/nonlinear algebraic and transcendental equations using numerical methods
- 9) Solve ordinary differential equations by Euler's method, modified Euler's method, Runge Kutta method, Predictor Corrector method and Milne's method

Unit 1: Laplace transforms :

Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n , division by t , convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs)

Unit II : Fourier series:

Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period, odd and even functions - half range series.

Unit III :Fourier transforms:

Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem

Unit IV: Solution to algebraic equations

Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method. finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Unit V: Numerical differentiation and integration

Numerical Differentiation, numerical integration- trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations-Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006

References

1. T.K.V.Iyengar, B.Krishna Gandhi and others, Engineering Mathematics-II,& Probability and Statistics, S.Chand Publishers
2. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO2	PO1:Apply the knowledge of mathematics	1.1	1.1.2
CO3	PO 2: First principles of mathematics.	2.2	2.2.2
CO4	PO1: Knowledge of mathematics	1.3	1.3.1
CO5	PO1: Knowledge of mathematics	1.1	1.1.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AES0509	Basics of Python Programming	2	0	0	2

Course Objectives:

- To learn the fundamentals of Python
- To elucidate problem-solving using a Python programming language
- To introduce a function-oriented programming paradigm through python
- To get training in the development of solutions using modular concepts
- To introduce the programming constructs of python

Unit – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

Unit – II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.

Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types.

Unit – III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.

Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.

Case Study: Reading word lists, Search, Looping with indices.

Lists: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

Unit – IV

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.

Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.

Files: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.

Classes and Objects: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.

Unit – V

Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus Planning

Classes and Methods: Object oriented features, Printing objects, The init method, The __str__ method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation

Inheritance: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Class diagrams, Data encapsulation.

The Goodies: Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, defaultdict, Named tuples, Gathering keyword Args.

Course Outcomes:

Student should be able to

- Apply the features of Python language in various real applications.
- Select appropriate data structure of Python for solving a problem.
- Design object oriented programs using Python for solving real-world problems.
- Apply modularity to programs.

Text books:

1. Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.

Reference Books:

1. Martin C. Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, “Fundamentals of Python”, CENGAGE, 2015.
3. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0107	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 Hollow), 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.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0108	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 & SCIENCES: TIRUPATI

II - Year

II - Semester

Branch of Study - CE

Subject Code	Subject Name	L	T	P	Credits
19APC0109	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 & SCIENCES: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0110	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. Design concrete mixes using various methods.
4. Understand the durability problems and remedial measure in the concrete.
5. Perform mix design and engineering properties of normal concrete.

UNIT I

Cement: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement. Admixtures: Types of admixtures – mineral and chemical admixtures.

UNIT - II

Aggregates: 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 curves – Grading of Aggregates – Maximum aggregate size

UNIT – III

Fresh Concrete: Workability – Factors affecting workability – Measurement of workability by slump and compaction factor test – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

Hardened Concrete: Water / Cement ratio – Abram's Law – Gain of strength of concrete – Strength in tension and compression – Factors affecting strength – Relation between compression and tensile strength - Curing.

UNIT - IV

Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests - 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 and Concrete Construction: Durability concept - Permeability of concrete - reinforcement corrosion – chemical attack-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 – 2009

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AMC9903	Environmental Studies	2	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-spots 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, 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.

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

Write a function called `estimate_pi` that uses this formula to compute and return an estimate of π .

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than $1e^{-15}$ (which is Python notation for 10^{-15}). You can check the result by comparing it to `math.pi`.

11. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.

13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.

14. Given rows of text, write it in the form of columns.

15. Given a page of text. Count the number of occurrences of each letter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same

16. Write program which performs the following operations on list's. Don't use built-in functions

a) Updating elements of a list

b) Concatenation of list's

c) Check for member in the list

d) Insert into the list

e) Sum the elements of the list

f) Push and pop element of list

g) Sorting of list

h) Finding biggest and smallest elements in the list

i) Finding common elements in the list

17. Write a program to count the number of vowels in a word.

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.

