Regulations -2020 (R20)

4 year B.Tech. Degree Course

Civil Engineering

(Choice Based Credit System)

(With effect from the academic year 2020-21)

Scheme &Syllabus

DEPARTMENT OF CIVIL ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

R20 (With effect from the academic year 2020-21)

SRI VENKATESWARA UNIVERSITY: TIRUPATI
SRIVENKATESWARAUNIVERSITYCOLLEGEOFENGINEERING
DEPARTMENTOFCIVIL ENGINEERING

Course
B.Tech (CIVILENGINEERING)

Choice Based Credit System (CBCS)

AcademicYear2020-2021

Amended as per NEP-2020

About the Department:

- Established in the year 1959.
- Largest department in the University.
- Well Qualified & Experienced Faculty.
- Meritorious students, Regular conduct of student's activities, Field visits, Internships participation of students in various activities in other Institutions.
- Good Alumni Support
- Faculty actively involved in teaching, research, consultancy and extension programmes and interaction with outside world.

Vision of the Department:

Vision of the Civil Engineering Department is to produce globally competitive and committed Civil Engineers with ethical values to cater to the needs of the society and strive for sustainable development through research and innovation.

Mission of the Department:

- To impart quality education with the support of state-of-art Infrastructure and faculty.
- To inculcate inquisitiveness, infuse training and research for the societal development.
- To address growing needs of sustainable infrastructure development.
- To provide technical advice and support to the industry.
- To provide awareness of global economic problems and contribute to Nation building.
- To provide entrepreneurial skills for the upliftment of the country.

PROGRAM OUTCOMES (PO'S):

1. To apply knowledge of mathematics, Science, Engineering fundamentals, and engineering specialization for the solution of complex engineering problems.
2. To identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. To design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. To use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. To create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
6. To apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. To function effectively as an individual, and as an member or leader in diverse teams, and in multidisciplinary settings.
10. To communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. To demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. To recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO'S)

a. To provide students with the fundamental, technical knowledge and skills in mathematics, sciences and engineering to recognize, analyze and solve complex problems in the areas of Structural, Geotechnical, Hydraulics and Water Resources, Transportation and Environmental engineering.
b. To provide students with individual working skills and practical experience and to fulfill their professional duties and communicate effectively in teamwork, ethical thinking, technical leadership, and lifelong learning.
c. To make the students responsible professionals to work in various positions in industry or government and/or succeed in graduate or other professional organizations.
d. To train the students to become engineers, managers, scientists, researchers and innovators and make substantial contributions to the society.
e. To guide the students to use modern tools to solve complex engineering problems
f. To make the students to strive for the improvement of the quality of life and improve the standard of living by providing environmental sustainability.

PROGRAMME SPECIFIC OUTCOMES (PSO'S):

PSO1: Specify, Design, test and evaluate foundations and super structure for residences, public buildings, industries, irrigation structures, transportation amenities and environmental Engineering systems.

PSO2: Development of state of art skills for using modern tools, as entrepreneur in the domain field or in multidisciplinary environment.

I Semester – Scheme &Syllabus
(R20 Regulations)

FIRST SEMISTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
MA 101	Mathematics – I	3	1	-	4	4	40	60	100
CY 102	Engineering Chemistry	3	1	-	4	4	40	60	100
EN103	English	2	-	-	2	2	40	60	100
EE 104	Basic Electrical & Electronics Engineering	3	1	-	4	4	40	60	100
ME 105	Engineering Graphics & Design	2	-	3	5	3.5	40	60	100
EN 106	English Communication Lab	-	-	3	3	1.5	40	60	100
Total		13	**3**	**6**	**22**	**19**	240	360	600

All courses- 40Marks Internal + 60 Marks(Univ. Semester End)

Category	**No. of. Courses**	**Credits**
Basic Science Courses – BSC	2	08
Basic Engg. Courses - BE	2	7.5
Humanities and Social and Sciences - HSS	2	3.5
Audit Course	1	0
	Total Credits	**19**

MA 101 MATHEMATICS - I

Instruction Hours/Week: 3(L) +1(T) Credits: 4
Sessional Marks : 40 End Semester Examination Marks: 60

Course Educational Objectives(CEOs):

This course enables the students to

1. Study the differential equations and solve them
2. Know the applications of differential equations to engineering problems.
3. Use transformation to convert one type in to another type presumablyeasierto solve.
4. Use shift theorems to compute the Laplace transform, inverse Laplace transform and the solutions of second order, linear equations with constant coefficients.
5. Understand an initial value problem for an n^{th} orderordinarydifferential equation using the Laplace transform.
6. Know the expand functions as power series using Maclaurin's and Talor's series
7. Know the problems related to OR, Computer science, Probability and Statistics
8. Understand the concept of drawing anapproximateshapebythestudyofsomeofitsimportantcharacteristicssuchas symmetry, tangents, regions enclosing curve tracing method to find length, area, volume.
9. Study the multipleintegralinevaluatingareaandvolumeofanyregionboundedbythegiven curves.

UNIT I

Differential Equations: Linear differential equations of second and higher order with constant coefficients-particularintegrals-homogeneous differential equations with variable coefficients-method of parameters-simulation equations.

UNIT II

Laplace Transforms I: Laplace transforms of standard functions-inverse transforms-transforms of derivatives and integrals-derivatives of transforms-integrals of transforms.

UNIT III

Laplace Transforms II: Transforms of periodic functions-convolution theorem-applications to solution of ordinary differential equations.

UNIT IV

Calculus: Roll's and Mean value theorems - Taylor's and Maclaurins's series-maxima and minima for functions of two variables - Infinite series - Convergence Tests series of positive terms - comparison, Ratio tests - Alternating series - Leibnitz's rule - Absolute and conditional convergence.

UNIT V

Multiple Integrals: Curve tracing (both Cartesian and polar coordinate) - Evaluations of double and Triple integrals-change of order of integrations-change of variables of integrations-simple applications to areas and volumes.

Text/Reference Books

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
4. Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

Course Outcomes(COs):

CO 1: Analyze & apply differential equations to engineering problems .
CO2: Use shift theorems to compute the Laplace transform, inverse Laplace transform.
CO3: The solutions of second order, linear equations with constant coefficients initial value problem for an nth order ordinary differential equation using the Laplace transform.
CO4: Expand functions as power series using Maclaurin's and Taylor's series and Analyze Infinite series.
CO5: Draw an approximate shape by using curve tracing method and Use multiple integral in evaluating area and volume of any region bounded by the given curves.

Course	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	0	2	0	0	0	0	2	2	2
CO2	3	2	2	1	2	0	0	0	0	2	2	2
CO3	3	2	2	1	2	0	0	0	0	2	2	2
CO4	3	2	2	0	2	0	0	0	0	2	2	2
CO5	3	2	2	0	2	2	0	0	0	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CY 102 ENGINEERING CHEMISTRY

Instruction Hours/week :3(L) +1(T) Credits : 4
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

This course enables the Students to

1. Study the microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces.
2. Understand the rationalizing bulk properties and processes using thermodynamic considerations.
3. Know the distinguished ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Study how to rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electro negativity.
5. Understand the list of major chemical reactions that are used in the synthesis of molecules.

UNIT I
Atomic and molecular structure (12 lectures)
Postulates of quantum chemistry.Schrodinger equation.Particle in a box solutions Molecular orbitals of diatomic molecules and plots of the multicentreorbitals.Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene. Band structure of solids and the role of doping on band structures

UNIT II
Spectroscopic techniques and applications

Principles of spectroscopy and selection rules.Electronic spectroscopy.Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomic molecules.Applications.Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques.

UNIT III

Chemical equilibria, Intermolecular forces and potential energy surfaces

Use of free energy in Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.Use of free energy considerations in metallurgy through Ellingham diagram.Equations of state of real gases and critical phenomena.

UNIT IV

Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular
geometries, Born- Haber cycle, The use of reduction potentials, Properties of ionic and covalent compounds.

UNIT V

Stereochemistry, **Organic reactions and synthesis of a drug molecule**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings.Synthesis of a commonly used drug molecule.

Reference/Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

7. Principles of physical chemistry, Puri, Sharma and Pattania

Course Outcomes(COs):

At the end of the course, students will be able to:

1. Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
5. List major chemical reactions that are used in the synthesis of molecules.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1				2	2					1
CO2		1		2		1	1					
CO3		2			1		2					2
CO4				1	1		2					
CO5	1			1	2		1					

R20 (With effect from the academic year 2020-21)

EN 103 ENGLISH

Instruction Hours/week :2(L) Credits : 2
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

This course enables the students to

1. Learn the elements of grammar and composition of English Language.
2. Learn literary texts such as Short stories and prose passages.
3. Maintain linguistic competence through training in vocabulary, sentence structures and pronunciation.
4. Understand the communication skills by cultivating the habit of reading comprehension passages.
5. Know the language skills like listening, speaking ,reading and writing.
6. Study self-instructedlearnerfriendlymodesoflanguagelearningthroughcompetence.

UNIT I

Vocabulary Building

The concept of Word Formation- Root words from foreignlanguagesand their use in English- Acquaintancewith prefixes and suffixes from foreign languages in English form derivatives- Synonyms,antonyms,and standard abbreviations.

UNIT II

Basic Writing Skills

SentenceStructures – Useof phrases andclauses in sentences –Importanceofproperpunctuation - Creating coherence – Organizingprinciplesof paragraphs in documents -Techniques for writingprecisely

UNIT III

Identifying CommonErrorsinWriting

Subject-verb agreement -Noun-pronoun agreement -Misplaced modifiers -Article -Prepositions -Redundancies -Clichés

UNIT IV

NatureandStyleofsensible Writing

Describing - Defining - Classifying –Providingexamples or evidence –Writingintroductionand conclusion

UNIT V

Writing Practices

Comprehension - Précis Writing –EssayWriting

Reference/Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper ResourceBook. 2001
4. Study Writing. LizHamp- Lyonsand Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay KumarandPushplata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts.I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes(COs):

At the end of the course, students will be able to:

1. Learn the elements of grammar and composition of English Language.
2. Learn literary texts such as Short stories and prose passages.
3. Maintain linguistic competence through training in vocabulary, sentence structures and pronunciation.
4. Develop communication skills by cultivating the habit of reading comprehension passages.
5. Develop the language skills like listening, speaking, reading and writing.
6. Make use of self-instructed learner friendly modes of language learning through competence.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2									
CO2	2		2	2								
CO3		1		2	2							
CO4			2	2	3							
CO5		1	1	2								
CO6												

EE 104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Instruction Hours/Week : 3 (L) +1(T) Credits: 4
Sessional Marks : 40 End Semester Examination Marks:60

Course Educational Objectives(CEOs):

This course enable the students to

1. UnderstandthebasicconceptsofD.C.singlephaseand3-phasesupplyandcircuitsandsolve basic electrical circuit problems
2. Understandthebasicconceptsoftransformersandmotorsusedasvariousindustrialdrives
3. Understandtheconceptofpowerfactorimprovementforindustrialinstallationsandconceptsof most economical power factor
4. Understandtheoperationandcharacteristicsofdiodes,transistors,integratedcircuitsanddigital circuits.

Unit-I

Electric DC Circuits: Kirchhoff's Voltage & Current laws, Superposition Theorem, Star – Delta Transformations.
AC Circuits: Complex representation of Impedance, Phasor diagrams, Power & Power Factor, Solution of Single Phase Series & Parallel Circuits. Solution of Three Phase circuits and Measurement of Power in Three Phase circuits.

Unit-II

Single Phase Transformers: Principle of Operation of a Single Phase Transformer, EMF equation, Regulation and Efficiency of a single phase transformer.
DC Machines: Principle of Operation, Classification, EMF and Torque equations,
Characteristics of Generators and Motors

UNIT-III

Three Phase Induction Motor: Principle of Rotating Magnetic Field, Principle of Operation of 3-φ I.M., Torque-Speed Characteristics of 3-φ I.M.

UNIT-IV

p-n junction operation, diode applications, Zener diode as regulator.
Transistor and applications: Introduction to transistors, BJT Characteristics, biasing and applications

UNIT-V

Integrated Circuits: Operational amplifiers, Applications: adder, subtractor, Integrator and Differentiator.
Digital Circuits: logic gates, Combinational Logic circuits, Flip-Flops, counters and shift registers, Laboratory measuring instruments: digital multi-meters and Cathode Ray Oscilloscopes (CRO's).

Text Books :

1. Electrical Technogy by Edward Hughes
2. Basic Electrical Engineering byNagrath and Kothari

Course Outcomes(COs) :

At the end of the course, students will be able to:

1. Understand the basic concepts of D.C. single phase and 3- phase supply and circuits and solve basic electrical circuit problems

2. Understand the basic concepts of transformers and motors used as various industrial drives
3. Understand the concept of power factor improvement for industrial installations and concepts of most economical power factor
4. Understand the operation and characteristics of diodes, transistors, integrated circuits and digital circuits

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1		1		1			1	
CO2	2	2	2	1		1		1			1	
CO3	2	2	2	1		1		1			1	
CO4	2	2	2	1		1		1			1	

R20 (With effect from the academic year 2020-21)

ME 105 ENGINEERING GRAPHICS AND DESIGN

Instruction Hours/week :2(L) +3(P) Credits : 3.5
Sessional Marks : 40 Semester End Examination Marks : 60

Course Educational Objectives(CEOs):

This course enables the students to

1. Study about distinction between first angle projection and third angle projection of drawing.
2. understand hyperbola, parabola, Involutes and Cycloidal curves.
3. Study the sections of solids including cylinders, cones, prisms and pyramids.
4. Understand the projections of lines, planes, solids and sections of solids.
5. Know the orthographic projections of lines, planes, and solids.

Unit I

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments,lettering, Conic sections including the Rectangular Hyperbola (General method only);Cycloid,Epi-cycloid, Hypo-cycloid and Involutes.

Unit II

Scales

Scales– construction of Plain &Diagonal Scales.

Projections of points, lines

Projections of Points and lines inclined to both planes, including traces;

Unit III

Projections of planes

Projections of planes (Regular surfaces only) inclined Planes-Auxiliary Planes;

Projections of Regular Solids (Simple solids - cylinder, cone, prism & pyramid)thoseinclined to both the Planes-Auxiliary Views;

Unit IV

Isometric Projections& Orthographic projections

Principles of Orthographic Projections-Conventions Draw simple objects, dimensioning and scale.Principlesof Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Unit V

Introduction to CAD

CAD workstation and peripherals, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars Standard, Object Properties, Draw, Modify and Dimension, Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom used in CAD, Select and erase objects.;

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. &Ingle P.R., (2014), Engineering Drawing, CharotarPublishing House
2. Shah,M.B.&RanaB.C.(2008),EngineeringDrawingandComputerGraphics,PearsonEducation
3. AgrawalB.&AgrawalC.M.(2012),Engineering Graphics, TMH Publication
4. Narayana, K.L. &P Kannaiah(2008),Text book on Engineering Drawing, ScitechPublishers
5. Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes(COs):

At the end of the course, the student will be able to :

1. Make a distinction between first angle projection and third angle projection of drawing.
2. Draw hyperbola, parabola, Involutes and Cycloidal curves.
3. Draw sections of solids including cylinders, cones, prisms and pyramids.
4. Draw projections of lines, planes, solids and sections of solids.
5. Draw orthographic projections of lines, planes, and solids.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	2	1	1			1	1					
CO2	2	1				1	1					
CO3		2		2		2						1
CO4			1	2			1					
CO5		1		2		3						

EN 106 ENGLISH COMMUNICATION LAB

Instruction Hours/week :3(P) Credits :1.5
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

This course enable the students to know about the basic proficiency in English including reading and listeningcomprehension, writing and speaking skills.

Listening Comprehension -Pronunciation, Intonation, Stress and Rhythm -Common EverydaySituations: Conversations andDialogues -Communication at Workplace -Interviews -Formal Presentations

Reference/Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. RemedialEnglish Grammar.F.T. Wood. Macmillan.2007
3. OnWritingWell.William Zinsser. Harper ResourceBook. 2001
4. StudyWriting.LizHamp– Lyonsand Ben Heasly.CambridgeUniversity Press. 2006.
5. Communication Skills. SanjayKumarandPushpalata. Oxford University Press. 2011.
6.Exercises in Spoken English.PartsI-III.CIEFL, Hyderabad. Oxford University Press

Course Outcomes(COs):

1. The student will acquire basic proficiency in English including reading and listening comprehension, writingand speaking skills.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2									

II Semester – Scheme &Syllabus
(R20 Regulations)

SECOND SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
MA 201	Mathematics – II	3	1	-	4	4	40	60	100
PY 202	Engineering Physics	3	1	-	4	4	40	60	100
CS 203	Programming for Problem solving	2	1	-	3	3	40	60	100
CE 204	Engineering Mechanics	3	1	-	4	4	40	60	100
ME 205	Workshop/Manufacturing Practices	-	-	3	3	1.5	40	60	100
CS 206	Computer Programming Lab	-	-	3	3	1.5	40	60	100

CE 207	Environmental Science	4	-	-	4	-	100	-	100
Total		15	4	6	25	18	340	360	700

- **All courses- 40Marks Internal + 60 Marks (Univ/Semester End),**

*** Audit Course 100Marks(Internal) – Zero Credits**

Category		**No. of. Courses**	**Credits**
Basic Science Courses	- BSC	02	08
Basic Engg. Courses	- BE	04	10
Audit Course	-AC	01	0
		Total Credits	**18**

MA 201 MATHEMATICS II

R20 (With effect from the academic year 2020-21)

Instruction Hours/Week : 3(L) +1(T) Credits : 4

Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

This course enable the students to

1. Understand ranks of matrices to decide whether the system of linear equations is consistent or not
2. Study How to Apply Cayley-Hamilton theorem to find inverses or powers of matrices.
3. Understand the Eigen values and vectorstoreduceQuadraticformstonormal form.
4. To know how to analyze motion problems from real lines to curves and surfaces in 3-D and use tools such as divergence and curl of vector and gradient, directional derivatives that play significant roles in many applications.
5. Study how to useGreen'stheoremtoevaluatelineintegralsalongsimpleclosedcontoursonthe plane
6. Understand the use of Stokes'theoremto giveaphysical interpretation ofthe curl of avectorfield
7. Know the divergence theorem to give a physical interpretation of the divergence of a vector field.
8. understand the Fourier Series to representa function as a series of constants times sine and cosinefunctions of different frequencies in order to observe periodic phenomenon.
9. Know how to Evaluatecertainimproperintegralstomakethemsimplewithintroductionof Gammaand Beta functions.
10. Understand the certain special functions that arise in solving certain ordinary differential equations tomodel many physical phenomena.

Unit I

Matrices: rank of a matrix-solution of system of linear equations-Eigen values, vectors –Canley-Hamilton theorem-quadratic forms-diagonalization.

Unit II

Vector Calculus: Gradient, Divergence, Curl of a vector and related properties-line, surface, volume integrals- Green's, Stokes's and Gauss Divergence theorems and its applications.

Unit III

Fourier Series: Fourier series-even and odd functions, periodic functions-half range sine and cosine series-harmonic analysis.

Unit IV

Special Functions I: Gamma and Beta functions-series solutions of differential equations-ordinary points.

