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

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

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Year: II   **Semester: II**

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

Course Outcomes:

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

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

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

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

Unit IV: Transportation & Assignment Problem
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Travelling salesman problem.
.
Unit V: Game Theory
Formulation of games, Two person-Zero sum game, Mini max and Max min Principle, games with and without saddle point, Rules of dominance, Solving a 2x2 game using graphical method.
TEXT BOOKS:
1. Mathematical Modeling: by Majid Jaberi-Douraki and Seyed M. Moghadas
2. Operations Research , S.D. Sharma.

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

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

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Year: II   **Semester: II**

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

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

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

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

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

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

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

TEXT BOOKS:
R.K Bansal, Engineering Mechanics, Lakshmi Publications.

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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.

Year: II   **Semester: II**

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

Course Outcomes:

1: Understand Laminar Flow and Turbulent flow through plates

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

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

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

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

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

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

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

UNIT -V:

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

TEXT BOOKS:

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

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

REFERENCES:

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

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

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

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

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Year: II   **Semester: II**

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

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

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

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

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

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

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

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

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

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Year: II   **Semester: II**

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

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

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

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

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

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

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

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TEXT BOOKS:

1. Concrete Technology by M.S. Shetty. – S. Chand & Co.; 2004
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford university Press, New Delhi
3. Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi

REFERENCES:

1. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
2. Concrete: Micro structure, Properties and Materials – P.K. Mehta and J.M. Monteiro, Mc-Graw Hill Publishers

IS Codes:

IS 383, IS 516, IS 10262 – 2019

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II B.Tech   **Branch Common to all**

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

Course Objectives

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

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

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

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

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

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

UNIT II: Understanding Harmony in the Human Being - Harmony in Myself!

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

AK20 Regulations
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Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

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

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

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

UNIT IV: **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

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

UNIT- V**: Implications of the above Holistic Understanding of Harmony on Professional Ethics.**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

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

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

Course Outcomes:
On completion of this course, the students will be able to
1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOKS

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

REFERENCE BOOKS

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. FSchumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"

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8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

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

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

Course Outcomes:

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

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

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Year: II   **Semester: II**

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

Course Outcomes:
1. Determine the properties of cement as per IS specifications.
2: Determine the properties of aggregates as per IS specifications.
3: Determine the properties of fresh concrete as per IS specifications.
4: Determine the properties of hardened concrete as per IS specifications.
5: Determine the strength of concrete using Rebound hammer method.
List of Experiments
1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity and soundness of cement.
4. Compressive strength of cement mortar.
5. Workability test on concrete by compaction factor, slump and Vee-bee.
6. Compressive strength, Tensile strength and Young's modulus of concrete.
7. Specific Gravity and Water Absorption of Coarse aggregate.
8. Bulking of Fine aggregate.
9. Specific Gravity and Water Absorption of fine aggregate.
10. Grain size distribution of coarse aggregate and fine aggregate
11. Non-Destructive testing on concrete (for demonstration)

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Year: II   **Semester: II**

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

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

LIST OF THE EXPERIMENTS

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

2. Drawing of plans for Single storey buildings

3. Drawing of plans for Multi storey buildings

4. Development of sections and elevations for Single storey buildings

5. Development of sections and elevations for Multi storey buildings

6. Detailing of building components like doors, windows

7. Development of building components roof trusses