19. Go to Project Gutenberg (<http://gutenberg.org>) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.

20. Go to Project Gutenberg (<http://gutenberg.org>) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.

21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.

22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object oriented approach.

23. Write a program illustrating the object oriented features supported by Python.

24. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

25. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format($0 \leq \text{YYYY} \leq 9999$, $1 \leq \text{MM} \leq 12$, $1 \leq \text{DD} \leq 31$) following the leap year rules.

26. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.($0 \leq \text{HH} \leq 23$, $0 \leq \text{MM} \leq 59$, $0 \leq \text{SS} \leq 59$)

Reference Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition,

Available at <http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf>

2. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016

3. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0111	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5

Course outcomes:

- 1: Calibrate flow measuring devices such as Venturimeter, orifice meter and notch*
- 2: Verify Bernoulli's theorem*
- 3: Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design*
- 4: Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports*
- 5: To provide the students knowledge in calculating performance analysis in turbines and pumps and can be used in power plants*

LABORATORY EXPERIMENTS

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: II

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0112	Concrete Technology Lab	0	0	3	1.5

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.
5. Workability test on concrete by compaction factor, slump and Vee-bee.
6. Young's modulus, Tensile and compressive strength 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)

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0113	Soil Mechanics	3	1	0	4

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).

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.

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0114	Design of Reinforced Concrete Structures	3	1	0	4

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, one way slab and continuous 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 PUBLISHERS.
4. A Textbook on Building Construction by S.K.Sharma, S.Chand PUBLISHERS.

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 Publishing House, Anand- INDIA.

Codes/Tables: IS 456-2000 and IS-800 code books to be permitted into the examinations Hall.

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0115	Engineering Geology	2	0	0	2

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 suitability of water and soil conservation projects.

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

Geophysical Studies:

Importance - Branches and necessity of Geophysical investigations - Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Electrical resistivity methods, and seismic refraction methods.

TEXT BOOKS:

1. Engineering Geology by N.Chennkesavulu, Mc-Millan, India Ltd. 2005
2. Engineering Geology by Vasudev Kanthi, Universities Press, Hyderabad.

REFERENCES:

1. Engineering Geology by Duggal.S.K., TMH Publishers.
2. Engineering Geology by Subinoy Gangopadhyay, Oxford University Press.
3. Engineering Geology by Prabin Singh, Katson Publications
4. Principles of Engineering Geology by K.V.G.K. Gokhale – B.S publications

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0116	Structural Analysis - II	3	0	0	3

Course Outcomes: At the end of the course the student will be 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

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0101	Building Planning and bye-laws	2	0	0	2

Course Outcomes: At the end of the course the student will able to

1. Understand the Principles of Building Planning
2. Understand the Building Bye-Laws and Regulations
3. Understand the Planning of Residential Buildings Public Buildings
4. Understand the Buildings Safety And Comfort
5. Understand the sign conventions and bonds doors and windows

UNIT – I

Principles of Building Planning: Types of buildings, types of residential buildings – site selection for residential building, orientation of buildings; aspect; prospect grouping, circulation, privacy, economy, flexibility and practical considerations.

UNIT – II

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 – Lighting and ventilation requirements.

UNIT – III

Planning of Residential Buildings: Introduction – Minimum standards for various parts of the buildings – Requirements of different rooms and their grouping – Veranda – Drawing room – Bed room – Kitchen – Dining room– Bath room

Public Buildings: Planning of Educational institutions, hospitals, Office buildings.