Unit V

Special Functions II: Bessel function-recurrence formulae-generating function for $J_n(X)$-Lengender polynomials-recurrence formulae-generating function for $P_n(X)$ - Rodriguez's formula - orthogonality of Lengender polynomials.

Text/Reference Books

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
   Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

Course Outcomes:

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

CO 1: Check whether the system of linear equations is consistent or not, Use Cayley-Hamilton theorem to find inverses or powers of matrices and Use Eigen values and vectors to reduce Quadratic forms to normal form.
CO2: Analyze motion problems from real lines to curves and surfaces in 3-D and use tools such as divergence and curl of vector and gradient, directional derivatives that play significant roles in many applications, Use Green's theorem, Stokes' theorem and divergence theorem evaluate the applications of integrals.
CO3: Find the Fourier series to represent function as a series of constants times sine and cosine functions of different frequencies in order to observe periodic phenomenon.
CO4: Evaluate certain improper integrals to make them simple with introduction of Gamma and Beta functions.
CO5: Study certain special functions that arise in solving certain ordinary differential equations to model many physical phenomena by using Bessel's and Legendre's equations.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	0	2	0	0	0	0	2	2	2
CO2	3	2	2	1	2	0	0	0	0	2	2	2
CO3	3	2	2	1	2	0	0	0	0	2	2	2
CO4		2	2	0	2	0	0	0	0	2	2	2

	3											
CO5	3	2	2	0	2	2	0	0	0	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PY 202 ENGINEERING PHYSICS

Instruction: Hours/Week: 3 (L) +1(T) Credits: 4
Sessional Marks: 40 End Semester Examinations Marks :60

Course Educational Objectives(CEOs):

This subject enables the student to

1. know how to Develop appropriate competence and working knowledge of laws of modern Physics in understanding advanced technical engineering courses
2. understand the quantum mechanics and ultimately the quantum behavior of charged particles when they are in motion.
3. Study the identify and apply appropriate analytical and mathematical tools of Physics in solving Engineering problems
4. understand the basic principles of Mechanics of rigid body and continuous media and their applications understand the principles in electrostatics and electromagnetics and magnetic properties of materials.
5. Study the size depended properties of nano-dimensional materials and their effective utilization in making nano- and micro-devices for further microminiaturization of electronic devices.

6. Know how to thinkandparticipatedeeply,creatively,andanalyticallyinemergingareasofengineering technology.
7. Study the thebasicsofinstrumentation,designoflaboratorytechniques,measurement,data acquisition, interpretation, and analysis.
8. Understand the multidisciplinaryexperiencesthroughoutthecurriculum.

UNIT I

Wave Optics

Interference: Huygen`s Principle-Principle of Superposition-Interference of Light-Young`s double slit experiment- -Newton's Rings.

Diffraction: Fraunhofer Diffraction at a Single Slit and a Circular Aperture-Plane Diffraction grating –Resolving Power-Rayleigh`s Criterion-Resolving power of Grating and Microscope.

Lasers : Introduction – Spontaneous and Stimulated Emission of Radiation – Population Inversion – Types of Lasers – Ruby Laser – He-Ne Laser – Semiconductor Laser – Applications of Lasers.

UNIT II

Mechanics of Rigid Body

Rigid Body-Rotational Motion and Kinematics Relations-Kinetic Energy and Angular Momentum of a Rotating Body-Equation of Motion of a Rigid body (Torque of a Rigid Body)-Combined Translation and Rotational Motion of a Rigid Body- Body Rolling on an inclined Plane.

Mechanics of Continuous Media

Elasticity, Stress and Strain- Hook`s Law and Behaviour of Wire Under Load- Elastic Constants-Relation Between Elastic Modulii-Types of Supports, Beams and Loads-Different types of Bending-Cantilever with an End Load. Ultrasonic Waves - Sound Absorption and Reverberation -Sabine Formula - Acoustics of Buildings.

UNIT III

Electromagnetism and magnetic properties of Materials

Laws of Electrostatistics- Electric Current- Laws of Magnetism- Ampere`s, Faraday`s laws-Maxwells Equations – Polarization - Permeability and dielectric constant- Polar and non-polar Dielectrics, Clausius-Mossotti equation, Applications of Dielectrics.

Magnetization - Permeability and Susceptibility- Classification of Magnetic Materials, Ferromagnetism-Magnetic Domains and Hesteresis, Applications of ferromagnetic materials.

UNIT IV

Quantum Mechanics

Wave – Particle duality – de Broglie Concept of Matter Waves – Properties of Matter Waves – Davison and Germer Experiment – G.P.Thomson Experiment – Heisenberg's Uncertainty Principle – Schrödinger's Time Independent and Time Dependent Wave equation – Significance of Wave Function – Electron in an Infinite Square Potential Well – Probability Densities and Energy Levels

UNIT V

NanoPhysics and Nanotechnology

Introduction to Nanomaterials –Properties: Optical Properties – Quantum Confinement – Electrical properties. Synthesis of Nanomaterials: Ball milling, Arc deposition method – Chemical Vapour Deposition-Pulsed laser deposition. Characteristics of C^{60} (Zero dimensional), Carbon Nanotubes (One Dimensional) and Graphene(Two Dimensional). Applications of Nanomaterials.

Text Books / Reference Books:

1. R.K.Gaur and S.L.Gupta ``Engineering Physics" Sultan and Chand Pub., New Delhi
2. S.L.Gupta and SanjeevGupta`UnifiedPhysics`Vol.I Jai PrakashNath& Co., Meerut.
3. HitendraK.Malik and A.K.Singh ``Engineering Physics" Tata MCGraw Hill Education PVt.Ltd., New Delhi
4. M.N.Avadhanulu and P.G.Kshirsagar ``A Text Book of Engineering Physics`` S.Chand and Company Pvt.Ltd., New Delhi
5. B.L Theraja, "Modern physics", S.Chand& Company.
6. V. Raghavan "Material Science", Tata McGraw Hill Publications.
7. M.S.RamachandraRao and Shubra Singh, ``Nanoscience and Nanotechnology`` Wiley India Pvt.Ltd, New Delhi

Course Outcomes(COs):

At the end of the course, students will be able to:

1. Develop appropriate competence and working knowledge of laws of modern Physics in understanding advanced technical engineering courses
2. Understand the quantum mechanics and ultimately the quantum behaviour of charged particles when they are in motion.
3. Identify and apply appropriate analytical and mathematical tools of Physics in solving Engineering problems
4. Apply the basic principles of Mechanics of rigid body and continuous media and their applications
5. Understand the principles in electrostatics and electromagnetics and magnetic properties of materials.
6. Understand size depended properties of nanodimensional materials and their effective utilization in making nano- and micro-devices for further microminiaturization of electronic devices.
7. Think and participate deeply, creatively, and analytically in emerging areas of engineering technology.
8. Learn the basics of instrumentation, design of laboratory techniques, measurement, data acquisition, interpretation, and

analysis.

9. Provide multidisciplinary experiences throughout the curriculum.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2									
CO2	2		2	2								
CO3		1		2	2							
CO4			2	2	3							
CO5		1	1	2								
CO6												
CO7												
CO8												
CO9												

CS 203 PROGRAMMING FOR PROBLEM SOLVING

Instruction Hours / Week : 2(L) + 1(T) Credits : 3

Sessional Marks : 40 Semester End Examination Marks : 60

Course Educational Objectives(CEOs):

1. To acquire problem solving skills
2. To be able to develop flow charts and algorithms for the given problem
3. To learn how to write modular programs in C
4. Toenabletousearrays,pointers,stringsandstructuresinsolvingproblems.
5. To explain the difference between object-oriented programming and procedural programming.
6. To understand principles of object-oriented programming.

UNIT-I

Introduction to Programming -Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -

Idea of Algorithm: steps to solve logical and numerical problems. Representation ofAlgorithm: Flowchart/Pseudocode with examples -From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code -Arithmetic expressions and precedence**.**

UNIT-II

Conditional Branching and Loops - Writing and evaluation of conditionals and consequent branching - Iteration and loops -Arrays (1-D, 2-D), Character arrays and Strings.

UNIT-III

Basic Algorithms -Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection) -Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT-IV

Functions -Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference - Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc - Quick sort or Merge sort.

UNIT-V

Structure -Structures, Defining structures and Array of Structures- Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

File handling.

Text Books / Reference Books :

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes(Cos):

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

1. Develop and test programs in C and correct syntax and logical errors.
2. Implement conditional branching, iteration and recursion.
3. Decompose a problem in to functions and synthesize a complete program.
4. Usearrays,pointers,stringsandstructurestoformulatealgorithmsandprograms
5. Use files toper form read and write operations.
6. Handleprogrammingassignmentsbasedonclass,abstraction,encapsulation,overloadingand inheritance.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		3			2			2		2
CO2	2	3	2		3					2		
CO3		2	1								3	
CO4		3										
CO5			3									
CO6												

CE 204 ENGINEERING MECHANICS

Instruction Hours/Week: 3(L) + 1(T) Credits :4

Sessional Marks: 40 End Semester Examination : 60

Course Educational Objectives(CEOs):

1. Introduce basic knowledge on different forces in a system and their applications
2. Impart knowledge on analysis of trusses, joints and methods of sections
3. Familiarize with evaluation of Centre of Gravity and Moment of Inertia for different geometrical sections.
4. Acquaint with different stress, strains and their relationships.
5. Impart basic understanding on impact of loading on strain energy and its applications.

UNIT I

STATICS : Basic concepts – System of force, Concurrent and non-concurrent coplanar and non-coplanar forces – Resultant – Moment of force and its application – Couples and resultant of force systems – Equilibrium of systems of forces – Free body diagrams, Equations of equilibrium of coplanar systems and spatial systems.

UNIT II

ANALYSIS OF PLANE TRUSSES : Types of supports – Types of trusses – Analysis of trusses using method of joints and method of sections.

UNIT III

CENTRE OF GRAVITY AND MOMENTS OF INERTIA: Theory of Pappus – Centroids of composite figures – Areas of gravity of bodies – Moment of inertia – Parallel and perpendicular axis theorems – Moments of inertia of composite areas (rolled and built up sections) – Radius of gyration of areas.

UNIT IV

SIMPLE STRESES AND STRAINS : Elasticity and plasticity – 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 relationship between elastic constants – Bars of varying section – Composite bars – Temperature stresses.

UNIT V

STRAIN ENERGY : Gradual, sudden and impact loading – Endurance limit principles of virtual work and its applications.

TEXT BOOKS :

1. Ghose D.N. – Applied Mechanics and Strength of Materials.
2. Timoshenko & Young – Engineering Mechanics.

3. Junarkar SB – Mechanics of Structures – Vol. I.
4. Junarkar SB – Elements of Applied Mechanics.

Course Outcomes(Cos) :

At the end of the course, students will be able to:

1. Apply the basic knowledge of force system.
2. Know the types of supports, trusses and joints that occur in civil engineering structures
3. Know the evaluation methods for geometrical properties of different cross sections.
4. Understand different types of stresses, strains and elastic constants.
5. Understand the impact of internal forces under different types of loading on strain energy.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	3	2	1				3	2	2	1		3	2
CO2	3	3	3	1	2		1		3	2	2	1		3	2
CO3	3	2	3	1	2				3		2	1		3	1
CO4	3	2	3	1	2				3		2	1		3	1
CO5	3	2	3	1	2				3		2	1		3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

ME 205 WORKSHOP/MANUFACTURING PRACTICES

Instruction Hours/week **:** 3(P) Credits : 1.5

Sessional Marks : 40 End Semester Examinations Marks : 60

Course Educational Objectives(CEOs):

This course enables the students

To understand the concept of fabrication of components with their own hands

WorkshopPractice:
1.Machineshop
2.Fittingshop
3.Carpentry
4.Electrical wiring
5.Weldingshop
6.Casting
7.Smithy
8.Plasticmoulding&GlassCutting

choose any of the above Five for practice

Examinations could involve the actual fabrication of simple components, utilizing one or More of the techniques covered above.

Detailedcontents
1.ManufacturingMethods-casting,forming,machining,joining, advancedmanufacturing methods
2. CNCmachining, Additivemanufacturing
3. Fittingoperations&powertools
4. Electrical&Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metalcasting
8. Welding(arc welding&gas welding), brazing
The above course content is learnt by online videos/ppt presentations.

Text/ReferenceBooks:
1. HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"Elementsof Workshop Technology", Vol. I 2008and Vol. II 2010, Media promoters and publishersprivatelimited,Mumbai.
2. KalpakjianS.AndStevenS.Schmid,"ManufacturingEngineeringandTechnology", 4th edition,PearsonEducationIndiaEdition,2002.

3. GowriP.HariharanandA.SureshBabu,"ManufacturingTechnology–I" Pearson Education,2008.
4. RoyA.Lindberg,"ProcessesandMaterialsof Manufacture",4th edition,PrenticeHall India,1998.
5. RaoP.N., "ManufacturingTechnology",Vol.IandVol.II,TataMcGrawHillHouse, 2017

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

Course Outcomes(Cos):

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		1		1	1						1

CS 206 COMPUTER PROGRAMMING LAB

Instruction Hours / Week ; 3(P) Credits : 1.5
Sessional Marks : 40 Semester End Examination Marks : 60

Course Educational Objectives(CEOs):

At the end of the course, students will be enable to develop Programming concepts to

1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in C language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Assignments in C

Variable types and type conversions:

Simple computational problems using arithmetic expressions

Branching and logical expressions:

Problems involving if-then-else structures

Loops, while and for loops:

Iterative problems e.g., sum of series

1D Arrays: searching, sorting:

1D Array manipulation

2D arrays and Strings

Matrix problems, String operations

Functions, call by value

Simple functions

Numerical methods (Root finding, numerical differentiation, numericalintegration):

Programming for solving Numerical methods problems

Recursion, structure of recursive calls

Recursive functions

Pointers, structures and dynamic memory allocation

Pointers and structures

Assignments in C and JAVA

File handling
File operations

Course Outcomes(Cos):

At the end of the course, students will be able to develop Programming concepts to

1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in C language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		3			2			2		2
CO2	2	3	2		3					2		
CO3		2	1								3	
CO4		3										
CO5			3									
CO6												
CO7												
CO8												

CE 207 ENVIRONMENTAL SCIENCE

Instruction Hours/week**:** 4(L) Credits :--
Sessional Marks : 100 End Semester Examinations Marks : --

Course Educational Objectives(CEOs):

1. Introduce the scope and importance of environmental resources and their sources

2. Impart knowledge on Ecosystem and Biodiversity
3. Impart knowledge on causes and consequences of Environmental pollution its Global effects
4. Familiarize with environmental issues and their management
5. Outline different social issues and the guidelines formulated for protection of environment.

UNIT I

Environmental Studies and Natural Resources

Definition, Scope and importance of Environment, Environmental studies, Need for public awareness

Components of Environment- Atmosphere, Hydrosphere, Lithosphere.

Renewable and **Non Renewable Resources and associated problems**

Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Land resources: Land as a resource, land degradation, Man induced landslides, soil erosion and desertification.

Mineral resources: Use and overexploitation, Environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity, Case studies.

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

Role of an individual in conservation of natural resources.

UNIT II

Ecosystem and Biodiversity

Ecosystem - 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.

(a)Forest ecosystem. (b) Grassland ecosystem

(c)Desert ecosystem. (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation:
Definition, genetic species and ecosystem diversity.
Biogeographically classification of India.
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
Environmental pollution and Global Effects
Definition, Causes, Effects, and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) 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, earthquakes, cyclone, landslides, Tsunami.
Climate change-Global warming, Acid rain, Ozone depletion.

UNIT – IV
Environment Issues and Management
Environment and Human health – Epidemic diseases, HIV/AIDS, Aviation Flue, Water Borne Diseases.
Environmental Impact Assessment, Sustainable Development, Clean Production and Clean Development Mechanisms
Environment Legislation: Environmental Protection Act, Water Act, Air Act, Wild Life Protection Act, Forest Conservation Act, Public Liability & Insurance Act, Issues involved in Enforcement of Environmental legislation.

UNIT – V
Social Issues and the Environment
Population growth, Population Explosion, Population Control, Women and Child welfare.
Urbanization, Industrialization, Development projects, Resettlement and Rehabilitation of people – Problems concerned, Case studies.

Consumerism and Waste Products Conservation, Public Awareness, Water Conservation, Rain water harvesting, watershed management, Wasteland reclamation, Human Rights, Value education, Environmental ethics- Issues and possible solution.
Role of information Technology in Environment and Human Health.

Text Books / Reference Books :

1. AnubhaKaushik& C P Kaushik, Environmental studies, New age International Publishers, 2008
2. Benny Joseph, Environmental studies, Tata McGraw-Hill Publishers, 2005
3. M Chandra Sekhar, Environmental Science, Hi-Tech Publishers, 2004
4. Keerthinarayana and Daniel Yesudian, Principles of Environmental Sciences and Engineering , Hi-Tech Publishers, 2005
5. AmalK.Datta, Introduction to Environmental Science and Engineering, Oxford & IBH Publishing Co.Pvt.Ltd, 2000
6. SanthoshkumarGarg,RajeshawriGarg and RajniGarg, Ecological and Environmental studies, Khanna publishers, 2006
7. Gilbert M, Introduction to Environmental Engineering and Science, Masters Publication by Prentice –Hall of India Private Ltd., 1991
8. William P Cunningham and Mary Ann Cunningham, Principles of Environmental Science, Tata McGraw Hill Publishing Co.Ltd, 2002

Course Outcomes(Cos):

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

1. Acquire knowledge in diverse components of environment and natural resources.
2. Understand ecosystem and biodiversity and its conservation methods.
3. Identify and resolve the issues related to sources of different types of pollution and its global effects
4. Provide solutions to individuals, industries and government for sustainable development of natural resources
5. Apply environmental ethics in resolving social issues for protection of diversified ecosystems.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1						**3**		**3**	**2**	**1**	**2**	**3**		**3**	**2**
CO2								**3**	**2**	**1**	**2**	**3**		**3**	**2**
CO3								**3**	**2**					**3**	**2**
CO4								**3**	**2**					**3**	**1**
CO5								**3**	**2**					**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

III Semester – Scheme &Syllabus
(R20 Regulations)

THIRD SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
MA301B	Mathematics – III *(Common to all branches)*	3	-	-	3	3	40	60	100

CE302C	Strength of Materials	3	-	-	3	3	40	60	100
HS303C	Managerial Economics and Accountancy *(Common to all branches)*	3		-	3	3	40	60	100
CE304C	Surveying	3	-	-	3	3	40	60	100
CE305C	Building Materials and Construction	3		-	3	3	40	60	100
CE306C	Engineering Geology	3	-	-	3	3	40	60	100
CE 307P	Surveying Lab	-	-	3	3	1.5	40	60	100
CE 308P	Materials Testing Lab	-	-	2	2	1	40	60	100
CE309S	Skill Development Course1	1	-	2	3	2	40	60	100
MC310A	Constitution of India *(Common to all branches)*	2	-	-	2	-	40	60	100
Total		21		**7**	**28**	**22.5**	**400**	600	1000

Category		**No. of. Courses**	**Credits**
Basic Science Course	- BS	01	03
Professional Core Course	-PC	06	14.5
Humanities and Social Sciences	-HSS	01	03
Skill Oriented Course	-SC	01	02
Mandatory Course	-MC	01	0
		Total Credits	**22.5**

MA 301B Mathematics – III

Instruction Hours/week: 3(L) **Credits :3**

Sessional Marks : 40 **Semester-end Examination Marks: 60**

Course Educational Objective (CEOs):

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering

2. To provide an overview of probability and statistics to engineers

UNIT I

Complex analysis - I: Analytical functions - Cauchy-Riemann equations – Construction of Analytic functions- Complex integration - Cauchy's theorem - Integral formula - Evaluation of integrals.

