

**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)**

**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	Total
<b>THEORY</b>										
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
		19APE0416	Sensor Networks							
		19APC0521	Artificial Intelligence							
		19APC0323	Operations Research							
7	MC	19AMC9904	Professional Ethics and Human values	2	-	-	-	30	-	30
<b>PRACTICAL</b>										
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
<b>TOTAL</b>							21.5	350	630	980

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI**

**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.

## ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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. Principals of Engineering Geology by K.V.G.K. Gokhale – B.S publications

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI**

**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 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



## ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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.

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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.

## ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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.

## ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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 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.

## ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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.

# ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: TIRUPATI

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", 3<sup>rd</sup> 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, 8<sup>th</sup> edition, 2011
2. Operations Research by R Panneerselvam, PHI, 2<sup>nd</sup> edition, 2012.
3. Operations Research, Wagner, PHI Publications , 2<sup>nd</sup> 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.