UNIT – IV

Buildings Safety And Comfort: Aspects of safety-structural, fire and constructional safety. Components of building automation system -fire-fighting, communication etc. design for thermal comfort, ventilation comfort, lighting comfort,

UNIT – V

SIGN CONVENTIONS AND BONDS: Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminium alloys, lead, zinc, tin,, earth, rock, timber and marble . English bond & Flemish bond; odd & even courses for one, one and half

DOORS AND WINDOWS: Paneled Door – paneled and glazed door; glazed windows – paneled windows;

TEXT BOOKS:

1. Planning and Designing and Scheduling – Gurucharan singh and Jagadish singh- Standard publishers.
2. Building planning and design – N.Kumara swamy and A.Kameswara rao. Charitor publications.

REFERENCE BOOKS:

1. National Building Code of India 2016 (NBC 2016) - SP 7:2016
2. Building drawing with an integrated approach to building environment-M.G.Saha, G.M.Kale, S.Y.patki-Tata Mc Graw Hill.

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0102	Water Harvesting and Conservation	2	0	0	2

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:

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

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0103	Cost Effective Housing Techniques	2	0	0	2

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 roofing/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 Repairs 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-cast 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.

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.

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0104	Green Buildings	2	0	0	2

Course Outcomes: At the end of the course the student will able to

1. Understand the concepts of green buildings
2. Understand the overview of materials used for green buildings.
3. Understand the concept of energy and resource conservation
4. Understand the interaction between building physics and climatic elements and their impact on occupant comfort and environment
5. Understand the concept of rating system for various types of buildings

UNIT I

Introduction to Green Buildings: Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings- Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage

UNIT - II

Environmentally friendly building materials and technologies: Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime-pozzolana cements, materials from agro and industrial waste, ferro-cement and ferro-concrete, alternative roofing systems, various paints reducing the heat gain of the building, etc.

UNIT – III

Energy and resource conservation: Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings-water harvesting in buildings – waste to energy management in residential complexes or gated communities.

Use of renewable energy resources: Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar appliances, success case studies of fully solar energy based buildings in India.

UNIT - IV

Climate Design: Local climatic conditions – temperature, humidity, wind speed and direction-impact of climate change on built environment - comforts: the desirable conditions – Principles of thermal design - means of thermal –light and lighting-building acoustics- energy efficient lighting, Ventilation and air quality requirement, various techniques for passive cooling, garden roofs, case studies for passive cooling and thermal comfort.

UNIT – V

Green Building Rating Systems: Introduction to Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment - Modular wastewater treatment systems for built environment - Building automation and building management systems

TEXT BOOKS:

1. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
2. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.

REFERENCES:

1. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
2. Complete Guide to Green Buildings by Trish riley
3. Renewable Energy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha Rao, B Natarajan, P Monga, Tata McGraw Hill, 2000 3. Energy and the
4. Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0105	Photogrammetric surveying	2	0	0	2

Course Outcomes: At the end of the course the student will able to

1. Understands the concept of photogrammetric surveying.
2. Understand applications of LIDAR.
3. Understand functions of Remote Sensing & GIS.
4. Understand field astronomy.
5. Understand various surveying instrument and their functions.

UNIT I:

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

UNIT II:

LiDAR Surveying: Introduction to LiDAR survey and fundamental concepts, Flight planning for airborne LiDAR data acquisition, Geolocation process, Error propagation and accuracy assessment for LiDAR, LiDAR data processing for DTM, DSM, BEM, and DEM generation, LiDAR data processing for DTM, DSM, BEM, and DEM generation.

UNIT III:

Advanced Remote Sensing & GIS: Image interpretation techniques, visual interpretation, Digital image processing, Components of GIS- data acquisition, spatial and attribute data, pre-processing, storage and management; Data structures raster and vector data; GIS analysis functions; Errors and corrections; Data presentation and generation of thematic maps; Applications.

UNIT IV:

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

UNIT V:

Special Survey Instruments and Functions: Introduction, Electromagnetic Distance Measurement, Electronics Theodolite, Total station, Site square, Pentagraph, Auto set Level, Transit level, Special Compasses, Brunton Universal Pocket Transit, Mountain Compass Transit.