UNIT II

Complex analysis - II: Taylor's and Laurent's' series- Transformations- Conformal mapping - Bilinear transformations - Transformation of 1/z, z^2, sin z and cos z.

UNIT III

Complex analysis –III: Singularities - Poles - Residues - Residue theorem – Contour integration- Evaluation of real integrals

UNIT IV

Partial differential equations - I : Formation of differential equations - Classification - First order linear partial differential equations – Lagrange's' linear equation - Method of multipliers - first order non-linear partial differential equations - Charpits method.

UNIT V

Partial differential equations - II: Method of separation of variables - One dimensional wave equation - Heat equation – Laplace's equation.

Text Books:

1. Grewal B S, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. Venkataraman M K, Engineering Mathematics, Vol. I & II, National Publishing Company, 1993.
3. Venkataraman M K, Engineering Mathematics, National Publishing Company, 1995.
4. Grewal B S, Engineering Mathematics, 13th Edition, Khanna Publications.
5. Kreyszig E, Advanced Engineering Mathematics, 8th edition, Wiley, 1998.

CO 1: After the completion of course, students will be able to understand the analyticity of complex functions and conformal mappings, Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
CO2: Apply Taylor's and Laurent's series to solve problems, Describe conformal mappings between various plane regions.
CO3: Compute the residue of a function and use the Residue Theory to evaluate a contour integral or an integral over the real line.

CO4: Formulate/solve/classify the solutions of Partial differential equation, Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method.
CO5: Apply Variables separable methods to solve boundary value problems and Find the solution of one dimensional wave equation, heat equation and Laplace equation.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	0	2	0	0	0	0	2	2	2	3	2
CO2	3	2	2	1	2	0	0	0	0	2	2	2	3	2
CO3	3	2	2	1	2	0	0	0	0	2	2	2	3	2
CO4	3	2	2	0	2	0	0	0	0	2	2	2	3	2
CO5	3	2	2	0	2	2	0	0	0	2	2	2	3	2

* * * * *

CE 302C STRENGTH OF MATERIALS

Instruction Hours/week : 3(L) **Credits :3**
Sessional Marks : 40 **Semester-end Examination Marks:60**

Course Educational Objective (CEOs):

1. To acquire the knowledge about behavior of members subjected to various types of forces on the members.
2. To impart procedure for drawing shear force and bending moment diagrams for beams.
3. To make the student able to analyze flexural stresses in beams due to.
4. To enable the student to apply the concepts of strength of materials in engineering applications and design problems.

UNIT I

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 overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads - Point of contra flexure - Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT II

FLEXURAL STRESSES AND SHEAR STRESSES:

Theory of simple bending - Distribution of flexural stresses and shear stresses - Resilience due to flexure and shear. Principal stresses and principal strains - Mohr's circle of stresses.

UNIT III

COMBINED DIRECT AND BENDING STRESSES:

Stresses under the combined action of direct loading and B.M - Core of a section - Circular, rectangular and triangular (solid and hollow) - Determination of stresses in the case of chimneys, retaining walls and dams.

UNIT IV

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 – eccentric loading and Secant formula – Prof. Perry's formula.

UNIT V

CYLINDERS:

Thin cylinders subjected to internal fluid pressure - Thick cylinders under internal and external pressure - Compound cylinders.

TEXT BOOKS:

1) Mechanics of Structures Vol.I & Vol.II by S.B.Junnarkar.
2) Analysis of Structures by Vazirani & Ratwani.
3) Strength of Materials Vol.I & Vol.II by Timoshenko.
4) Strength of Materials by Andrew Pytal and Ferdinand L.Singer (Longman).

REFERENCES:

1) Engineering Mechanics by Egor. P. Popov.

Course Outcomes (COs):

After completion of the course the student will be able to:

1) Develop shear force and bending moment diagrams for different load cases.
2) Compute the flexural stresses for different load cases and different cross-sections.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	2	2	2		1	1			1	2	1	1
CO2		2	1		1	1			1	2	1	1

* * * * *

HS 303C MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction Hours/week : 3(L) **Credits :3**

Sessional Marks : 40 **Semester-end Examination Marks :60**

Course Educational Objective (CEOs):

1. To learn the fundamental concepts of economics and analysis methods.
2. To study depreciation methods and inflation process and trade policies.
3. To acquire knowledge in basic concepts of accounting, principles.
4. To learn the techniques for preparing cost sheet.

Unit -I

Introduction to Engineering Economics, Fundamental concepts, Time value of money, Cash flow and Time Diagrams, choosing between alternative investment proposals, Methods of Economic analysis (pay back, ARR, NPV, IRR and B/C ratio), The effect of borrowing on investment, Equity vs Debt Financing, concept of leverage, Income tax leverage.

Unit -II

Depreciation and methods of calculating depreciation (straight line, sum of the years digit method, Declining balance method, Annuity method, Sinking fund method), National income accounting Methods of estimation, Various concepts of National Income, Significance of National income Estimation and its limitations.

Unit -III

Inflation: Definition, Process and Theories of inflation and Measure of control. New Economic Policy 1991(Industrial Policy, Trade Policy, Fiscal Policy), Impact on Industry.

Unit -IV

Accounting Principles, procedure, Double entry system, Journal, ledger, Trial balance, Cashbook, preparation of Trading and Profit and Loss account, Balance sheet.

Unit -V

Cost Accounting: Introduction, Classification of costs, Methods of costing, Techniques of costing, Cost sheet and preparation of cost sheet, Break-even Analysis, Meaning and its application, Limitation.

TEXT BOOKS:

1. Henry Malcom Steiner, Engineering Economics Principles, 2nd Edition, McGraw Hill Education, 1996.
2. Dewett. K.K., Modern Economic Theory, Sultan Chand and Co., 2006.
3. A.N. Agarwal, Indian Economy, Wiley Eastern Limited, New Delhi.
4. Jain and Narang, Accounting Part-I, Kalyani Publishers, 2011.
5. Arora, M.N. Cost Accounting: Principles and Practice, 12th Edition,Vikas Publication, 2012.

Course Outcomes (COs): After the completion of the course the student will be able to

1. Understand Macro Economic environment of the business and its impact on enterprise.
2. Identify various cost elements of the product and its effect on decision making.
3. Understand the concepts of financial management and smart investment.
4. Prepare the Accounting records and interpret the data for Managerial Decisions.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1			**1**	**1**		**2**					**1**	
CO2			**1**	**1**		**2**					**1**	
CO3			**1**	**1**		**2**					**1**	
CO4			**1**	**1**		**2**					**1**	**1**

* * * * *

CE 304C SURVEYING

Instruction Hours/week : 3(L) **Credits :3**
Sessional Marks : 40 **Semester-end Examination Marks :60**

Course Educational Objectives (CEOs):

1. Highlight the purpose of surveying in civil engineering construction,
2. Explain different types of curves, their requirement and curve setting.
3. Formulate survey observations and perform calculations
4. Train on utilization of surveying instruments like EDM, Total station and GPS.

UNIT – I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination and dip.

UNIT – II : Levelling and Contouring

Leveling- Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes

Areas - Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

Volumes - Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT - III

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT - IV

Tacheometric Surveying: Principles of Tacheometry, stadia and tangential methods of Tacheometry.

Curves: Types of curves and their necessity, elements of simple curve, setting out of simple Curves, Introduction to compound curves. Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves.

UNIT – V: MODERN SURVEYING INSTRUMENTS:

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, Applications of GPS.

TEXT BOOKS:

1. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.
2. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
3. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill –2000.
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004.
3. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.
4. Chandra A M, "Plane Surveying", New Age International Pvt. Ltd., New Delhi, 2002.
5. Surveying by Bhavikatti; Vikas publishing house ltd.
6. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.
7. Surveying and leveling by R. Agor Khanna Publishers 2015.

Course Outcomes (COs):

After completion of the course the student will be able to:

- Identify data collection methods and prepare field notes.
- Measure and layout elevations and relative position of points, understand plans and field notes.
- Ability to design, set out curves and use modern equipment.
- Calculate angles, distances, levels, estimate measurement errors and apply corrections.
- Interpret survey data and compute areas and volumes.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**2**		**2**	**1**	**2**	**1**		**1**		**1**
CO2	**1**	**1**	**2**	**1**			**1**			**2**		**1**
CO3	**2**	**2**		**1**	**2**	**1**		**2**	**1**			**2**
CO4	**2**	**2**	**1**			**1**		**1**		**1**	**1**	**1**
CO5	**2**	**2**	**1**			**1**		**1**		**1**	**1**	**1**

* * * * *

CE 305C BUILDING MATERIALS AND CONSTRUCTION

Instruction Hours/Week: 3(L) Credits : 3
Sessional Marks : 40 Semester-end Examination Marks: 60

Course Educational Objective (CEOs):

- To learn and understand the manufacturing, physical and mechanical properties of various construction materials and their testing procedures.
- To study the basic building components.
- To learn the methods to be followed in constructing various components of a building.

UNIT-I
STONES-BRICKS
Stone as building material-Selection of stones for construction-Tests on stones-Qualities of a good building stone-Deterioration of stones-Preservation of stones.

Bricks-composition of good brick earth-Manufacture of bricks-Classification of bricks-Tests for bricks-Absorption, Crushing strength, Hardness, presence of soluble salts, shape and size, soundness, structure-Uses of bricks-Refractories.

UNIT-II
CEMENT-AGGREGATES
Cement ingredients-Setting action of cement-Manufacturing process of ordinary cement
-Types of cement – Field and laboratory tests for cement-storage and uses of cement.

Aggregates-Qualities-classification of aggregates-Testing of Aggregates—Grading of aggregates-classification of sand-Bulking of sand-properties of good sand.

UNIT-III
TIMBER AND OTHER MATERIALS
Timber-Qualities of good timber- Market forms-Industrial timber, Plywood, Veneer-.
Steel -Market forms of steel. Aluminum -properties , alloys of aluminium.

UNIT-IV

CONSTRUCTION ELEMENTS

Types of foundations, Stone Masonry-joints in stone masonry, classification of stone masonry. Brick Masonry-Bonds in brick masonry, types of brick masonry. Lintels- Types of lintels. Roofs and its types. Flooring -types of flooring, timber floors, composite floors. Damp proofing- meaning, causes, effects, materials used for damp proofing, methods of damp proofing.

UNIT-V

OTHER ELEMENTS

Pointing-objects, mortar for pointing, method of pointing, types of pointing. Plastering-requirements of good plaster, methods of plastering. Painting-types of paints, painting on different surfaces failure of paint, defects in painting. Varnishing- characteristics of ideal varnish, ingredients, types, process of varnishing. Distempering-properties, ingredients of a distemper, process of distempering.

Thermal Insulation - insulating materials, thermal insulation of exposed doors, windows, exposed roofs and exposed walls. Acoustics-definition, types of absorbent materials, conditions for good acoustics, methods of sound insulation.

TEXTBOOKS:

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015,StandardPublishers
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangwala S. C. "Engineering Materials", Charotar Publishing House, India.

REFERENCES:

1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd
3. Building Materials and Components, CBRI, 1990,India
4. Jagadish. K.S, "Alternative Building Materials Technology", New Age International,2007.
5. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

Course Outcomes (COs):

After completion of the course the student will able to:

- Explain the manufacturing, physical and mechanical properties of various construction materials and their testing procedures.
- Describe the basic building components.

- Apply the methods to be followed in constructing various components of a building.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**1**	**1**		**1**	**1**	**1**		**1**	**1**	**2**
CO2	**2**	**2**	**2**		**1**	**1**	**2**	**1**		**2**		**1**
CO3	**2**	**1**	**2**	**2**		**1**	**1**		**1**	**1**	**2**	**2**

* * * * *

CE 306C ENGINEERING GEOLOGY

Instruction Hours/Week : 3(L) Credits : 2
Sessional Marks : 40 Semester-end Examination Marks: 60

Course Educational Objective (CEOs):

1. To learn various geological parameters.
2. To study characteristics of various minerals and their Identification.
3. To study the formation and features of rocks and their Identification .
4. To learn elements of geological structures.
5. To acquire knowledge in preliminary causes for landslides and earth quakes.

UNIT – I

Introduction to geology and its various branches -Role of Earth Sciences in Civil Engineering Operations, Processes acting at the surface of the earth - Volcanism, Geological action of wind, glaciers, rivers and oceans - 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.

UNIT – II

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. Study of minerals like Garnet, Olivine, Hornblende, Augite, Calcite, Talc, Kyanite, Bauxite and Clay minerals.

UNIT – III

Petrology: Origin and formation of rocks - Classification of rocks - Igneous, Sedimentary and Metamorphic rocks - Their textures and structures -Study of rocks like Granite, Gabbro, Dolerite, Basalt, Breccia, Conglomorate, Sand stone, Shale, Limestone, Laterite, Quartzite, Schist, Gneiss, Marble, Slate. Definition of rock - Rock forming processes - Geological classification of rocks - Megascopic study, Chemical and Mineralogical Composition of rock.

UNIT – IV

Structural Geology: Elements of structural geology like strike, dip, outcrop. Study of folds, joints, faults and their importance in civil engineering works. Dykes and sills, common structures and textures - 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 – V

Geology of dams, reservoirs, tunnels landslides and rock falls. Earthquakes. Groundwater exploration. Rock as construction materials. 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.

TEXT BOOKS:

1. A text book of geology By Mukharjee.P.K.
2. A Text Book of Engineering Geology - N.Chennakesavulu.
3. Engineering and general Geology by Parbin Singh
4. Engineering Geology by R.E.Goodman

REFERENCES:

1. Principles of Engineering geology and Geotechnics By Krynine & Judd
2. Geology for Engineers by Blyth & de freitaus
3. Fundamental of Engineering Geology by F.H.Bell.

Course Outcomes (COs):

After completion of the course the student will be able to:

1. To apply the geological knowledge to Civil Engineering Constructions, at different stages. The kind of study exposes the geological draw backs, if any.
2. To help the site engineers to take suitable precautionary measures to overcome the drawbacks but also to take advantage of the site geology findings wherever possible.
3. To take precautionary measures in civil engineering constructions based on geological parameters.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**1**	**1**	**1**		**1**			**1**		**1**
CO2	**2**	**1**	**2**	**1**			**1**	**1**				
CO3	**2**	**2**	**1**					**1**				**1**

* * * * *

CE 307P SURVEYING LAB

Instruction Hours/week : 3 (P) **Credits : 1.5**

Sessional Marks : 40 **Semester-end Examination Marks: 60**

Course Educational Objective (CEOs):

1. To apply the possess knowledge about survey field techniques
2. To apply the possess knowledge about traverse survey
3. To determine distances, areas of polygons
4. To gain knowledge of modern field measurement tools and techniques

EXERCISE – 1

Measurement of distance by chain, Tape and Area of a polygon by cross staff survey

EXERCISE – 2

Compass traversing and adjustment of closing error by Bowditch method (Graphical method)

EXERCISE – 3

Plane table survey; finding the area of a given boundary

EXERCISE – 4

Fly levelling: Height of the instrument method and rise and fall method.

EXERCISE – 5

Fly levelling; Longitudinal Section and Cross sections of a given road profile.

EXERCISE – 6

Theodolite Survey: Determining the Horizontal and Vertical Angles Finding the distance between two inaccessible points.

EXERCISE – 7

Tachometric survey: Heights and distance problems using tachometric principles.

EXERCISE – 8

Set out simple curve using Perpendicular offsets from long chord and Rankine's deflection angles method.

EXERCISE – 9

Total Station: Determination of area using total station.

EXERCISE – 10

Total Station: Determination of Remote height.

Course Outcomes (COs):

After completion of the course the student will have:

1. Ability to use the techniques, skill and surveying equipment for engineering practice.
2. Ability to apply mathematics concepts in the field of surveying.
3. Ability to develop an understanding of modern surveying equipment

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**1**								**1**		
CO2	**2**	**2**								**1**		
CO3	**1**	**2**	**2**			**1**	**1**			**1**		**2**

* * * * *

CE 308P MATERIAL TESTING LAB

Instruction Hours/Week : 2(P) **Credits** : 1
Sessional Marks : 40 **Semester-end Examination Marks**: 60

Course Educational Objective (CEOs):

1. To make student understand the fundamental modes of loading of the structures
2. To train student in methods for determining mechanical properties of materials.

LIST OF EXPERIMENTS

1. Tension and Torsion Test on Mild Steel bar and HYSD bar
2. (a) Deflection Test on Simply Supported Beam
   (b) Charpy Impact Test
3. (a) Deflection Test on Fixed Beam
   (b) Izod Impact Test
4. (a) Compression Test on Wood
   (b) Shear Test on Wood
5. (a) Test on Closed coil Helical Spring
   (b) Bending Test on Carriage Spring
6. (a) Deflection Test on beam under Uniform Bending
   (b) Bending Test on R.S. Joist

7 Sieve Analysis of coarse and fine aggregates
8 Bulking of Sand by Volume and Weight methods
9 Normal consistency, Initial and Final Setting Times of Cement
10 Tests on concrete
a) Slump Test
b) Compressive Strength of Concrete Cubes
c) Compaction Factor Test
d) Compressive Strength of Concrete Cylinders
11 (a) Specific gravity & Water absorption of Coarse aggregate
(b) Specific gravity of Cement

12 Water absorption and Compressive Strength of Bricks

Course Outcomes (COs):

After completion of the course the student will be able to

1. Determine the properties of different building construction materials.
2. Analyse the behaviour of different construction materials.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	1	2	1	1		1		1	1	1	2	
CO2	2	2	1					1	1	1	1	1

* * *

R20 (With effect from the academic year 2020-21)

CE 309S COMPUTER SKILLS

Instruction Hours/week: 2 (P) **Credits :1**

Sessional Marks : 40 **Semester-end Examination Marks: 60**

Course Educational Objectives (CEOs):

1. To learn and use MSWORD.
2. To learn and use MSEXCEL,MSPOWERPOINT
3. To learn and browse the INTERNET and EMAIL

EXERCISE – 1:
MS WORD: Text Basics, Text Formatting and saving file, working with Objects

EXERCISE – 2 :
MS WORD: Header & Footers, Working with bullets and numbered lists, Tables

EXERCISE –3:
MS WORD: Styles and Content, Merging Documents, Sharing and Maintaining Document

EXERCISE –4 :
MS WORD: Sharing and Maintaining Document, : Proofing the document, Printing

EXERCISE –5:
MS EXCEL: Introduction to Excel, Formatting excel work book

EXERCISE –6
MS EXCEL: Perform Calculations with Functions, Sort and Filter Data with Excel

EXERCISE – 7:
MS EXCEL: Create Effective Charts to Present Data Visually, Analyze Data Using PivotTables and Pivot Charts, Protecting and Sharing the work book

EXERCISE – 8:
MS EXCEL: Use Macros to Automate Tasks, Proofing and Printing

EXERCISE – 9:
MS POWER POINT: Setting Up PowerPoint Environment, Creating slides and applying themes, Working with bullets and numbering, Working with Objects, Slide show option and print

EXERCISE – 10:
INTERNET AND EMAIL: What is Internet, Receiving Incoming Messages , Sending Outgoing Messages, Email addressing , Email attachments, Browsing, Search engines , Text chatting, Job Searching.

COURSE OUTCOMES (COs):

After completion of the course the student will be able to:

1. Use MS WORD, MS EXCEL AND POWER POINT in any civil engineering project works and for personal works.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	2	2	2	1	2	1		1	1	2		1

* * * * *

MC310A CONSTITUTION OF INDIA

Instruction Hours/Week : 2(L) **Credits : -**
Sessional Marks : 100 **End Semester Examinations Marks : -**

Course Educational Objectives(CEOs): Students will learn:

1. To Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit-I

History of Making of the Indian Constitution:

History **,**Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution: Preamble Salient Features

Unit-II

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-III

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-IV

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: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit-V

Election Commission:

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS/REFERENCES:

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.

Course Outcomes(COs):

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 passage of the Hindu Code Bill of 1956.

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**			**2**	**1**	**2**			**2**	**1**	**1**
CO2	**2**	**1**	**1**		**1**	**1**				**1**	**1**	**1**
CO3	**2**	**2**			**2**	**1**	**2**			**2**	**1**	**1**
CO4					**2**	**1**	**2**			**2**	**1**	**1**

* * * * *

IV Semester – Scheme &Syllabus
(R20 Regulations)

FOURTH SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
MA401C	Probability &Statistics *(Common to all branches)*	3	-	-	3	3	100	-	100
CE402C	Concrete Technology	3	-	-	3	3	40	60	100
CE403C	Fluid Mechanics and Hydraulic Machines	2	1	-	3	3	40	60	100
CE404C	Structural Analysis-I	2	1	-	3	3	40	60	100
CE405C	Water Quality and Treatment	3	-	-	3	3	40	60	100
CE406C	Soil Mechanics	2	1	-	3	3	40	60	100
CE407P	Fluid Mechanics and Hydraulic Machines Lab	-	-	3	3	1.5	40	60	100
CE408P	Soil Mechanics Lab	-	-	2	2	1	40	60	100
CE409S	Skill Development Course 2	1	-	2	3	2	40	60	100
CE410P	Computer Aided Building Drawing	-	-	3	3	1.5	40	60	100
MC411B	NCC/NSS/NSO	-	-	-	-	-			
Total		16	**3**	**10**	**29**	**24.0**	**400**	600	1000

Category	**No. of. Courses**	**CREDITS**
Professional Core Course-PCC	08	19
Engg. Science course -ESC	01	03
Skill Oriented Course -SC	01	02
Mandatory (**NCC/NSS/NSO)**	01	00
	Total Credits	**24.0**

MA 401C PROBABILITY & STATISTICS

Instruction Hours/Week: 3(L) **Credits: 3**
Sessional Marks : 40 **End Semester Examinations Marks: 60**

Course Educational Objective (CEOs)

The objective of this course is

1. To familiarize the students with numerical methods of solving the non-linear equations, interpolation, differentiation, integration, and ordinary differential equations.
2. To impart knowledge in basic concepts and few techniques in probability and statistics in relation to the engineering applications.

UNIT- I

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- II

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.

UNIT -III

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- IV

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 -V

SMALL SAMPLE TESTS: Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint 2012.

References

1. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Course Outcomes:

At the end of the course students will be able to

1. Evaluate approximating the roots of polynomial and transcendental equations by different algorithms
2. Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations
3. Apply discrete and continuous probability distributions
4. Design the components of a classical hypothesis test infer the statistical inferential methods

based on small and large sampling tests

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**1**		**1**		**1**			**1**	**1**	**1**
CO2	**2**	**2**	**1**	**1**	**1**		**2**		**1**	**1**	**1**	**1**
CO3	**2**	**1**	**1**		**1**		**1**			**1**	**1**	**1**
CO4	**2**	**2**	**2**	**1**	**1**		**1**			**1**	**1**	**1**

--oOo—

CE 402C CONCRETE TECHNOLOGY

Instruction Hours/Week : 3(L) **Credits : 3**
Sessional Marks : 40 **End Semester Examinations Marks : 60**

Course objectives:

1) Explain the role of ingredients of concrete and apply this knowledge to mix design philosophy
2) Develop fundamental knowledge in the fresh and hardened properties of concrete
3) Produce the testing methodology to evaluate the properties of concrete during fresh and hardened stage
4) Knowledge on the behaviour of concrete with response to stresses developed.
5) Knowledge on the special concretes and Concreting methods.

UNIT-I

CEMENTS AND AGGREGATES:

General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, hydration of cement, heat liberation from a setting cement, hardening of cement, structure of hydrated cement, water requirements for hydration.

TYPES OF CEMENTS: Ordinary Portland cement, Rapid hardening cement, Sulphate resisting cement,Portland Slag cement, Quick setting cement, Super sulphated cement, Portland pozzolana cement, air entraining cement, coloured cement, expansive cement, High alumina cement.

AGGREGATES: Classification, source, size and shape texture and influence of texture on strength, specific gravity of aggregates, moisture in aggregates, bulking of fine aggregate, methods used for determination of moisture content of aggregates, grading of aggregates, sieve analysis, standard grading curve, grading limits of fine aggregates as per IS ; gap grading.

UNIT-II

WATER & ADMIXTURES: Quality of water for mixing concrete, Tolerable concentrations of some impurities in mixing water, permissible limit for solids as per IS456-2000, use of sea water for mixing concrete.

ADMIXTURES AND CONSTRUCTION CHEMICALS: General, plasticizers and super plasticizers – Dosage, mixing procedure, equipment, effect of super plasticizes on the properties of fresh and hardened concrete, Retardors, accelerators. Air-entraining admixtures, effect of air-entrainment on the properties of concrete, fly ash, effect of fly ash on fresh and hardened concrete, high volume fly ash concrete, silica fume, available forms, effect of silica fume on compressive strength of concrete, construction chemicals for curing, construction chemicals for water proofing.

UNIT-III

FRESH CONCRETE:

Workability, factors affecting workability, slump test, Kelly ball test, V-B test, compaction factor test, segregation, bleeding, volume batching and weigh batching, hand mixing, machine mixing, mixing time, compaction of concrete, hand compaction, compaction by vibration, internal vibrator, form work vibrator, table vibrator, platform vibrator, surface vibrator.

UNIT-IV

HARDENED CONCRETE: General, water-cement ratio; gel/space ratio; gain of strength with age; maturity concept of concrete

TEST ON HARDENED CONCRETE: Compression test; moulds and compacting; curing; failure of specimen under compression; effect of height/diameter ratio on strength; flexural strength of concrete; tensile strength of concrete

ELASTICITY, CREEP AND SHRINKAGE: Elastic properties of concrete, modulus of elasticity of concrete. Factor's affecting modulus of elasticity, Poisson's ratio, creep and factors affecting creep, shrinkage and factors affecting shrinkage.

DURABILITY OF CONCRETE: Factors contributing to cracks in concrete, sulphate attack and methods of controlling sulphate attack, chloride attack, corrosion of steel and its control.

UNIT-V

SPECIAL CONCRETES AND CONCRETING METHODS: Fibre reinforced concrete; Fibres used, factors effecting properties, aspect ratio of fibres, orientation of fibres, workability, mixing, applications, current development in FRC.

NO-FINES CONCRETE: mix proportion, drying shrinkage, Thermal conductivity, applications.

Ferrocement: Casting techniques, hand plastering, semi-mechanized process, Centrifuging, guniting, applications.

LIGHT-WEIGHT CONCRETE: Natural and artificial light-weight aggregates, properties of common light-weight concretes.

READY MIXED CONCRETE: Batching of aggregates, cement, water, mixing of RMC, Time of transit, Use of admixtures, Pumping of concrete

TEXT BOOK

1. Concrete Technology by M.S.Shetty, S.Chand & Company Pvt. Ltd., New Delhi

REFERENCE BOOKS

1. Properties of concrete by A.M.Neville, Longman Publishers
2. Concrete technology by M.L.Gambhir, Tata McGraw-Hill Publishing company Ltd., New Delhi.

Course Outcomes:

At the end of the course student is 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. Perceive special concretes for accomplishing performance levels.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**1**	**2**						**1**				
CO2		**2**	**1**	**2**			**2**	**1**		**1**	**1**	
CO3	**2**	**2**	**1**	**1**			**1**	**1**		**1**	**1**	**1**
CO4		**2**	**1**	**1**		**1**		**1**		**1**	**1**	**1**

CE403C FLUID MECHANICS AND HYDRAULIC MACHINES

Instruction Hours/Week : 2(L) +1(T) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks: 60

Course Educational Objective (CEOs)

1. To understand the significance of fluid properties.
2. To apply the knowledge of fluid flow concepts and fundamental equations.
3. To solve the problems related to impacts of jets and flow measurements.
5. To apply the knowledge of laminar and turbulent flows.
6. To design the characteristics of turbines and pumps.

UNIT – I

FLUID PROPERTIES

Definition of a fluid –Density, Specific weight, Specific volume, Specific gravity – Viscosity – Bulk modulus of elasticity – Vapour pressure – Surface tension and capillarity- Pressure at a point – Absolute and gauge pressures

FLUID STATICS

Pascal's law – Pressure measurement – Manometers- Mechanical gauges – Hydrostatic pressure and force: horizontal, vertical and inclined planes, Curved surfaces.

UNIT – II

FLUID FLOW CONCEPTS

Flow characteristics – Velocity – Acceleration – Types of flow – Streamlines, Path lines, Streak lines – Stream function, Velocity potential, flow-net – Circulation and Vorticity.

FUNDAMENTAL EQUATIONS

Continuity equation – Energy Equation - Euler's equation of motion along a streamline – Bernoulli's equation – Applications of Bernoulli's Equation – Free jets and vortex flows.

UNIT III

IMPACTS OF JETS

Linear momentum equation - Impacts of jets on free and fixed moving vanes – Moment of momentum equation.

FLOW MEASUREMENT

Velocity measurement – Pitot tubes – Flow measurements: Flow through pipes- Venturi meter, Orifice meter and Nozzle meter- Flow through Channels: Weir and notches – Flow through tanks: Orifice and Mouth pieces.

UNIT IV

LAMINAR FLOW

Laminar flow through: circular pipes, annulus and parallel plates. 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, Turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes,

UNIT V

HYDRAULIC TURBINES

Classifications of turbines – Pelton Wheel, Francis Turbine and Kaplan Turbine velocity triangles at inlet and outlet – work done and efficiency– Draft Tube theory- Specific Speed – Characteristic Curves .

CENTRIFUGAL PUMPS

Components – Working – Types – Workdone – Heads – Losses and Efficiencies – Specific Speed – Multi Stage Pumps – Performance Characteristic Curves – Net positive Suction Head (NPSH).

Course Outcomes (COs)

After completion of the course the student will be

1. Able to solve fluid flow problems using fundamental principles
2. Able to apply the knowledge of fluid flow concepts and fundamental equations for solving problems
3. Able to measure pressure, velocity and discharge, and apply the knowledge of impacts of jets related to real life problems.
4. Able to analyze the flow problems in laminar and turbulent flow conditions.
5. Able to analyze the characteristics of turbines and pumps.

TEXT BOOKS

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi and S.M. Seth – Twentieth edition 2015, Standard Book House , New Delhi.
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput - 2002 Publication, S.Chand & Company Ltd., New Delhi.
3. Fluid Mechanics and Hydraulic Machines by R.K.Bansal -Revised Ninth edition 2010, Laxmi Publications (P) Ltd., New Delhi.

REFERENCE BOOKS

1. Fluid Mechanics by Victor L. Streeter and E.Benjamin Wylie, Keith W. Bedford – Edition 2010, Tata Mc Graw Hill Education Private Limited, New Delhi.
2. Fluid Mechanics and Turbo machines by Madan Mohan Das. – First Edition 2009, PHI Learning Pvt.Ltd., New Delhi.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**1**	**2**	**2**	**2**					**2**	**1**	**1**
CO2	**1**	**2**	**2**	**2**	**2**					**2**	**1**	**1**
CO3	**2**	**1**	**2**	**2**	**2**					**2**	**1**	**2**
CO4	**2**	**2**	**2**	**2**	**1**					**1**	**1**	**1**
CO5	**2**	**2**	**2**	**1**		**1**				**1**	**1**	**2**

--oOo—

CE 404C STRUCTURAL ANALYSIS-I

Instruction Hours/Week: 2(L)+1(T) **Credits : 3**
Sessional Marks : 40 **End Semester Examinations Marks : 60**

Course Objectives

1) To impart the principles of elastic structural analysis and deflection behavior of structures.
2) To impart knowledge about various methods involved in the analysis of determinate structures and indeterminate structures
3) To study the torsional effect and power transmission and to analyze various types of springs
4) To make the student familiar with moving loads on bridges

UNIT- I

DEFLECTIONS: Relationship between curvature, slope and deflection - Differential equation for the elastic line of a beam - Slope and deflection of cantilevers and simply supported beams under point loads, Uniform distributed load, Uniformly varying load by integration method (Macaulay's method),moment area method (Mohr's theorem) and conjugate beam method.

UNIT-II

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion in solid and hollow circular shafts - Transmission of power - Combined bending, torsion and end thrust.
SPRINGS: Types of springs - Close and open coiled helical springs under axial loads and axial couple - springs in series and parallel - Carriage or leaf springs.

UNIT- III

ENERGY THEOREMS: Virtual work and energy principles - Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force –Maxwell's theorem– Betti's theorems–Castigliano's first theorem and unit load method – Deflection of simple pin jointed trusses.

UNIT- IV

INDETERMINATE STRUCTURES: Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Analysis of plane trusses with two degrees of internal and external indeterminacy – Castigliano's theorem–II – Lack of fit–Analysis of propped cantilever beams under UDL and point loads.

UNIT- V

INFLUENCE LINES AND MOVING LOADS:

Influence lines for reactions, BM and SF; Curves of maximum BM and SF for single, two and multiple loads, UDL longer and shorter than span, enveloping parabolic and EUDL – forces in truss members.

Text Books:

1) Theory of Structures - Vol.I by S.P.Gupta, G.S.Pandit & R.Gupta.
2) Strength of Materials-U.C.Jindal,Pearson Publishers
3) Mechanics of Structures Vol.II by S.B.Junarkar.
4) Structural Analysis by L.S.Negi & R.S.Jangid.

References:

1. Intermediate structural Analysis by Wang
2. Fundamentals of Structural analysis by sujith kumar rao & subrata chakrabarty

Course Outcomes:

At the end of the course, students will be able to:

1. Distinguish between determinate and indeterminate structures
2. Analyze determinate and indeterminate structures
3. Use influence line diagram as a valid tool for structural analysis
4. Asses the power transmission of shafts and springs

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**1**	**2**	**2**	**1**				**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**1**	**1**	**1**			**1**	**1**	**1**
CO3	**2**	**2**	**2**	**1**	**1**				**1**	**1**	**2**	**1**
CO4	**2**	**1**	**2**	**2**	**2**				**1**	**2**	**2**	**1**

--oOo—

CE 405C WATER QUALITY AND TREATMENT

Instruction Hours/Week : 3(L) **Credits : 3**
Sessional Marks : 40 **End Semester Examinations Marks : 60**

Course Educational Objective (CEOs)

1. To know the water quality of different sources and water demand estimation.
2. To analyze the distribution network
3. To learn about the water quality parameters
4. To know the design concepts of water treatment plant
5. To study the advanced water treatment methods.

UNIT – I

SOURCES AND DEMAND OF WATER: Different sources of water, quantity and quality of different sources, Types and variation in water demand, factors affecting water demand, design period, population forecasting – Different methods and their suitability.

UNIT-II

WATER COLLECTION, CONVEYANCE AND DISTRIBUTION: Intake works for collection of surface water – Conveyance of water – Gravity and pumping – Their design – Different materials used for conveying conduits and their suitability, systems of distribution – Distribution reservoirs – Distribution networks, design of simple and complex pipe networks, pipe accessories – Valves and their location and suitability.

UNIT – III

WATER USES AND QUALITY REQUIREMENTS: Sources of water pollution, water borne diseases. Need for protected water supply, water quality – Physical, chemical and biological characteristics, water quality standards for different uses.

WATER TREATMENT: Conventional water treatment processes units and their functions. Theory and design of aeration, coagulation, flocculation and clarification, Determination of optimum dose of alum for coagulation of water.

UNIT – IV

FILTRATION AND DISINFECTION: Theory of Filtration – Different types of filters and their design. Disinfection – Disinfectant's mechanism of disinfection – Different methods of Disinfection. Types of Chlorination - Break point chlorination.

UNIT – V

ADVANCED TREATMENT METHODS: Treatment methods for removal of fluorides, arsenic, hardness, iron and manganese, salinity, colour.

TEXT BOOKS :

1. Water Treatment Principles and Design by James M. Montgomery.
2. Water Supply Engineering, by S.K.Garg.
3. Environmental Engineering by H.S.Peavy et al.
4. Water Supply and Sewerage, by E.W.Steel.

Course Outcomes (COs)

After completion of the course the student will be:

1. Able to estimate the water demand of any area and understand the water sources and its quality
2. Able to solve the distribution network problems
3. Able to explain the water quality parameters
4. Able to plan and design water treatment plant

5. Able to understand advanced water treatment technologies

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**2**	**2**	**1**	**2**	**2**			**1**	**1**	**1**
CO2	**1**	**1**	**2**	**1**	**2**	**1**	**2**			**1**	**1**	**1**
CO3	**2**	**1**	**1**	**1**		**2**	**1**			**1**	**2**	**1**
CO4	**2**	**2**	**2**	**2**	**1**	**2**	**2**			**1**	**1**	**1**
CO5	**2**	**1**	**1**	**1**		**2**	**1**			**1**	**2**	**1**

--oOo—

CE 406C SOIL MECHANICS

Instruction Hours/Week: 2(L)+1(T) **Credits : 3**
Sessional Marks : 40 **End Semester Examinations Marks: 60**

Course Objectives:

1) To know about types of soils formation and the phase composition for arriving the interrelationships
2) To know the procedures for finding index properties of the soils for identification and classification.
3) To understand the modes of soil water existence & effective stresses principle
4) To understand permeability in soils and concept of seepage analysis
5) To know the principle of Consolidation and compute settlements in soils.
6) To know the methods of determining Shear Strength of soils.

UNIT- I
SOIL COMPOSITION AND PHASE RELATIONSHIPS:

Types of soils - formation and deposition - Phase composition and Soil as 3−Phase system- Weight-Volume parameters: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity - Relationship between various soil parameters - Determination of Moisture content, Specific gravity and Unit weights using various methods.

UNIT -II
IDENTIFICATION AND CLASSIFICATION OF SOILS:

Index properties- Determination of particle size-Dry Sieve Analysis &Sedimentation Analysis- Determination of Consistency limits-liquid limit, plastic limit, shrinkage limit - Indices from Index properties-Density Index, Plasticity, Liquidity and Consistency indices, Flow & Toughness indices - Soil classification based on particle size , texture - Unified and Indian standard soil classification systems – Engineering significance of classification and classification parameters- Tests for field identification of soils

UNIT -III

SOIL WATER & EFFECTIVE STRESS PRINCIPLE:

Mode, Occurrence and types of soil water – Geostatic stresses in soils - capillarity – Total Stress- Pore water pressure- Effective Stress Principle - nature of effective stress, effect of ground level, surcharge &water table on effective stress.