TEXT BOOKS

1. Duggal, S. K., Surveying Vol. I & II, Tata McGraw Hill, New Delhi
2. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi

3. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Gruh.
4. Remote sensing and Image interpretation by T.M Lillesand, R.W Kiefer and J.W Chipman, 5th edition, John Wiley and Sons India.

REFERENCE BOOKS

1. Punmia, B.C., Surveying Vol. I, II & III, Laxmi Publications.
2. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi.
3. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.

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Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AOE0401	Sensor Networks	2	0	0	2

Course Outcomes: Students will be able to

1. Understand the concepts of Converters and Sensor data acquisition systems
2. Understand the concepts of Sensor Measurements in Structural Monitoring
3. Understand the concepts of commonly used sensing technologies and algorithms
4. Understand the concepts of Piezoelectric transducers for assessing and monitoring infrastructures
5. 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, 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

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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Year: III

Semester: I

Branch of Study: CE

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0521	ARTIFICIAL INTELLIGENCE	2	0	0	2

Course Outcomes:

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

UNIT I

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II

Solving Problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT III

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT IV

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT V

Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains

Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Textbook:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.

References:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." *Journal of Accounting Education* 27.1 (2009): 30-39.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0323	Operations Research	2	0	0	2

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; Optimality Testing. 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.

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AMC9904	Professional Ethics & Human Values	2	0	0	0

Course Outcomes: Students will be able to

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:

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:

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!

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 Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0117	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

Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0118	Computer- aided Civil Engineering Drawing Lab	0	0	3	1.5

Course Outcomes: After the completion of the course student should be able to

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 & SCIENCES:: TIRUPATI

Year: III

Semester: I

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0119	Engineering Geology Lab	0	0	2	1

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.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0120	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.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0121	Transportation 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)

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Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0122	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

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.Publiications,New Delhi.
5. GIS by Kang – Tsung Chang, TMH Publications & Co.,

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0106	Subsurface Investigation and Instrumentation	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

1. Understand the exploration and geophysical methods
2. Understand the exploration techniques
3. Understand the sampling of soil
4. Understand field testing of soil
5. Understand the usage of instrumentation in subsurface investigation

UNIT -I

EXPLORATION AND GEOPHYSICAL METHODS: Exploration program planning -methods of exploration- preliminary and detailed design spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole - down hole methods.

UNIT –II

EXPLORATION TECHNIQUES: Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

UNIT -III

SOIL SAMPLING: Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

UNIT -IV

FIELD TESTING IN SOIL EXPLORATION: Field tests, penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressure meter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests

UNIT -V

INSTRUMENTATION: Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements.

TEXT BOOKS:

1. Alam Singh and Chowdhary G. R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation", CBS Publishers and Distributors, New Delhi, 2006.
2. Dunicliff J., and Green, G. E., "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley, 1993.

REFERENCES:

1. Bowles J. E., "Foundation Analysis and Design", 5th Edition, The McGraw-Hill companies, Inc., New York, 1995.
2. C. Venkataramiah, "Geotechnical Engineering", New age International Pvt . Ltd, (2002).
3. Hanna T. H., "Field Instrumentation in Geotechnical Engineering", Trans Tech., 1985. 4. Hunt R. E., "Geotechnical Engineering Investigation Manual", McGraw Hill, 1984.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0107	Prestressed Concrete	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

1. Understand the methods of prestressing.
2. Understand the prestress losses
3. Analyze and design of sections to withstand flexure and shear.
4. Analyze and design of composite sections.
5. Understand the concepts of deflections.

UNIT – I

INTRODUCTION: Historic development – General principles of Prestressing, Pretensioning And Post Tensioning – Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel their characteristics.

METHODS OF PRESTRESSING:-

Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System, Freyssinet system and Gifford – Udall System.

UNIT – II

LOSSES OF PRESTRESS: Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of stress in steel, slip in anchorage ,bending of member and wobble frictional losses.