PERMEABILITY & SEEPAGE ANALYSIS:

Darcy's law- coefficient of permeability: determination by constant-head and falling-head methods-Permeability of stratified soils - factors affecting Permeability -Movement of water through soils- stream and potential functions - flow nets, graphical method to plot flow nets- seepage pressure - quick sand condition.

UNIT- IV

CONSOLIDATION OF SOILS:

Comparison between compaction and consolidation, initial, primary & secondary consolidation - Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

UNIT – V

SHEAR STRENGTH OF SOILS:

Shear strength of soils - Mohr'-Coulomb Failure Criteria - Measurement of shear strength - Direct shear, Unconfined compression and Tri-axial compression tests - Shear strength parameters - Shear strength of cohesive and cohesion less soils - Test conditions - Stress Paths under different stress conditions.

TEXT BOOKS:

1. C. Venkataramiah, Geotechnical Engineering, New age International Pvt. Ltd, (2002).
2. K. R. Arora, Soil Mechanics and Foundation Engg, Standard Publishers and Distributors, Delhi.

REFERENCES:

1. Gopal Ranjan & A. S. R. Rao, Basic and Applied Soil Mechanics, New age International Pvt . Ltd, New Delhi.

2. Braja M. Das Principles of Geotechnical Engineering, Cengage Learning

3. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation, Laxmi publications Pvt. Ltd., New Delhi

Course Outcomes:

At the end of the course, the student must be able to:

1. Identify and classify various soils based on their characteristics.
2. Compute effective stresses in soils under different conditions
3. Evaluate permeability and seepage of soils.
4. Understand consolidation in soils and Calculate consolidation time and settlement of soils.
5. Understand shear strength theories and determine Shear Characteristics of soils

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**1**	**1**	**1**	**1**					**1**	**1**
CO2	**2**	**2**	**1**	**1**	**1**	**1**		**1**			**1**	**1**
CO3	**2**	**2**	**2**	**2**	**1**	**2**	**1**		**1**		**1**	**1**
CO4	**2**	**2**	**2**	**2**	**2**	**2**	**1**		**1**	**1**	**1**	**1**

--oOo—

CE407P FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Instruction Hours/Week : 3(P) Credits : 1.5

Sessional Marks : 40 End Semester Examinations Marks : 60

Course Educational Objective (CEOs)

1. To determine the coefficient of discharge in flow measuring devices.
2. To determine the coefficients of different losses in pipe flow.
3. To draw the performance characteristic curves of pumps.

FLOW MEASUREMENT

1. Calibration of Small Orifice
2. Calibration of Venturimeter
3. Calibration of Orifice meter
4. Calibration of Bend meter
5. Calibration of Triangular Notch

HEAD LOSSES IN PIPES

6. Determination of Friction factor of the pipe material
7. Determination of Head Loss coefficient due to Sudden Contraction
8. Determination of Head loss coefficient due to Gate Valve in a pipe line
9. Determination of Head Loss coefficient due to Bend in a pipe line

HYDRAULIC MACHINES

10. Characteristic curves of 0.8 kW two stage centrifugal pump

11. Characteristic curves of variable speed centrifugal pump

Course Outcomes (COs)

After completion of the course the student will be:

1. Able to calibrate the flow measuring devices.
2. Able to calculate loss coefficients for use in the pipe flow analysis.
3. Able to prepare the characteristic curves of the pumps.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**2**	**1**	**1**	**2**	**1**			**1**	**1**	**1**
CO2	**2**	**2**	**2**	**1**		**2**				**1**	**1**	**1**
CO3	**2**	**2**	**2**	**2**		**1**				**2**	**2**	**2**

--oOo—

CE408P SOIL MECHANICS LABORATORY

Instruction Hours/week : 2 (P) **Credits :1**

Sessional Marks : 40 **Semester-end Examination: 60**

Course Educational Objective (CEOs)

The course should enable the students to:

1. Know the procedure to determine basic properties of soils in the laboratory.
2. Know the procedure to determine compaction characteristics of soils in the laboratory.
3. Develop laboratory skills to arrive the basic properties and compaction characteristics of soils.

List of Experiments

1.a. Grain Size Distribution by Dry Sieve Analysis.

b. Shrinkage Limit of given soil

2. Grain Size Distribution by Hydrometer Analysis

3.a. Specific Gravity of soil

b. Free Swell Index of soil

4.a. Liquid limit of soil

b. Plastic limit of soil

5.a. In-situ density of soil by Core Cutter method

b. Shrinkage Limit of given soil pat

6. In-situ density by Sand Replacement method.

7. I.S. Light Compaction test/ Standard Proctor Compaction test

Course Outcomes (COs)

After completion of the course the student will be able to:

1. Describe the procedure for determining the basic properties and compaction characteristics of soils.
2. Conduct basic tests and classify the soils for engineering purpose.
3. Conduct I.S. Light compaction test on soils and determine the compaction characteristics for engineering purpose.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**2**	**2**	**1**			**1**			**1**		**1**	**1**
CO2	**2**	**2**	**2**		**1**			**1**		**1**		
CO3	**2**	**1**	**1**		**1**					**1**		**1**

--oOo—

CE409S PYTHON PROGRAMMING

Instruction Hours/Week: 1(T) +2(P) **Credits : 2.0**
Sessional Marks : 40 **End Semester Examinations Marks : 60**

Course Educational Objective (CEOs)

1. Computer programming skills are now becoming part of basic education as these skills are increasingly of vital importance for future job and career prospects.
2. The Python programming language which is one of the most popular programming languages worldwide.
3. The course shows you how to use the free open-source Python to write basic programs and high-level applications using concepts such as Class, BIF of Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm.
4. This course will be of great interest to all learners who would like to gain a thorough knowledge and understanding of the basic components of computer programming using the Python language – and might be a gentle introduction to programming for those who think they might have a longer-term interest in the subject area.

UNIT I

Introduction to Python Programming Language: Introduction to Python Language: What is Python? Why Python? Installing Python on Windows, Python IDLE, Python Literals, Python Data Types Basic Input-Output operations, Operators in Python, Decision making in Python, Conditional execution in Python, Logical and bit operations in Python, Naming Conventions, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Data type conversion, Built in Functions.

UNIT II

Python Built-in Data Structures: Introduction, List, Tuples, Dictionary, Sets, List Operations append, extend, insert, remove, pop, slice, and reverse, List Comprehension, Dictionary operations, Sorting Dictionaries, Copying Collections, Set operations. Standard python modules math, time, IO and time, Regular expressions, multi-threading.

UNIT III

Classes in Python, Principles of Object Oriented programming, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes.

UNIT IV

Functions, I/O, Exception Handling in Python

Introduction:Defining your own functions, keyword and optional parameters, mapping functions, lambda functions, **Data Streams:** Creating Your Own Data Streams · Access Modes · Writing Data to a File · Reading Data From a File · Additional File Methods · Using Pipes as Data Streams · Handling IO Exceptions · Working with Directories · Metadata · Errors · Run Time Errors · The Exception Model · Exception Hierarchy · Handling Multiple Exceptions

Unit V

Python API development.

Introduction to API, Python API programming, Python web application frameworks, REST API, Python Flask, Flask Environment, Routing, Cookies, Sessions, Running Flask Application, Testing API with POSTMAN client

Course Outcomes (COs)

Upon completion of this course, students should be able to

1. Apply the OOP principles and best practices of python programming.
2. Write clear and effective pythonic code.
3. Create applications using python programming.
4. Implementing databases using SQLite and Access databases using python programming.
5. Understand and feel comfortable in working with web application frameworks.
6. Develop APIs required for the web applications using web frameworks like Flask and Fast API.

Reference Book:

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. Programming Python, 4th Edition by Mark L

Fundamentals of Python Programming, Richard L. Halterman Updated content of the book is maintained under the URL:http://python.cs.southern.edu/pythonbook/pythonbook.pdf

The official Python Tutorial. http://docs.python.org/tut/ How to think like a computer scientist (interactive) http://interactivepython.org/runestone/static/thinkcspy/index.html

How to think like a computer scientist http://openbookproject.net/thinkcs/python/english3e/

Code Academy Python http://www.codecademy.com/tracks/python A useful hands-on book: http://anh.cs.luc.edu/python/hands-on/3.1/Hands-onPythonTutorial.pdf

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)
2. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173

3. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016) Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1 st edition (6th February 2009

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**1**			**1**	**2**						**2**	**2**
CO2		**2**			**1**	**2**		**1**			**2**	**2**
CO3	**1**			**2**	**2**					**1**	**2**	**2**
CO4	**1**			**1**	**2**				**1**		**2**	**2**
CO5		**2**			**1**	**2**	**1**				**2**	**2**
CO6	**1**			**2**	**2**			**1**			**2**	**2**

--oOo—

CE410P COMPUTER AIDED BUILDING DRAWING

Instruction Hours/Week : 3(P) **Credits : 1.5**
Sessional Marks : 40 **End Semester Examinations Marks : 60**

Course Educational Objective (CEOs)

1) Develop parametric design and the conventions of formal engineering drawing
2) Produce and interpret 2D drawings
3) Communicate a design idea/concept graphically/ visually
4) Examine a design critically and with understanding of AUTOCAD software.

UNIT- I

INTRODUCTION: Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, coordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT- II

SYMBOLS AND SIGN CONVENTIONS: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT- III

MASONRY BONDS: English Bond and Flemish Bond – Corner wall and Cross walls – One brick wall and one and half brick wall

UNIT- IV

BUILDING COMPONENTS: Terms, Doors, Windows, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan.

UNIT- V

TYPICAL BUILDING DRAWINGS: A Building, An Office building, A Dwelling, A Residential House, Plan of a Secondary School, Bank, Primary Health Centre, Duplex House.

It may be advisable to conduct Drawing sessions along with Lab demonstrations.

Text book:

Building Planning and Drawing – Dr. N. Kumaraswamy and A. Kameshwara Rao – CHARATOR PUBLISHING HOUSE**.**

COURSE OUTCOMES:

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

1. Develop drawing skills for effective demonstration of building details.
2. Draw building plans using Computer Aided Design and Drafting soft wares.
3. Develop engineering project drawings incorporating details and design parameters in 2D.
4. Examine efficacy of AUTOCAD design and Drawing.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**1**			**1**	**2**						**2**	**2**
CO2		**2**			**1**	**2**					**2**	**2**
CO3	**1**			**2**	**2**						**2**	**2**
CO4	**1**	**2**		**2**	**1**	**2**					**2**	**2**

--oOo—

V Semester – Scheme &Syllabus
(R20 Regulations)

FIFTH SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
CE501C	Hydraulic Engineering	2	1	-	3	3	40	60	100
CE502C	Foundation Engineering	2	1	-	3	3	40	60	100
CE503C	Design of RCC Structures	2	1	-	3	3	40	60	100
CE504O	Open Elective Course I (MOOCS1)	-	-	-	-	3	-	-	100
CE505E	Professional Elective Course I	3	-	-	3	3	40	60	100
CE506P	Concrete Technology Lab	-	-	3	3	1.5	40	60	100
CE507P	Geotechnical Engineering Lab	-	-	3	3	1.5	40	60	100
CE508P	Water Quality Analyses Lab	-	-	3	3	1.0	40	60	100
CE509S	Skill Development Course 3	1	-	2	3	2	40	60	100
MC510B	Universal Human Values	2	-	-	2	-	40	60	100
CE511SI	**Community Service Project(45 hrs)/Summer Internship (6 weeks)** (Mandatory) after second year (to be evaluated during V Sem)	-	-	-	-	1.5	40	60*	100
Total		**12**	**3**	**11**	**26**	**22.5**	**400**	**600**	**1100***

***To be evaluated by department constituted committee**

Category		No. of. Courses	Credits
Professional Core Courses	-PCC	06	13
Professional Elective Course	-PEC	01	03
Open Elective Course/Job Oriented Course	-OEC	01	03
Skill Oriented Course	-SC	01	02
Community Service Project/ Summer Internship	-SI	01	1.5

Mandatory Course	-MC	01	00
		Total Credits	**22.5**

CE501C HYDRAULIC ENGINEERING

Instruction Hours/Week : 2(L) +1(T) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION OF THE COURSE:
Fluid Mechanics and Hydraulic Machines is the pre-requisite for this course. This course consists of basics of dimensional analysis, flow through pipes, boundary layer theory and open channel flows.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the importance of dimensional analysis and solve the problems related to flow through pipes.
2. To understand the concepts of boundary layer and flow around submerged objects.
3. To understand the basic concepts of open channel flows and to learn uniform flow characteristic in channels.
4. To understand the concepts of specific energy and specific force.
5. To understand the principles of gradually varied flows and rapidly varied flows.

UNIT I
DIMENSIONAL ANALYSIS AND SIMILITUDE- Dimensional homogeneity, Rayleigh's method, Buckingham's Pi method. Dimensionless groups, Similitude, Types of models, model studies.
FLOW THROUGH PIPES- Loss- Major loss, Darcy-Weisbach equation, minor losses, total energy line, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes – Pipe networks – Hardy- cross method.

UNIT II
BOUNDARY LAYER THEORY- Boundary layer concepts- Thickness of Boundary Layer – Boundary Layer Along a Long Thin flat Plate and its Characteristics –Laminar Boundary Layer – Turbulent Boundary Layer – Laminar Sublayer – Separation of Boundary Layer – Methods of Controlling the Boundary Layer
FLOW AROUND SUBMERGED BODIES-Types of Drag –Drag on a Sphere, Cylinder and Airfoil – Development of Lift on Immersed Bodies.

UNIT III

INTRODUCTION TO OPEN CHANNEL FLOW- Section between open channel flow and pipe flow, geometric parameters of a channel, classification of open channels, classification of open channel flow, Velocity and pressure distribution of a channel section.

UNIFORM FLOW- Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient. Most economical section of a channel. Computation of Uniform flow, Normal depth.

UNIT IV

SPECIFIC ENERGY AND SPECIFIC FORCE CONCEPTS-Specific energy, Specific energy curve, critical flow, discharge curve Specific force , Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats.

UNIT V

GRADUALLY VARIED FLOWS- Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profiles, Characteristics of surface profiles. Computation of water surface profile by graphical, Direct and standard step methods.

RAPIDLY VARIED FLOWS- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

Text/Reference Books:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971.

Course Outcomes (COs):

1. Able to explain the concepts of dimensional analysis and analyse the problems related to flow through pipes.
2. Able to apply the knowledge of boundary layer concepts and flow around submerged objects.
3. Able to apply the concepts of open channel flows and determine the most economical section of a channel.

4. Able to compute specific energy and specific force concepts.
5. Able to analyse the GVF profiles, RVF profiles and their characteristics.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	3	3	2	3	1	-	-	-	-	-	-		3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-		3	1
CO3	3	3	3	2	2	-	-	-	-	-	-	-		3	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-		3	1
CO5	3	3	3	3	3	-	-	-	-	-	-	-		3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

*****

CE502C FOUNDATION ENGINEERING

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION OF THE COURSE:
Foundation engineering is a branch of geotechnical engineering which applies soil mechanics, structural engineering, and project serviceability requirements for design and construction of foundations for onshore, offshore, and in-land structures.

Course Educational Objectives (CEOs):

1. To get a basic understanding of the geotechnical site investigation and compaction methods with mechanism behind.
2. To learn the concept and methods of stress distribution in soils due to applied loads and analyzing stability of slopes.
3. To understand the basic the principle and analysis of earth pressure in retaining structures.
4. To learn the methods of Bearing capacity and the design concepts of shallow foundations.
5. To learn the design concepts of pile foundations and pile groups.

UNIT - I
SOIL EXPLORATION: Methods of soil exploration – Boring and Sampling methods – Penetration Tests – Pressure meter – Programme planning and preparation of soil investigation report.
SOIL COMPACTION: Compaction of cohesive and cohesionless soils - Standard Proctor's test and Modified Proctor's test - Field compaction - Compaction control - C.B.R. test and its use.

UNIT - II
STRESS DISTRIBUTION IN SOILS : Boussinesq's equation - Vertical stress due to line load, strip load, and uniformly loaded circular area - Newmark's chart - Westergaard's approach - Pressure bulb concept - Approximate methods.
STABILITY OF SLOPES : Stability analysis of infinite slopes - Stability analysis of finite slopes - Swedish circle method - Friction circle method - Taylor's stability number and use of charts - Improving stability of slopes.

UNIT – III
EARTH PRESSURE THEORIES: Types of Earth Pressures – Earth Pressure at Rest-Active and passive earth pressures in cohesion less and cohesive soils (with and without surcharge) - Rankine's and coulomb's earth pressure theories - Graphical methods

due to Rebhann and Culmann.

UNIT – IV

BEARING CAPACITY AND SHALLOW FOUNDATIONS: Classification and purpose of foundations-general requirements, location and deep foundation of shallow foundations -factors influencing bearing capacity- analytical methods to determine bearing capacity- Terzaghi's, Meyerhof's and Skempton bearing capacity theories- IS code recommendations-Settlement of shallow foundations resting on cohesive and Cohesionless soils-contact pressure under footing.

UNIT-V

PILE FOUNDATIONS: Types of piles - Load carrying capacity based on static formula, dynamic formula, Pile load tests - Pile groups in sands and clays - negative skin friction in single pile and pile groups – causes and remedies.

TEXT/REFERENCE BOOKS:

1. Geotechnical Engineering - C.Venkatramaiah.
2. Numerical Problems, Examples and Objective Questions in Geotechnical Engineering - Prof.A.V.Narasimha Rao and Prof.C.Venkatramaiah.
3. Soil Mechanics and Foundation Engineering - K.R.Arora.
4. Soil Mechanics & Foundations - B.C.Punmia
5. Analysis and design of foundations and retaining structures - Shamsher Prakash, Gopal Ranjan & Swamisaran
6. Basic and Applied Soil Mechanics - Gopal Ranjan & A.S.R.Rao.
7. Soil Mechanics & Foundation Engineering – P.Purushothama.Raj
8. Foundation Engineering – Teng

Course Outcomes (COs):

1. Able to describe different soil exploration techniques and compaction methods .
2. Able to determine stresses in soils due to applied loads and analyze stability of slopes.
3. Able to calculate earth pressure in soil retaining structures.
4. Able to determine bearing capacity of different types soils for foundation design.
5. Able to determine load carrying capacity and settlement of piles and pile groups.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	3	3	3	2	2						2	2		3	3
CO2	3	3	3	3	2	2	2	3	2	3	3	2		3	2

CO3	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**		**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**		**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**						**2**	**2**		**3**	**2**

1 - Slightly; 2 - Moderately; 3 – Substantially

CE503C DESIGN OF R.C.C STRUCTURES

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION OF THE COURSE:
R.C.C. Structure design is a combination of concrete and steel reinforcement that are joined into one piece and work together in a structure. The term "reinforced concrete" is frequently used as a collective name for reinforced-concrete structural members and products.

Course Educational Objectives (CEOs):

1. To understand the general mechanical behavior of reinforced concrete members.
2. To develop ability to analyze and design reinforced concrete flexural members and compression members.
3. To develop an intuitive feeling about structural & material vise behaviour and design of RC systems and elements.

UNIT – I

INTRODUCTION: Design Philosophies – working stress method, ultimate load method and limit state method.

DESIGN FOR FLEXURE – WORKING STRESS METHOD: Assumptions, permissible stresses in concrete and steel, balanced design, transformed area method, analysis and design for flexure of singly and doubly reinforced and flanged sections.

LIMIT STATE METHOD

UNIT – II

DESIGN PRINCIPLES: Basic Design Principles - Stress strain curves for concrete and steel - Characteristic strengths and loads - Partial safety factors - Stress block - Various limit states.

DESIGN FOR FLEXURE: Limit state of collapse in flexure - Ultimate flexural strength - Balanced, under-reinforced and over-reinforced sections - Design of singly and doubly reinforced rectangular beams - Design of flanged beams.

UNIT - III

DESIGN FOR SHEAR, TORSION AND BOND: Shear-Truss analogy - Design of beams for shear and torsion - Anchorage and development length.

LIMIT STATES OF SERVICEABILITY: Deflection (short and long term) - Cracking.

UNIT – IV

DESIGN OF SLABS, STAIR CASES AND BEAMS: Design of one way and two way slabs - Design of stair cases - Design of continuous beams and slabs.

UNIT – V

DESIGN OF COMPRESSION MEMBERS: Columns - Reduction factors - Axially loaded - Eccentrically loaded columns - Uniaxial moment - Biaxial moment (for practice only and not for University Examination).

DESIGN OF FOUNDATIONS: Types of footings - Design of wall footings and isolated, pad stepped and sloped footings - Square, rectangular subjected to axial load.

TEXT BOOKS:

1) Reinforced Concrete by Limit State Design by AK Jain.
2) Reinforced Concrete Design by SN Sinha.
3) LSD of Reinforced Concrete Structures by Ramachandra.
4) Reinforced Concrete Design by Unni Krishna Pillai and Devdas Menon.
5) Reinforced Concrete Design by P.C. Varghese.

Course Outcomes (COs):

1. To know the Design Philosophies for design of basic elements of reinforced concrete structures in Working Stress Method and Limit State Method.
2. To design Beams using Limit State Method
3. To design slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice for reinforced Concrete Structures and Design

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	3	3	3	3	3	1	2	2	-	1	2	1		3	2
CO2	3	3	3	3	2	2	3	2	-	1	2	1		3	2
CO3	3	3	3	3	2	2	2	2	-	1	2	1		3	2

1 - Slightly; 2 – Moderately; 3 – Substantially

CE504O OPEN ELECTIVE - I

Instruction weeks : 12 **Credits :3**

Sessional Marks : NIL End Semester Examination Marks : **NIL**

ONE MOOCS COURSE TO BE STUDIED (Offered in Swayam Portal that are not are offered in regular B.Tech Program)

(Course can be in Domain Engineering/ Interdisciplinary Engineering/Engineering Sciences/ Technical English with prior HoD permission)

(Certificate to be produced to the department for inclusion of credits and marks in Marks Memo)

CE505E PROGRAMME ELECTIVE -I

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

ONE COURSE FROM AMONG THE PROGRAMME ELECTIVE COURSES TO BE STUDIED.

CE506P CONCRETE TECHNOLOGY LAB

Instruction Hours/week : 3 (P) Credits :1.5

Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

The objectives of the course is to gain the practical knowledge of properties of concrete materials, behaviour of concrete properties of fresh and hardened concrete.

List of Experiments:

1. To find the properties of ingredients or concrete
2. To know the properties of fresh & hardened concrete under different loading conditions.
3. Sieve Analysis of coarse and fine aggregates
4. Bulking of Sand by Volume and Weight methods
5. Normal consistency, Initial and Final Setting Times of Cement
6. Tests on concrete:

a) Slump Test b) Compressive Strength of Concrete Cubes c) Compaction Factor Test d) Compressive Strength of Concrete Cylinders

7. (a) Specific gravity & Water absorption of Coarse aggregate

(b) Specific gravity of Cement

8. Water absorption and Compressive Strength of Bricks

Course Outcomes (COs):

1. Able to find the quality of materials used in concrete and the properties of hardened concrete.

TEXT BOOKS:

1. Concrete Technology by M.S. Shetty – S. Chand & Co
2. Concrete Manual by M.L. Gambhir, Dhanpat Rai & Son

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)

CO1	**3**	**3**		**2**	**2**				**1**	**2**	**2**	**1**		**3**	**2**

1 - Slightly; 2 - Moderately; 3 – Substantially

CEPCP 507P GEOTECHNICAL ENGINEERING LABORATORY

Instruction Hours/week : 3 (P) Credits :1.5

Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1) To gain practical knowledge on determination of permeability of soils.
2) To gain practical knowledge on determination of strength characteristics of soils.
3) To gain practical knowledge on determination of compaction characteristics of soils using heavy compaction energy.
4) To gain practical knowledge on determination of consolidation characteristics of fine soils.

List of Experiments:

1. Permeability test using Constant-head test method
2. Permeability test using Falling-head test method
3. Relative Density
4. Unconfined Compression Strength Test.
5. Direct Shear Test
6. North Dakota Cone Test
7. I.S. Heavy Compaction test
8. California Bearing Ratio test
9. Triaxial Test UU (Demo)
10. Consolidation Test (Demo)
11. Vane Shear Test (Demo)

Course Outcomes(Cos):

At the end of the course, the student will be able to:

1. Determine permeability and evaluate seepage characteristics of soils.
2. Determine Strength Characteristics of various soils and assess their behaviour.

3. Determine Heavy Compaction Characteristics for various applications.
4. Determine Consolidation Characteristics and evaluate settlement in fine soils.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1			3	1		1		2	3	2	1	3		3	2
CO2			3	1		1		2	3	2	1	3		3	2
CO3			3	1		1		2	3	2	1	3		3	2
CO4			3	1		1		2	3	2	1	3		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

CE508P WATER QUALITY ANALYSES LAB

Instruction Hours/week : 2(P) Credits :1.0

Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objective (CEOs):

1 To be aware of water quality analysis
2 To be aware of how to interpret the results

Water Analysis

1. (a) Determination of Color.
   (b) Determination of Taste and Temperature

2. Determination of
(a) Total Suspended and Dissolved Solids.
   (b) Organic and Inorganic Solids.

3. (a) Determination of pH and Electrical Conductivity.
   (b) Determination of Turbidity.

4. (a) Determination of Acidity.
   (b) Determination of Alkalinity.

5. Determination of Hardness

6. (a) Determination of Chlorides.
   (b) Determination of Sulphates.

7. (a) Determination of Dissolved Oxygen.
   (b) Determination of Residual Chlorine.

8. (a) Determination of Optimum Coagulant Dose.

(b) Determination of MPN Index of water.

9. (a) Ambient Air Quality Monitoring.
   (b) Determination of Ambient Noise

Course Outcomes (COs):

After completion of the course the student will be:

1. Able to Perform common environmental experiments relating to water quality Analyses
2. Able to Statistically analyze and interpret laboratory results
3. Demonstrate good written and oral communication skills

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1						3		2	2	2		2		3	2
CO2						3		2		1	3	1		3	2
CO3						2		3	3	3		2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

CE509S SKILL DEVELOPMENT COURSE III

Instruction Hours/Week : 3(L) Credits : 1.5
Sessional Marks : 40 Semester Examination Marks : 60

ONE COURSE FROM AMONG THE SKILL DEVELOPMENT COURSES TO BE STUDIED

MC510B UNIVERSAL HUMAN VALUES

Instruction Hours/week : 3 (P) Credits :3

Sessional Marks : 40 End Semester Examination Marks : 60

COURSE DESCRIPTION:

The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dogma or value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

COURSE OBJECTIVES(CEOs):

1. To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. To understand (or developing clarity) the harmony in the human being, family, society and nature/existence.
3. To strengthen self-reflection and to develop commitment and courage to act.
4. To understand social responsibility of an engineer.
5. To appreciate ethical dilemma while discharging duties in professional life.

UNIT I

Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and

Prosperity correctly - A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

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 (Sukh and Suvidha). 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.

UNIT III

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 Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness (Ubhay-tripti); Trust **(Vishwas)** and Respect **(Samman)** 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 (Samadhan), Prosperity (Samridhi), fearlessness (**Abhay**) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family.

UNIT IV

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

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

Course Outcomes(COs): On completion of this course, the students will be able to

1. To become more aware of themselves, and their surroundings (family, society, nature)
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

REFERENCE BOOKS:

1. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
2. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
3. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
4. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
5. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986, 1991.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.

8. M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Humna Values), Eastern Economy Edition, Prentice Hall of India Ltd.
9. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
10. India Wins Freedom - Maulana Abdul Kalam Azad.

Relevant CDs, Movies, Documentaries & Other Literature:

1. value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. AI Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charle Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology - the Untold Story.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1		3	2			3		2			1	1		1	1
CO2		3	2			2					1	2		1	1
CO3		3	2								1	2		1	1
CO4		3	2								1	2		1	1
CO5		3	2								1	2		1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

CE5IISI COMMUNITY SERVICE PROJECT/ SUMMER INTERNSHIP

No. of Hours : 45 Credits : 1.5
Sessional Marks : NIL End Semester Examination Marks: NIL

Course Educational Objectives (CEOs)

- To enable the students to have practical work knowledge in convenient group on a project involving theoretical and experimental studies related to Civil Engineering
- Exposing the students to practical know-how in the chosen area of Civil Engineering
- Preparations of Detailed Project Report.

Course Outcomes (Cos)

1. To enable the students to acquire practical knowledge.
2. Capable of carrying out Civil Engineering works in the field.

CO-PO Mapping

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1						3			3	3	3			3	2
CO2						3			3	3	3			3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Community Service Project(45 hrs)/Summer Internship (6 weeks) (Mandatory) after second year (**to be evaluated during V Sem**)

4 year B.Tech. Degree Course
Civil Engineering
Choice Based Credit System
(With effect from the academic year 2020-21)

VI Semester – Scheme &Syllabus

DEPARTMENT OF CIVIL ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

Department of Civil Engineering, S.V.University College of Engineering, TIRUPATI

SIXTH SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
CE601C	Wastewater Treatment	3	-	-	3	3	40	60	100
CE602C	Professional Elective Course II	3	-	-	3	3	40	60	100
CE603C	Hydrology and Water Resources Engineering	2	1	-	3	3	40	60	100
CE604E	Transportation Engineering	2	1	-	3	3	40	60	100
CE605O	Open Elective Course II (MOOCS1)	-	-	-	-	3	-	-	100
CE606P	Wastewater Analyses Lab	-	-	3	3	1.0	40	60	100
CE607P	Remote Sensing and GIS Lab	-	-	3	3	1.5	40	60	100
CE608P	Transportation Engineering Lab	-	-	3	3	1.5	40	60	100
CE609S	Skill Development Course 4	1	-	2	3	2	40	60	100
MC610C	Essence of Indian Traditional Knowledge	2	-	-	2	-	40	60	100
Total		**13**	**2**	**11**	**26**	**21**	**360**	**540**	**1000**

Category		No. of. Courses	Credits
Professional Core Courses	- C	06	13
Professional Elective Course	- E	01	03
Open Elective Course/Job Oriented Course (MOOCS2)	- O	01	03
Skill Oriented Course	- S	01	02
Mandatory Course	-MC	01	**00**
		Total Credits	**21**

CE601C WASTEWATER TREATMENT

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1. To know how to estimate quantity of waste water generation from any area.
2. To study the physical, chemical and biological characteristics of the waste water.
3. To learn the design concepts involved in the waste water treatment plant.
4. To know the advanced technologies involved in the waste water treatment plant.
5. To study the elements of solid waste management.

UNIT I

WASTEWATER COLLECTION:

Sanitation - systems of sanitation, water carriage system, sewerage, systems of sewerage, sources of wastewater - Estimation of quantity of municipal wastewater - Estimation of quantity of storm water - Different types of sewers, design flows through sanitary sewers, storm sewers and combined sewers. Hydraulic design of sewers - Sewer appurtenances. House drainage and Plumbing systems

UNIT II

CHARACTERISTICS OF DOMESTIC WASTEWATER:

Characteristics and composition of sewage - Physical, chemical and biological.
BOD equation and factors affecting the BOD rate of reaction, population equivalent.

PRELIMINARY AND PRIMARY SEWAGE TREATMENT:

Concept of wastewater treatment, primary, secondary and tertiary treatment - Conventional treatment process flow diagrams of municipal wastewater treatment plants - Functions of each unit and design of screens, grit chamber, and primary settling tanks.

UNIT III

SECONDARY TREATMENT OF SEWAGE:

Principles of biological treatment, nutritional requirement of biological treatment system, factors affecting biological treatment systems.

Design, construction, operation and maintenance of activated sludge process, oxidation ditch trickling filters and waste stabilization ponds.

UNIT IV

SLUDGE MANAGEMENT:

Quantity and characteristics, and types of sludge, sludge conditioning and dewatering, handling, treatment, sludge utilization and disposal.

Tertiary treatment - Removal of nitrogen, phosphorus, refractory organic, heavy metals, suspended solids and pathogenic bacteria.

UNITV

EFFLUENT DISPOSAL:

Standards for disposal - disposal into surface water bodies - Self purification, zones of pollution - Dissolved oxygen sag curve-Streeter - Phelps equation, Marine disposal - On land disposal and treatment systems - overflow, flooding and irrigation. Onsite Disposal System: Septic tank and effluent disposal system.

MUNICIPAL SOLIDWASTES:

Characteristics, generation, collection and transportation of solid wastes, Engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal).

TEXTBOOKS:

1. Sewage Disposal and Air Pollution Engineering, by S.K.Garg.
2. Environmental Engineering by H.S.Peavy et al.
3. Water Supply and Sewerage, by E.W.Steel and Mc.Ghee.

REFERENCE BOOKS :

1. Wastewater Engineering, Treatment, Disposal, ana Reuse by Metcalf and Eddy.
2. Techobanglous, G.Theisen, H. and Ehasin, R.(1996). Solid waste engineering principles and Management Issues - McGraw Hill, Tokyo.

Course Outcomes (COs):

1. Able to estimate the quantity of waste water generation from any area and design sanitary sewers
2. Able to understand the different types of sewers and house plumbing system.
3. Able to analyze the strength/characteristics of waste water Able to design waste water treatment plant.
4. Able to manage sludge from wastewater treatment plant
5. Able to dispose effluent properly and can manage solid waste.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	2			1	1								
CO2		3	2			1	1								
CO3	3	3	2			1	1								
CO4	3	3	2			1	1								
CO5		3	2			1	1								

1 - Slightly; 2 - Moderately; 3 – Substantially

CE602E PROFESSIONAL ELECTIVE COURSE II

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE FROM AMONG THE PROGRAMME ELECTIVE COURSES TO BE STUDIED.

CE603C HYDROLOGY AND WATER RESOURCES ENGINEERING

Instruction Hours/week: 2 (L)+1 (T) **Credits :3**

Sessional Marks : 40 End Semester Examination Marks**:60**

DESCRIPTION OF COURSE:

Fluid Mechanics and Hydraulic Machines and Hydraulic Engineering courses are the pre-requisite courses for this course. Students will learn various hydrological aspects, estimation and their applications. They also learn various aspects of irrigation, canals and related structures.

Course Educational Objective (CEOs):

1. To understand the phases of hydrologic cycle and estimation of precipitation.
2. To learn the concepts and measurement of different abstractions from precipitation.
3. To analyze runoff, flood frequency and flood routing.
4. To understand the concepts of ground water and different methods of irrigation.
5. To design canals and select suitable irrigation structures and cross drainage works.

UNIT I

INTRODUCTION: Hydrologic cycle, Forms and types of precipitation, measurement of precipitation, rain gauge network, mean precipitation, estimation of missing rainfall, consistency of rainfall data, Depth-Area-Duration (DAD) relationship, Intensity-Duration-Frequency (IDF) relationship, Probable Maximum Precipitation (PMP).

UNIT II

ABSTRACTIONS FROM PRECIPITATION: Initial abstractions, Evaporation, process, factors affecting evaporation, measurement, its control, Evapotranspiration, process, types, factors affecting, measurement, Infiltration, process, factors affecting, measurement, infiltration indices.

UNIT III

RUNOFF: Process, factors affecting, estimation, Hydrographs, base flow separation, Unit Hydrograph – derivation of Unit Hydrograph of different durations, distribution graph

FLOODS: Estimation, flood control measures.

FLOOD ROUTING: Basic equations, Reservoir routing.

UNIT IV

GROUND WATER: Types of formations, Darcy's law, equilibrium equations for confined and unconfined aquifers, recuperation test.

IRRIGATION- Necessity, advantages and ill effects, water requirement of crops, methods of irrigation, duty and delta, soil-water relationships, irrigation requirement, frequency of irrigation.

UNIT V

CANALS: Classification, alignment, Kennedy's silt theory and Lacey's regime theory, Design of lined canals.

CANAL STRUCTURES: Falls, necessity, location, classification; Regulators, necessity, location, classification; Outlets, necessity, location, classification.

Course outcomes (Cos) : After completing the course, the student will be,

1. Able to explain the different phases of hydrologic cycle and estimate precipitation.
2. Able to analyse the concepts of abstractions and estimate the abstractions.
3. Able to analyse runoff and the flood frequency analysis.
4. Able to explain the concepts of groundwater and select suitable type of irrigation system.
5. Able to design canals and select suitable irrigation structures and cross drainage works.

Text/Reference Books:

1. P N Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House
2. S K Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers.
3. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
4. P. Jaya Rami Reddy, A text book of Hydrology, University Science Press, (Laxmi Publications).
5. L W Mays, Water Resources Engineering, Wiley.

***

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	3	3	2	2	-	-	_	-	_	-	_		3	1
CO2	3	3	3	2	2	-	-	_	-	_	-	_		3	1
CO3	3	3	3	3	3	-	-	_	-	_	-	_		3	2
CO4	3	3	3	3	3	-	-	_	-	_	-	_		3	3
CO5	3	3	3	3	3	-	-	_	-	_	-	_		3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

CE604C TRANSPORTATION ENGINEERING

Instruction Hours/week : 3(L) Credits : 3

Sessional Marks : 40 End Semester Examination Marks:60

DESCRIPTION OF COURSE:

Transportation engineering or transport engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods transport.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. Identify the requirements of highways and apply the knowledge for planning highway alignment.
2. Estimate the geometrics for highways
3. Select appropriate highway materials and design the various highway pavements.
4. Estimate the traffic requirements from traffic studies.
5. Understand the various components of Railways, Airports and Docks and Harbors.

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

UNIT – II

HIGHWAY GEOMETIC 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

PAVEMENT DESIGN: Aggregates and bitumen - desirable properties, tests - Aggregate bitumen mixes - Design by Marshall

method., Pavement Types, components and their functions, design factors, flexible pavement design - IRC methods based on CBR only. Rigid pavement design - Calculation of stresses, design of joints, dowel bars, tie bars, thickness of pavement by IRC procedure.

UNIT – IV

TRAFFIC ENGINEERING:

Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies- Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams--Road Traffic Signs – Types and Specifications – Road markings- -Types of Road Markings- Design of Traffic Signals –Webster Method –IRC Method-Types of Intersections – Conflicts at Intersections- Types of At-Grade Intersections and Grade Separated Intersections - Channelization: Objectives –Traffic Islands and Design criteria- Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersection.