UNIT – III

ANALYSIS & DESIGN OF SECTIONS FOR FLEXURE: Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons.Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure – Kern – lines, cable profile.

UNIT – IV

DESIGN OF SECTION FOR SHEAR : Shear and Principal Stresses – Design for Shear in beams.

COMPOSITE SECTION: Introduction – Analysis of stress – Differential shrinkage – General design considerations.

UNIT – V

DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS: Importance of control of deflections – factors influencing deflections – short term deflections of uncracked members prediction of long term deflections.

TEXT BOOKS:

- 1 Prestressed Concrete by N. Krishna Raju; - Tata Mc.Graw Hill Publications.
- 2 Prestressed Concrete by K.U.Muthu, PHI Publications.
- 3 Prestressed Concrete by Ramamrutham, Dhanpatrai Publications

REFERENCE:

1. Prestressed Concrete Design By Praveen Nagrajan, Pearson Publications, 2013 Editions.
2. Design Of Prestressed Concrete Structures (Third Edition) By T.Y. Lin & Ned H.Burns, John Wiley & Sons.
3. Prestressed Concrete By Pandit.G.S. And Gupta.S.P., CBS Publishers And Distributers Pvt. Ltd, 2012.
4. Prestressed Concrete By Rajagopalan.N, Narosa Publishing House, 2002.
5. Prestressed Concrete Structures By Dayaratnam.P., Oxford And IBH, 2013

Codes/Tables:

Codes: BIS code on prestressed concrete, IS 1343-2012 to be permitted into the examination Hall.

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Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0108	Advanced Structural Analysis	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

1. Understand indeterminate structures
2. Analyze the structures using stiffness matrix method
3. Analyze the trusses and frames using flexibility matrix method
4. Analyze the trusses and frames using stiffness matrix method
5. Understand the shear wall analysis

UNIT – I

Introduction to matrix methods

Introduction to matrix methods of analysis – static indeterminacy and kinematic indeterminacy – degree of freedom – coordinate system – structure idealization stiffness and flexibility matrices – suitability element stiffness equations – elements flexibility equations – mixed force – displacement equations – for truss element, beam element and tensional element. Transformation of coordinates – element stiffness matrix – and load vector – local and global coordinates.

UNIT – II

Stiffness matrix method

Assembly of stiffness matrix from element stiffness matrix – direct stiffness method – general procedure – band matrix – semi bandwidth – computer algorithm for assembly by direct stiffness matrix method.

UNIT – III

Truss and Frame-Flexibility method

Analysis of plane truss – continuous beam – plane frame and grids by flexibility methods.

UNIT – IV

Truss and Frame-Stiffness method

Analysis of plane truss – continuous beam – plane frame and grids by stiffness methods.

UNIT – V

Shear wall analysis

Special analysis procedures – static condensation and sub structuring – initial and thermal stress. Shear walls- Necessity – structural behavior of large frames with and without shear walls – approximate methods of analysis of shear walls.

TEXT BOOKS:

1. Matrix Analysis of Frames structures by William Weaver J.R and James M. Gere, CBS publications.
2. Advanced Structural Analysis by Ashok. K. Jain, Nem Chand Brothers.

REFERENCES:

1. Basic Structural Analysis by C.S. Reddy, Tata Mc-Graw hill
2. Matrix Structural Analysis by Madhu B. Kanchi, John Willey publishers
3. Indeterminate Structural Analysis by K.U. Muthuet al., I.K. International Publishing House Pvt. Ltd.
4. Matrix Methods of Structural Analysis by J.L. Meek, Mc-Graw hill

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Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0109	RAILWAYS, AIRPORT, DOCKS AND HARBOUR ENGINEERING	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

1. Know various components and their functions in a railway track
2. Acquire design principles of geometrics in a railway track.
3. Know basic concepts of airport engineering and its layouts
4. Acquire design principles of airport geometrics design
5. Know the planning, construction and maintenance of Docks and Harbours.