UNIT – V

INTRODUCTION TO RAILWAY, AIRPORT AND HARBOUR ENGINEERING:

Site selection – Engineering Surveys- Permanent way components – Cross Section of Permanent Way - Points &Crossings -Turn outs- Stations and Yards.

Factors affecting selection of site for Airport – Airport layout and terminal area -Aircraft Characteristics- Geometric Design of Runway- Computation of Runway length – Correction for runway length – Orientation of Runway – Wind Rose Diagram – Runway Lighting system.

Harbours - Types of harbours, site selection- ports, classification of ports – docks - break water, types of breakwaters, quays, jetties, wharves, dolphins, fender systems, aprons, transit sheds and ware houses, dredging.

Course Outcomes (COs):

1. Estimate the requirements and design highway pavements.
2. Apprehend different components of Railways, Airports and Harbours.

TEXT BOOKS:

1. Highway Engineering – S.K.Khanna & C.E.G.Justo, Nemchand & Bros., 7th edition (2000).
2. Railway Engineering – A text book of Transportation Engineering – S.P.Chandola – S.Chand & Co. Ltd. – (2001).
3. Airport Planning and Design- S.K.Khanna and Arora,Nemchand Bros.
4. Docks and Harbour Engineering - S.P.Bindra.

REFERENCES:

1. Highway Engineering – S.P.Bindra , Dhanpat Rai & Sons. – 4th Edition (1981)
2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna publications – 6th Edition – 1997.
3. Railway Engineering – August – Prabha & Co., 15th Edition – 1994.
4. Docks and Harbour Engineering - R.Srinivasan.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	3	2	3	2		2		1			2			3	3
CO2	2	2				3					3	3		2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

CE606P WASTEWATER ANALYSES LAB

Instruction Hours/week : 2(P) Credits :1

Sessional Marks : 40 End Semester Examination Marks:60

Course Educational Objectives (CEOs):

1. To be aware of wastewater analysis.
2. To be aware of how to interpret the results.

List of Experiments on Waste Water Analysis:

1. (a) Determination of Color.
   (b) Determination of Odor and Temperature.
2. Determination of Total Dissolved Solids.
3. (a) Determination of Settleable Solids.
   (b) Determination of pH.
4. Determination of Total Nitrogen.
5. Determination of Total Phosphorous.
6. Determination of Sulphates
7. Determination of BOD of sewage water.
8. Determination of COD.
9. Solid Waste Analysis for physical components.

Course Outcomes (COs):

After completion of the course the student will be:

a. Able to Perform common environmental experiments relating to wastewater characteristics.
b. Able to Statistically analyze and interpret laboratory results.
c. Demonstrate good written and oral communication skills.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1							**3**	**3**	**2**	**3**	**3**			**3**	**2**
CO2							**3**	**3**	**1**	**3**	**1**				
CO3							**3**	**3**	**1**	**3**	**2**				

1 - Slightly; 2 - Moderately; 3 – Substantially

CE607P REMOTE SENSING AND GIS LAB

Instruction Hours/week : 3(P) Credits :1.5

Sessional Marks : 40 End Semester Examination Marks:60

DESCRIPTION OF THE COURSE:

In this Course students learn about basic concepts of Remote sensing and GIS, Preparing various thematic map using GIS, Open source software in application of Civil Engineering.

Course Educational Objectives (CEOs):

1. To learn and perform the Map projections.
2. To know how to prepare the Land use/Land cover Map using toposheet.
3. To understand how to prepare the Land use/Land cover Map using satellite Map.
4. To know how to prepare Surface water mapping.
5. To understand the concepts of preparation of water quality map.

LIST OF EXPERIMENTS:

1. **GEOREFERENCING THE TOPOSHEET:** Basic concepts and foundation of remote sensing, resolution, sensors and satellite, visual interpretation techniques. Understanding the concepts of Map Projections, Introduction to open source software QGIS/GRASS.
2. **LAND USE/LAND COVER MAP USING TOPOSHEET:** Basic concepts of Digitizing, types of digitizing, preparing thematic maps of contours, water bodies, streams, rivers and villages.
3. **LAND USE/LAND COVER MAP USING SATELLITE MAP:** Introduction, Overview, Preprocessing, Radiometric correction, Geometric correction, Rectification. Enhancement Techniques, Contrast stretch, Edge enhancement, Filtering Techniques, Classification Techniques - Supervised and unsupervised classification.
4. **APPLICATION OF GIS IN SURFACE WATER MAPPING:** Delineating Watershed, preparing Stream order map, Stream length map and Drainage density map.
5. **APPLICATION OF GIS IN WATER QUALITY AND MANAGEMENT:** Converting GPS data into Map, preparing spatial map using Inverse Distance Weightage Method.

REFERENCE BOOKS:

1. M. Anji Reddy Remote sensing and GIS, B. S. Publications, New Delhi.
2. L. R. A. Narayana, Remote Sensing and its applications, University Press 1999.

Course Outcomes (COs):

1. Able to perform map projections using GIS software.
2. Able to generate Land use/Land cover map using toposheet.
3. Able to generate Land use/Land cover map using Satellite data.
4. Able to prepare surface water mapping using GIS.
5. Able to generate water quality mapping using GIS.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	1	1	-	3	3	-	-	-	-	-	-	-		2	3
CO2	1	1	-	3	3	-	-	-	-	-	-	-		2	3
CO3	1	1	-	3	3	-	-	-	-	-	-	-		2	3
CO4	1	1	-	3	3	-	-	-	-	-	-	-		2	3
CO5	1	1	-	3	3	-	-	-	-	-	-	-		2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

CE608P TRANSPORTATION ENGINEERING LAB

Instruction Hours/week : 3 (P) Credits :1.5

Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1. To enable to study different highway construction materials.
2. To facilitate students to perform different tests on highway construction materials.

LIST OF EXPERIMENTS:

CYCLE – I

1. Specific Gravity and Water Absorption Test.
2. Aggregate Impact Test
3. Elongation Index Test
4. Flakiness Index Test
5. Angularity Test
6. Los Angles Abrasion Test
7. Aggregate Crushing Test
8. Stripping Value of Aggregate

CYCLE – II

1. Flash & Fire Point Test
2. Softening point Test
3. Specific Gravity of Bitumen
4. Penetration Test on Bitumen

Course Outcomes (COs):

After completion of the course the student will be:

1. Able to perform various tests for selection of various materials used in highway construction.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	3	3						2		2				3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

CE609S SKILL DEVELOPMENT COURSE IV

Instruction Hours/Week : 3(L) Credits : 1.5
Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE FROM AMONG THE SKILL DEVELOPMENT COURSES TO BE STUDIED

MC610C ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION OF COURSE:

Indian traditional knowledge systems evolved over centuries through the cultures of various communities. They are also called indigenous systems made upon by versatile people by their diversified habits on foods, dresses, languages, living styles, and therapeutic methods in health care.

Course Educational Objectives(CEOs):

1. Impart basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. Understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003
3. Focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection
4. Know the student traditional knowledge in different sector

Unit-I

CONCEPTS AND PERSPECTIVES:

Meaning of History-Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history- Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

Unit-II

SCIENCE AND TECHNOLOGY IN ANCIENT INDIA:

Technology in pre-historic period Beginning of agriculture and its impact on technology
Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

Unit-III

SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA:

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy

Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

Unit-IV

SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

Unit-V

SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA

Science, Technology and Development discourse Shaping of the Science and Technology Policy

Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

Course Outcomes(Cos):

Upon successful completion of the course, the student will be able to:

1. Understand the concept of Traditional knowledge and its importance.
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.
5. Understand the importance of Intellectual property in different sectors.

Text books:

1. ―Traditional Knowledge System in India‖, Amit Jha, 2009, Atlantic publisher.
2. ―Traditional Knowledge System and Technology in India‖, Basanta Kumar Mohantra, Vipin Kumar Singh, 2012, Pratibha Prakashan publisher.

Reference books:

1. ―Knowledge Traditions and Practices of India‖, 2012, Kapil Kapoor, MichelDanino.

e-resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	**2**	**2**	**1**	**3**	**2**	**1**				**1**	**2**			**2**	**1**
CO2	**2**	**2**	**1**	**3**	**2**	**1**				**1**	**2**			**2**	**1**
CO3	**2**	**2**	**1**	**3**	**2**	**1**				**1**	**2**			**2**	**1**
CO4	**2**	**2**	**1**	**3**	**2**	**1**				**1**	**2**			**2**	**1**
CO5	**3**	**1**		**2**	**1**						**1**			**1**	

1 - Slightly; 2 - Moderately; 3 – Substantially

4 year B.Tech. Degree Course
Civil Engineering
Choice Based Credit System
(With effect from the academic year 2020-21)

VII Semester – Scheme &Syllabus

DEPARTMENT OF CIVIL ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

SEVENTH SEMESTER

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
CE701E	Professional Elective Course- III	3	-	-	3	3	40	60	100
CE702E	Professional Elective Course -IV	3	-	-	3	3	40	60	100
CE703E	Professional Elective Course -V	3	-	-	3	3	40	60	100
CE704O	Open Elective Course -III (MOOCS 3)	-	-	-	-	3	-	-	100
CE705O	Open Elective Course- IV (MOOCS 4)	-	-	-	-	3	-	-	100
HS706A	Humanities and Sciences Elective	3	-	-	3	3	40	60	100
CE707II	Industry Internship 2Months (mandatory) after IV Semester to be evaluated in VII Semester	-	-	-	-	3	40	60*	100
CE708S	Skill Development Course- V	1	-	2	3	2	40	60	100
Total		**14**	**0**	**2**	**15**	**23**	**240**	**360**	**800***

***To be evaluated by department constituted committee**

Category		No. of. Courses	Credits
Professional Elective Courses	-E	03	09
Open elective course/ job oriented elective (MOOCS3 and MOOCS 4)	-O	02	06
Humanities and Social Science Elective	-HSE	01	03
Skill Oriented Course	- S	01	02
Industry Internship	- II	01	03
		Total Credits	**23.0**

CE701 PROFESSIONAL ELECTIVE COURSE III

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE AMONG THE PROGRAMME ELECTIVE COURSES TO BE STUDIED.

CE702 PROFESSIONAL ELECTIVE COURSE IV

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE AMONG THE PROGRAMME ELECTIVE COURSES TO BE STUDIED.

CE703 PROFESSIONAL ELECTIVE COURSE V

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE AMONG THE PROGRAMME ELECTIVE COURSES TO BE STUDIED.

CE704O OPEN ELECTIVE - III

Instruction weeks : 12 Credits :3

Sessional Marks : NIL End Semester Examination Marks :NIL

ONE MOOCS COURSE TO BE STUDIED (Offered in Swayam Portal that are not are offered in regular B.Tech Program)

(Course can be in Domain Engineering/ Interdisciplinary Engineering/Engineering Sciences/ Technical English with prior HoD permission)

(Certificate to be produced to the department for inclusion of credits and marks in Marks Statement)

CE705O OPEN ELECTIVE - IV

Instruction weeks : 12 Credits :3

Sessional Marks : NIL End Semester Examination Marks :NIL

ONE MOOCS COURSE TO BE STUDIED (Offered in Swayam Portal that are not are offered in regular B.Tech Program)

(Course can be in Domain Engineering/ Interdisciplinary Engineering/Engineering Sciences/ Technical English with prior HoD permission)

(Certificate to be produced to the department for inclusionof cresits and marks in Marks Statement)

HS706E HUMANITIES AND SCIENCES ELECTIVE

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks: 60

ONE COURSE AMONG THE HUMANITIES AND SCIENCES ELECTIVE COURSES TO BE STUDIED.

R20 (With effect from the academic year 2020-21)

CE707II INDUSTRY INTERNSHIP

No. of Hours : 60 Credits : 3
Sessional Marks : NIL End Semester Examination Marks: NIL

Course Educational Objectives (CEOs)

- To enable the students to have practical work knowledge in convenient group on a project involving theoretical and experimental studies related to Civil Engineering
- Exposing the students to practical know-how in the chosen area of Civil Engineering
- Preparations of Detailed Project Report.

Course Outcomes (Cos)

1. To enable the students to acquire practical knowledge.
2. Capable of carrying out Civil Engineering works in the field.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1						3			3	3	3			3	2
CO2						3			3	3	3			3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Industry Internship 2Months (mandatory) after VI Semester to be evaluated in VII Semester

Industry Internship Internship (8 Weeks or 60 hrs) (Mandatory) after third year VI Semester (**to be evaluated during VII Sem**)

4 year B.Tech. Degree Course
Civil Engineering
Choice Based Credit System
(With effect from the academic year 2020-21)

VIII Semester – Scheme &Syllabus

DEPARTMENT OF CIVIL ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

Course Code	Course Title	Scheme of Instruction(Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
CE801PROJ	Project Work, Seminar and Internship in Industry	-	-	-	12	-	40	60	100
	Industry Internship 6Months	-	-	-	-	-			
Total			-	-	**12.0**		**40**	**60**	**100**

CE801 PROJECT WORK

Instruction Hours/Week : -
Sessional Marks : 40

Credits :12
End Semester Examinations Marks : 60

Course Educational Objectives (CEOs)

- To enable the students to work in convenient group on a project involving theoretical and experimental studies related to Civil Engineering
- Carrying out project work in the chosen area of Civil Engineering
- Preparations of Detailed Project Report

Course Outcomes (Cos)

1. To enable the students to work in convenient group
2. Capable of doing a project involving theoretical and experimental studies.
3. Modern trend and technology in civil engineering

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	3		2					2				3	2
CO2	3	3	3		2					2				3	2
CO3	3	3	3		2					2				3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Professional Elective Courses (R20 Regulations)

S. No.	Course Title
	Structural Engineering
1	Structural Analysis-II
2	Design of Steel Structures
3	Prestressed Concrete
4	Advanced Structural Analysis
5	Structural Dynamics and Design of Earthquake Resistant Structures
	Geotechnical Engineering
6	Advanced Foundation Engineering
7	Applied Soil Mechanics
8	Expansive Soils
9	Geoenvironmental Engineering
10	Geotechniques for Design of Underground Structures
	Environmental Engineering
11	Air Pollution and Control
12	Noise Pollution and Control
13	Environmental Pollution and Control
14	Industrial Wastewater Treatment
15	Environmental Quality and Pollution Monitoring Techniques
	Water Resources and Hydraulics Engineering
16	Watershed Management
17	Hydraulic Structures
18	Water Resources System Analysis
19	Design and Drawing of Irrigation Structures
20	IOT in Civil Engineering

	Miscellaneous Courses
21	Traffic Engineering And Management
22	Estimating and Costing
23	Building Construction Practice
24	Construction Planning and Project Management
	Humanities and Social Sciences
25	Project Formulations and Appraisal
26	Optimization Techniques
27	Organizational Behavoiur
28	Entrepreneurship and Incubation

R20 (With effect from the academic year 2020-21)

E1 STRUCTURAL ANALYSES – II

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTON:

Structural analysis is a branch of Solid Mechanics which uses simplified models for solids like bars, beams and shells for engineering decision making. It's main objective is to determine the effect of loads on the physical structures and their components.

Course Educational Objective (CEOs):

1. In continuation of Structural Analysis-I to incorporate the advanced method of analysis like Matrix method and Plastic Analysis
2. Able to find the collapse loads of different structural frames.

UNIT I

SLOPE DEFLECTION METHOD:

Continuous Beams – Sinking of Supports

MOMENT DISTRIBUTION METHOD:

Continuous Beams – Sinking of Supports

UNIT II

KANI'S METHOD:

Continuous beams, settlement of supports, single bay portal frames with side sway.

UNIT III

MULTISTOREYED FRAMES:

Analysis of multistoried frames using substitute frame method, portal and cantilever methods.

UNIT IV

INTRODUCTION TO MATRIX METHODS:

Flexibility and Stiffness Coefficients – Force and Displacement methods – Application to beams

UNIT V

PLASTIC ANALYSIS : Theory of plastic bending - Idealized stress - strain diagram - Shape factor - Moment - curvature relationships - Plastic hinges - Collapse Mechanisms - Analysis of fixed and continuous beams, and portal frames - Statical method and mechanism method of analysis.

TEXT BOOKS:

1) Structural Analysis by L.S.Negi & R.S.Jangid.
2) Theory of Structures Vol. I by R.S. Khurmi
3) Structural Analysis by T S Thandavamoorthy, Oxford University Press
4) Mechanics of Structures Vol.II by S.B.Junarkar.
5) Steel Structures Vol. II by Ramachandra.
6) Fundamentals of Structural Analysis – Sujit Kumar Roy & Subrata Chakrabarthy

Course Outcomes (COs) :

After completion of the course the student will have:

1. Ability to solve statically indeterminate structures using matrix (Stiffness & flexibility) methods.
2. Ability to analysis framed structures by using appropriate methods and exact methods
3. Ability to analysis framed structures by using Kani's method

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	3	3	3	2	2	3	2	-	1	2	1		3	2
CO2	3	3	3	3	3	1	2	2	-	1	2	1		3	2
CO3	3	3	3	3	2	2	2	2	-	1	2	1		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E2 DESIGN OF STEEL STRUCTURES

Instruction Hours/week : 3(L) Credits :3

Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION:

There are currently two common methods of steel design: The first method is the Allowable Strength Design (ASD) method. The second is the Load and Resistance Factor Design (LRFD) method. Both use a strength, or ultimate level design approach.

Course Educational Objective (CEOs):

1. To understand the design of structural steel members subjected to compression, tension and bending loads, as per current codal provisions (IS:800 – 2007) .

UNIT - I

Introduction - Properties of sections - Types of loads - Design stresses in tension, compression, and shear as per IS code. Riveted and bolted connections - Strength of rivet - Strength of lap and butt joints - Modes of failure and efficiency of a Bolted joint - Design of Bolted joints - Design of bracket connections.

UNIT – II

Welded joints - Types of welded joints - Strength of fillet and butt welds - Design of welded joints - Design of bracket connections ,Design of Tension members - Lug angles - Tension splice

UNIT – III

Design of compression members - Single and built-up columns - Design of the lacing and battens - Design of eccentrically loaded columns

UNIT – IV

Laterally supported beams - Design of simple beam - Design of Built-up beams - Curtailment of flange plates

UNIT – V

Design of column bases - Slab base - Gusseted base - Subjected to moment - Grillage foundation.

TEXT BOOKS

1. Design of Steel Structures – (Limit State Method as per IS 800-2007) by Bhavakatti S.S.
2. Design of Steel Structures - (Limit State Method as per IS 800-2007) by N. Subramanian.
3. Design of Steel Structures - (Limit State Method as per IS 800-2007) by S.K.Duggal.

Course Outcomes (COs):

After completion of the course the student will have:

1. Ability to perform analysis and design, tension members, compression members and ability to analyze and design of simple bolted and welded connections.
2. Ability to design steel framing system of a building.
3. Familiarity with professional contemporary and ethical issues.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3										2			3	
CO2				2	3				2	1				3	
CO3		3	2			2	1	1				2			1

1 - Slightly; 2 - Moderately; 3 – Substantially

E3 PRESTRESSED CONCRETE

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION:

Prestressed concrete is a system devised to provide sufficient precompression in the concrete beam by tensioned steel wires, cables, or rods that under working conditions the concrete has no tensile stresses or the tensile stresses are so low that no visible cracking occurs.