UNIT I

RAILWAY ENGINEERING:

Permanent way components –Cross Section of Permanent Way – Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II:

GEOMETRIC DESIGN OF RAILWAY TRACK:

Gradients – Grade Compensation – Cant and Negative Super Elevation – Cant Deficiency – Pointing And Crossings – Layout And Functioning Of Left Hand Turn Out And Right Hand Turn Outs– Station Yards – Signaling

UNIT - III

AIRPORT ENGINEERING:

Airport Site Selection – Factors Affecting Site Selection And Surveys- Runway Orientation – Wind Rose Diagram – Basic Runway Length – Correction For Runway Length – Terminal Area- Layout And Functions – Simple Building , Linear Concept, Pier Concept And Satellite Concept and Typical Layouts

UNIT – IV

GEOMETRIC DESIGN OF RUNWAYS AND TAXIWAYS:

Aircraft Characteristics – Influence Of Characteristics On Airport Planning And Design – Geometric Design Elements Of Runway – Standards And Specifications As Per- Functions Of Taxiways – Taxiway Geometric Design – Geometric Elements And Standard Specifications – Runway And Taxiway Lighting.

UNIT – V

PORTS AND HARBOURS:

Requirements of Ports And Harbours – Types Of Ports – Classification Of Harbours –Docks And Types Of Docks – Dry Docks, Wharves And Jetties – Breakwaters:– Dredging Operations – Navigation Aids,

TEXT BOOKS:

Text Books:

1. A Text Book of Railway Engineering-S.C.Saxena and S.Arora, Dhanpatrai and Sons, New Delhi.
2. Transportation Engineering: Railways, Airports, Docks and Harbours, Bridges and Tunnels, by C.Venkataramaiah, Universities Press, Hyderabad (2016)
3. Airport Planning and Design- S.K. Khanna and M.G Arora, Nemchand Bros.

REFERENCES:

1. Highway, Railway, Airport and Harbour Engineering – K.P. Subramanian, Scitech publishers.
2. Harbour, Dock and Tunnel Engineering – R. Srinivasan, Charotar Publishing House Pvt. Limited, 2009
3. A Text book of Transportation Engineering – S.P.Chandola – S.Chand & Co.Ltd. –

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Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APE0110	Finite Element Methods	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

1. Solve simple boundary value problems using Numerical technique of Finite element method.
2. Demonstrate the differential equilibrium equations and their relationship.
3. Develop finite element formulation of one and two dimensional problems and solve them.
4. Demonstrate the displacement models and load vectors
5. Analyze plane stress and plane strain problems

UNIT-I INTRODUCTION:

Concepts of FEM - Steps involved - Merits & Demerits Energy Principles Discretization Review of stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation.

UNIT-II Principles of Elasticity- Equilibrium Equations- Strain Displacement relationships- Constitutive relationship for plane stress, plane strain and axis symmetric bodies of revolution with axis symmetric loading.

UNIT-III ONE DIMENSIONAL & TWO DIMENSIONAL ELEMENTS:

Stiffness matrix for bar element-shape functions for one dimensional elements one dimensional problem. - - - - -

Two Dimensional Elements - Different types of elements for plane stress and plane strain analysis Displacement models generalized coordinates shape functions convergent and compatibility requirements Geometric invariance Natural coordinate system area and volume-coordinates

UNIT-IV GENERATION OF ELEMENT:

Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.

UNIT-V SOLUTION TECHNIQUES:

Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Text Book

1. Finite Element Methods in Civil Engineering by M.Rama Narasimha Reddy, Dr.K.Sreenivasu Reddy, D.Srinivasulu Reddy, Sci-Tech Publications Pvt.Ltd.
2. Finite Element Analysis By S.S. Bhavakatti-New Age International Publishers.
3. Finite Element Methods by R.Dhanaraj & K.Prabhakar Nair, Oxford Publishers.

REFERENCES:

1. Finite Element analysis Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers
2. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad. 2003.
3. Finite Element Analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
4. Finite Element Analysis And Procedures In Engineering by H.V.Lakshminaryana, 3rd Edition, Universities Press, Hyderabad.

A First Course in the Finite Element Methods by Daryl Logan, Cengage Publishers.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19A0EMB01	Managerial Economics and Financial Analysis	2	0	0	2

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 (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.

TEXTBOOKS:

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

REFERENCE BOOKS:

1. Ahuja HI 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, NewDelhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AOE0301	Management Science	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

- 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).

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.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19A0EMB02	ENTERPRENEURSHIP DEVELOPMENT	2	0	0	2

Course Outcomes: After the completion of the course student should be able to

- Understand the concept of Entrepreneurship and challenges in the world of Competition.
- Apply the Knowledge in generating ideas for New Ventures and design business plan structure.
- Analyze various sources of finance and subsidies to entrepreneurs.
- Evaluate the role of central government and state government in promoting women
- Entrepreneurship. Study the role of incubations in fostering startups.

UNIT – I INTRODUCTION TO ENTREPRENEURSHIP

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

UNIT – II FORMULATION OF BUSINESS IDEA

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

UNIT III FINANCIAL ASPECTS OF PROMOTION

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development.

UNIT IV WOMEN ENTREPRENEURSHIP

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

UNIT V STARTUPS AND INCUBATION

Startups – Definition, Role of startups in India, Governmental initiatives to foster entrepreneurship across sectors. Funding opportunities for startups. Business Incubation and its benefits, Pre-Incubation and Post - Incubation process.

Textbooks:

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012.
(For PPT, Case Solutions Faculty may visit : login.cengage.com)
- 2 . Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

Reference Books:

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, HimalayaPublishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code 19AOE9901	Subject Name English For Research Paper Writing	L 2	T 0	P 0	Credit: 2
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Course Outcomes:

Students will be able to:

1. Improve writing skills and level of readability.
2. Learn what to write in each section, avoiding plagiarism.
3. Understand the review of research literature
4. Apply skills in writing a Title, abstract and literature
5. Learn the skills of drafting Summations

Syllabus

Unit -1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit -2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Unit -3

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit – 4

Key skills for writing a title – an abstract – an introduction – review of literature

Unit:5

Key skills for writing methodology – results – discussions – conclusions.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19AHE9911	Environmental Waste Management	2	0	0	2

Course Outcomes:

CO-1. To examine the various types of solid waste and methods to categorize it

CO-2. To find out methods to reduce solid waste at the source

CO-3. To carry out analysis and audit of waste

CO-4. To understand people's responsibility in reducing and managing waste

UNIT I : INTRODUCTION

Problem of Wastes, Types of Solid Waste, Categories of solid waste, Effects of Excess Waste Generation, Waste Characterization

UNIT II : WASTE REDUCTION AT SOURCE

Solid Waste Reduction, Waste reduction strategies - How to Start a Waste Reduction Program Guidelines, Economic benefits of Waste Reduction, Operation on daily basis.

UNIT III : WASTE ANALYSIS AND AUDIT

Introduction to Terminology of Waste, Waste Analysis, Introduction to Waste Audit, Checklist for performance audit in Waste Collection, Segregation, Transport and Treatment.

UNIT IV: PEOPLE'S RESPONSIBILITY OF WASTE MANAGEMENT

Responsibility of Waste Management, Polluter Pays Principle (PPP), Assimilative Capacity and the Precautionary Principle, World Scenario in Scrap Trade Extended Producer Responsibility (EPR), Carrying Capacity and Precautionary Principles.

UNIT V : WASTE REDUCTION TOWARDS ZERO WASTE

Sustainable Living, Waste Reduction at Business (Producer) Level, Waste Reduction at Individual Level: Zero Waste Living and Waste Reduction at Domestic and community Level.

TEXT BOOKS:

1. Karia G.L., and Christian R.A., (2001), "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Tchobanoglous, G, Theisen, H, and Eliassen, R (1977).Solid Waste Engineering. Principles and Management Issues McGraw Hill Book Company, New York.
3. Srilatha,H.R., Krishna, N., Sudhakar Bada, K. and Madhukara, K. 1995. Fungal pretreatment of orange processing waste by solid state fermentation for improved production of methane

REFERENCES:

1. Metcalf and Eddy Inc., (2003), "Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

(AUTONOMOUS)

AK19 Regulations

III B.Tech

Semester-II

Branch : Common to all

Subject Code 19AHE9902	Subject Name Principles of Effective Public Speaking	L 3	T 0	P 0	Credit: 3
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Course Objectives:

1. Gain and demonstrate the basic skills of effective oral communication, for use throughout your academic career and beyond.
2. Learn and develop the skills necessary to maximize public speaking effectiveness, including effective research and organization of information, how to make the most of presentation aids (and not become reliant on them!), and understanding the speaker-audience relationship.
3. Develop critical thinking and listening skills, enabling you to maximize your own understanding as an audience member, and offer considered and constructive critiques of others' speeches.
4. Become more confident in public speaking arenas, whether as a formal speech giver or as a participant in group settings. Improvement will be valued over perfection.

Unit -1

Introduction to Public Speaking:

Basic communication concepts, processes, and models Communication concepts and principles and public speaking Steps and methods of speech preparation; Ethics in public speaking

Unit -2

Listening and Speech Criticism:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles; Evaluating speech and effective speech techniques.

Unit -3

Selecting Topic and Knowing your Audience:

Identifying sources; Tools and techniques for selecting and refining speech topics; Identifying speech purposes; Central idea statement; The central idea; Audience analysis techniques.

Unit – 4

Speaking with a Purpose:

Informative, persuasive, and ceremonial speeches

Unit:5

Delivering your speech and using Visual Aids.

The mechanics of verbal and nonverbal communication in speech delivery; Modes of speech delivery; Speaking style and language; Effective delivery techniques; Incorporating presentation aids

Course Outcomes:

Students will be able to:

- 1. Apply knowledge of principles, concepts and skills learned in speech preparation.**
- 2. Develop skills in effective listening.**
- 3. Evaluate the delivery of speeches.**
- 4. Develop skills in speech composition.**
- 5. Use supporting materials and presentation aids in speech preparation.**

References:

1. DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.
 2. Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.
- Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: PearsonEducation, Inc).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code 19AMC9902	Subject Name CONSTITUTION OF INDIA	L 2	T 0	P 0	Credits: 2
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Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the Powers and functions of Governor, President, Judiciary.
5. Discuss the functions of local administration bodies.

Unit:1

History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)

Unit:2

Philosophy of the Indian Constitution - Preamble Salient Features

Unit:3

Contours of Constitutional Rights & Duties - Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

Unit:4

Organs of Governance - Parliament – Composition - Qualifications and Disqualifications - Powers and Functions - Executive, President, Governor - Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.

Unit:5

Local Administration - District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZillaPachayat - Elected officials and their roles, CEO Zilla Panchayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

Suggested books for reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0123	Remote Sensing and GIS Lab	0	0	3	1.5

Course Outcomes: After the completion of the course student should be able to

1. To understand spatial technologies, mapping the field problems and solution convergence through GIS.

LIST OF THE EXPERIMENTS

1. Development of georeferencing of maps either from cadastral or AutoCAD based map.
2. Identification of best locations of ground control points and mosaicing the different sources of maps of information like topo sheets & satellite data and other drawings.
3. Digitization and GIS coordination
4. GIS interface and features using open Source Software QGIS.
5. Case example on mapping like water distinguish, Road alignment road network etc.,

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

Year: III

Semester: II

Branch of Study: CE

Subject Code	Subject Name	L	T	P	Credits
19APC0124	Transportation 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. Pycnometers.
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