Course Educational Objectives (CEOs):

1. To learn the principles, materials, methods and systems of prestressing
2. To know the different types of losses and analysis of prestressed members
3. To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam
4. To learn the design of anchorage zones in post-tensioned and transmission length of pre-tensioned beams
5. To learn the calculation of short & long term deflection of PSC beams.

UNIT – I

INTRODUCTION: Historic development – General principles of pre-stressing – pre-tensioning and post tensioning – Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel their characteristics. I.S.Code provisions, Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of pre-stressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System.

UNIT – II

ANALYSIS OF SECTIONS FOR FLEXURE: Elastic analysis of concrete beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons.

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

UNIT – III

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

UNIT – IV

ANALYSIS OF END BLOCKS: by Guyon's method, Fressinet and Magnel blotten method, Anchorage zone stresses – Approximate method of design – Anchorage zone reinforcement – Transmission length - Transfer of prestress in pre-tensioned members.

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. Pre-stressed Concrete by Krishna Raju; - Tata Mc.Graw Hill Publications.
2. Pre-stressed Concrete by N.Rajasekharan; - Narosa publications.

Course Outcomes(COs):

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

1. Know the general principle of prestressed concrete and materials & methods.
2. Analysis of a prestressed concrete beam accounting for losses
3. Design the anchorage zone for post tensioned members
4. Design of PSC beams under flexure & shear
5. To get an idea over Estimation of deflection of PSC beams

REFERENCES:

1. Pre-stressed Concrete by Ramamrutham; Dhanpatrai Publications.
2. Design of Pre-stressed concrete structures (Third Edition) by T.Y. Lin & Ned H.Burns, John Wiley & Sons Inc..

Codes: BIS code on pre-stressed concrete, IS 1343.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3			2					1		2			1
CO2	3	3		3	2				2	1	2	2		3	2
CO3	3	3	2	2	3				2	2	1	2		3	1
CO4	3		3	2	3				1	2	1	2		3	2
CO5	3	3			2				2	2	1			2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E4 ADVANCED STRUCTURAL ANALYSES

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION:
It covers different methods to solve statically indeterminate structures. It also covers Influence Lines for Displacements. After finishing this course, you will be able to analyze most structures for a variety of loads. These methods are different ways to solve statically indeterminate structures.

Course Educational Objectives (CEOs):
1. To impart knowledge on the analysis of complex systems
2. To enable the student analyze the arches
3. To teach procedure for analysis of cables and suspension bridges.
4. To enable the student undergo analysis procedure using yield line theory method.
5. To illustrate analysis procedure when systems are subjected to unsymmetrical bending

UNIT I
Analysis of Portal frames with inclined legs and gable frames.
BEAMS CURVED IN PLAN : Analysis for internal forces – circular beams supported on symmetrically placed columns – semicircular beams simply supported on three equally spaced supports.

UNIT II
ARCHES: Eddy's theorem, analysis of three and two hinged parabolic and circular arches for static and moving loads.

UNIT III
CABLES: Analysis of cables under uniformly distributed and concentrated loads - shape of cable under self weight - Effect of temperature in suspension cables – Anchor cables- suspension bridges – moving loads.

UNIT IV
YIELD LINE THEORY: method of yield line analysis of slabs for different support conditions – Strip method.

UNIT V

UNSYMMETRICAL BENDING:

Introduction – Centroidal principal axes of section – graphical method for locating principal axes – moments of inertia referred to any set of rectangular axes – stress in beams subjected to unsymmetrical bending – principal axes –resolution of bending moment due to two rectangular axes through the centroid – location of neutral axis – deflection of beams under unsymmetrical bending.

TEXT BOOKS:

1.Analysis of Structures – Vol.I, II – Vazirani and Ratwani.
2.Indeterminate structural analysis by C.K. Wang, Mc-Graw Hill Publications.

Course Outcomes(COs):

At the end of course students will be able to:

1. Analyze indeterminate portal frames and beams curved in plan.
2. Analyze arches, cables and suspension bridges.
3. Analyze the slabs using yield line theory.
4. Analyze the systems with unsymmetrical bending.

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

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3			2	1				1	2	2	2		3	2
CO2	3	3		2	2				1	2	2	2		3	2
CO3	3	3	3	2	1				1	2	2	2		3	1
CO4	3	3	3		1				2	2	2	2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E5 STRUCTURAL DYNAMICS AND DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

DESCRIPTION

Structural Dynamics is an extension of the conventional static structural analysis. It is the study of structural analysis that considers the external loads or displacements to vary with time and the structure to respond to them by its stiffness as well as inertia and damping.

Course Educational Objective (CEOs):

1. Learn to find the response of the structures subjected to dynamic loads.
2. Learn to analyze and design of Earthquake Resisting Structures.

UNIT I

THEORY OF VIBRATIONS:

Introduction- Elements of a vibratory system – Degrees of Freedom –Free and Forced –Undamped and Damped –Vibrations

SINGLE DEGREE OF FREEDOM SYSTEM:

Formulation and solution of the equation of motion –Response of Free vibration system – Critical damping – Logarithmic decrement –Response to harmonic excitation –Dynamic magnification factor

UNIT II

MULTI DEGREE OF FREEDOM SYSTEM

Formulation of equations of motion of MDOF- Evaluation of structural property matrices – undamped free vibrations – Evaluation of natural frequencies and mode shapes.

UNIT III

ENGINEERING SEISMOLOGY

Earthquake phenomenon – cause of earthquakes – Seismic waves – Terms associated with earthquakes – Magnitude and intensity of an earthquake –Scales – Energy released – Earthquake measuring instrument –Seismic zones of India.

UNIT IV

INTRODUCTION TO EARTHQUAKE RESISTANT DESIGN

Concept of earthquake resistant design – Regular and irregular configurations – Design Earthquake loads – Basic load combinations

– Lateral load resisting systems – Determination of design lateral forces – Equivalent lateral force procedure – Lateral distribution of base shear – provisions of IS: 1893(part I)- 2002

UNIT V

DUCTILE DETAILING

Ductility – definition –Types –Choice of construction materials –Unconfined concrete – Confined concrete – Factors affecting Ductility – Ductile detailing provisions as per IS:13920-1993 – Ductile detailing of beams, columns and beam-column joint.

TEXT BOOKS:

1. Mario Paz - Structural Dynamics Theory and Computations, CBS Publishers
2. Anil Kumar Chopra, Dynamics of Structures, Prentice Hall India Pvt. Ltd.
3. O Pankaj Agarwal & Manish Shrikhonde - Earthquake Resistant Design of Structures, Prentice Hall India Pvt. Ltd.

REFERENCES:

1. R.W.Clough & J.penzien, Dynamics of Structures, Mc. Graw Hill Publications,
2. J.J.Humar, Dynamics of Structures, Prentice Hall India Pvt. Ltd.
3. Jaikrishna & Chandra Sekar Elements of Earthquake Engineering, South Asian Publications N.D.

Course Outcomes (COs) :

After completion of the course the student will be:

1. Able to find the response of the structures subjected to dynamic loads.
2. Able to analyze and design of Earthquake Resisting Structures

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3		2			1	2				2			2	
CO2		3		2	3			3	3	2		2			3

1 - Slightly; 2 - Moderately; 3 – Substantially

E6 ADVANCED FOUNDATION ENGINEERING

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

The course will enable students to:

1) Gain knowledge on types of retaining structures and their stability considerations
2) Know different types of sheet piles and the design concepts
3) Understand the concepts and design of proportioning of isolated and combined footings
4) Acquire knowledge on components and design of well foundations.
5) Gain knowledge on foundations on expansive soils and design of belled pier and under reamed piles.

UNIT I

EARTH RETAINING STRUCTURES : Types of Retaining Structures - Stability Considerations of Gravity and Cantilever Retaining Walls.

UNIT II

SHEET PILE WALLS: Types of sheet pile walls – Free cantilever sheet pile – Cantilever sheet pile in Cohesionless soils – Cantilever sheet pile in cohesive soils. Anchored sheet pile wall with free earth support method – Rowe's moment reduction curves

UNIT III

PROPORTIONING OF SHALLOW FOUNDATIONS– Classification and purpose, Contact pressure under footings, proportioning of isolated footings, Need of Strap & Combined Footings-Types of Combined Footings-Proportioning of Rectangular & Trapezoidal Combined Footings -Strap Footing

UNIT IV

WELL FOUNDATIONS Types of wells; Components of well foundation; Shapes of wells; Forces acting on well foundation; Construction and Sinking of wells.

UNIT V

FOUNDATIONS ON EXPANSIVE SOILS- Expansive soils, parameters of expansive soils, classification of expansive soils, preventive measures for expansive soil, design of foundation in swelling soils-drilled piers, belled drilled pier, under reamed piles, construction of under reamed piles.

TEXT BOOKS:

1. V.N.S.Murthy, "Advanced Foundation Engineering", CBS Publishers.
2. Gopal Ranjan & A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age Publishers.

REFERENCES:

1. Braja M. Das, "Principles of Geotechnical Engineering", Cengage Learning.
2. Purushtoma Raj, " Ground Improvement Techniques " .Pearson Publications
3. Bowles, J.E., Foundation Analysis and Design (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork.

Course Outcomes (COs) :

After completion of the course the students will be able to:

1. Analyse the stability of earth retaining structures
2. Design sheet pile walls in different soils
3. Design isolated, strap and combined footing
4. Design different components for construction of well foundations
5. Design foundation on expansive soils.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1			3	3	2		1			2	2	1		3	2
CO2			3	3	2	1	1			2	2	1		3	3
CO3			3	3	2	1	1			2	2	1		3	3
CO4			3	3	2	1	1			2	2	1		3	3
CO5			3	3	2	1	1			2	2	1		3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

E7 APPLIED SOIL MECHANICS

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

CourseEducational Objectives (CEOs):

1. Impart different soil improvement techniques for shallow soil layers.
2. Impart different soil improvement techniques for deep soil layers.
3. Introduce of Arching in soils and Tunnels in soils.
4. Introduce braced cut and it component design.
5. Introduce conduits and the design load on conduits.

UNIT I SOIL IMPROVEMENT TECHNIQUES FOR SHALLOW LAYERS

Soil improvement - Mechanical treatment - Lime stabilization - Cement Stabilization - Bituminous stabilization - Chemical Stabilization - Freezing and heating - Geotextiles.

UNIT II SOIL IMPROVEMENT FOR DEEP LAYERS

Dynamic compaction and consolidation - Preloading - Sand drains - Electro-osmosis - Lime columns - Stone columns - Grouting.

UNIT III ARCHING & OPEN CUTS

Arching in soils-Theories of Arching-Cain's Theory-Tunnels through Sand

UNIT IV BRACED EXCAVATIONS

Braced cut - Apparent pressure diagrams for cuts in both sands and clays - Types of bracing systems - Design of various components of bracing - Bottom heave of cuts in soft clays - Piping failure of cuts in sands

UNIT V CONDUITS

Classes of Under Ground Conduits-Uses of Conduits-Load on Ditch Conduit-Load on Positive & Negative Projecting Conduits-Load on Conduits due to Live Loads.

TEXT BOOKS :

1. Alam Singh "Modern Geotechnical Engineering"
2. Gopal Ranjan & A.S.R.Rao, “Basic and Applied Soil Mechanics.
3. K.R.Arora - "Soil Mechanics and Foundation Engg.".
4. C.Venkatramaiah - Geotechnical Engineering.
5. A.V.Narasimha Rao and C.Venkatramaiah - Numerical Problems Examples and Objective Questions in Geotechnical Engg.
6. Soil Mechanics and Foundation Engineering - B.C.Punmia

Course Outcomes (Cos):

The students can:

1. Choose ground improvement techniques to be adopted for shallow soil layers
2. Choose ground improvement techniques to be adopted for deep soil layers
3. Analyse and design Arches and Tunnels
4. Design different components of braced excavations
5. Design conduits to withstand different loading conditions.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	2	3	2		2			2				2	1
CO2	3	2	2	3	2		2			2				2	1
CO3		3	3	3	2		2			2				3	2
CO4		3	3	3	2					1				3	2
CO5		3	3	3	2					1				2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

--oOo--

E8 EXPANSIVE SOILS

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1. Familiarize Students with Nature of Soils and Soil Structure
2. Equip student with concepts of Swelling and methods of determination
3. Understand foundation practices in expansive soils
4. Familiarize different materials and techniques for stabilization
5. Under land procedure to improve shear strength of expansive soils

UNIT - I

Clay Mineralogy: Nature of Soils-Clay mineral structure- Cation exchange - Soil water- Soil Structure-Soil water interaction

UNIT- II

Swelling Characteristics- Swelling- Factors effecting Swelling- Swelling Potential- Swell Pressure- Methods of Determination- Factors effecting Swelling potenti l and swell pressure- Heave- Factors effecting Heave- Methods of determination of heave.

UNIT-III

Foundation Practices in Expansive Clays: Sand Cushion-Belled Piers-CNS layer technique- Under reamed Pile foundation- Construction Techniques- Design Specifications- Load-carrying capacity in compressive and uplift of single and multi under reamed piles in clays and sands- Granular pile Anchors.

UNIT-IV

Lime Soil columns and Lime Slurry pressure injection- Stabilization with admixtures- Propounding- Vertical and Horizontal Moisture barriers.

UNIT: V

Shear strength of expansive soils- Katti's concept of bilinear envelope- Stress -state variables in partly saturated soils- Frelend's strength parameters- Determination of matrix suction by axis translation technique- field suction measurement.

TEXTBOOKS:

I. F. C. Chen, Foundation on Expansive Soils, Elsevier Scientific Publishing Company, Newyork

2. J. D. Nelson and D. I. Miller, Expansive soils- Problems and Practice in Foundation and pavement Engineering, John Wiley & Sons Inc.

REFERENCES:

1. D. G. Fredlund and H. Rhardjo, Soil Mechanics for Unsaturated Soils, WILEY Inter Science Publication, John Wiley & Sons, Inc.
2. D. R. Katti, A. R. Katti, Behavior of Saturated Expansive Soils and Control Methods Taylor and Francis

Codes:

IS: 2720 (Part XV)-1977 "Measurement of Swelling Pressure of Soils"

Course Outcomes(COs):

At the end of this course the student will be able to:

1. Demonstrate behavior of expansive soils.
2. Explain need of foundation practice on expansive soils.
3. Perform methods of stabilization of expansive soils.
4. Select additives and methodology for stabilization.
5. Apply the gained knowledge for suitable performance.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	2	3	2		2			2				2	1
CO2	3	2	2	3	2		2			2				2	1
CO3		3	3	3	2		2			2				3	2
CO4		3	3	3	2					1				3	2
CO5	3	3	3	3	2					1				2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E9 GEOENVIRONMENTAL ENGINEERING

Instruction Hours/Week : 3(L) Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1. Understand mineralogical composition and fabric/ structure in engineering behavior of soil.
2. Know the sources of subsurface contamination sources and their effects.
3. Introduce waste contaminant system and selection criteria for impounding containment.
4. Know the construction and design of contaminant systems.
5. Know the use of waste material in geotechnical constructions.

UNIT I

SOIL COMPOSITION & STRUCTURE

Phase Composition of Soil – Minerological Composition of solid phase – Role of Composition in Engineering behaviour of soils – Fabric and Structure – Types of soil structure – Diffused double layer – Role of soil structure in the Engineering behaviour of soils.

UNIT II

SUBSURFACE CONTAMINATION

Industrialisation and Urbanisation – Pollution – Control & Remediation – Subsurface Contamination – Mechanisms of contaminant transport – Effects of subsurface contamination – Detection of polluted zones – Monitoring effectiveness of designed facilities.

UNIT III

WASTE CONTAINMENT SYSTEM

Essentials of waste containment – Factors influencing contaminant mobility in the subsurface – Containment site selection techniques – Types of containment systems – Configuration of land fills, slurry wells and surface impoundments for containment.

UNIT IV

CONSTRUCTION AND DESIGN OF CONTAINMENT SYSTEMS

Leachate generation – Leachate collection and Removal systems – Stability of land fills – Land fill construction and operation – Construction of Impoundments – Design of Impoundments – Construction of Slurry trench walls.

UNIT V

GEOTECHNICAL REUSE OF WASTE MATERIAL

Waste Reduction – use of waste in Geotechnical Constructions – Engineering properties of waste – Waste material in embankments and fills.

REFERENCE BOOKS

1. Geotechnical Engineering by S.K. Gulhalti & Manoj Datta.
2. Geoenvironmental Engg. by L.N. Reddi and H.J. Inyaung.

Course Outcomes (COs):

1. Analyze the engineering behavior of soils based on soil composition and structure
2. Explain mechanism of containment transportation and its effects in soil property
3. Able to analyze contaminant and select the site based on type of containment system
4. Analyze different containment systems for construction and design of containment systems
5. Explain the need for waste deduction and reuse of waste material in geotechnical construction.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	2	2	1					2	1			3	2
CO2	3	2	2	2	1					2	1			2	2
CO3	2	2	2	2	1					2	1			3	2
CO4	2	2	2	2	1					2	1			3	2
CO5	3	2	2	2	1					2	1			3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

--oOo--

E10 GEOTECHNIQUES FOR DESIGN OF UNDERGROUND STRUCTURES

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1) To teach excavation methods and design of supporting systems
2) To train analysis of deep excavation techniques
3) Explain the design procedure of excavation supporting systems.
4) To demonstrate excavation and protection procedure to be adopted during constructions carrying out below the ground level.
5) To teach the elements and construction process of tunnel

UNIT-I

Excavation Methods and Lateral Supporting System

Introduction - excavation methods and lateral supporting systems - retaining walls - strutting systems - factors influencing on the selection of the retaining strut system - case history. Lateral earth pressure for design of supporting systems - Rankine's and Coulomb's earth pressure theory - earth pressure for design of excavation.

UNIT II

Analysis of Deep Excavation

Introduction - free and fixed earth support method - shear failure of strutted walls - push in - basal heave - upheaval - sand boiling - Stress
and deformation analysis of excavation: simplified method - beam on elastic foundation method - finite element method.

UNIT III

Design of Excavation Supporting Systems

Introduction - design methods and factor of safety - retaining wall - structural components in braced excavations - strut systems - anchor systems -tests of anchors.

UNIT IV

Excavation and Protection of Adjacent Buildings

Introduction - protection of building using the behaviour of excavation induced deformation _ building protection by auxiliary methods – construction defects and remedial measures _ building rectification methods.

UNITV

Design of Tunnel

Introduction - longitudinal and transverse profile of tunnel structure - tunnel protection against fire - advanced systems of anti-water insulation of underground structures - loading types of shallow and deep tunnels, rock mass classification - mining technologies of deep excavation -

shield technology, execution technology of shallow underground structures, sewerage objects - trenchless technologies.

TEXTBOOKS:

1. Chang - Yu Ou, Deep Excavation Theory and Practice, Taylor & Francis Group, ./ London, UK, 2006.
2. Terzaghi, K. and Peck, R. B, John, Soil Mechanics in Engineering Practice, Wiley & Sons, New York, 1967.

REFERENCES:

1. Holtz, R.D. and Kovaces, W.D, An Introduction to Geotechnical Engineering., Prentice - Hall, Inc., Englewood Cliffs, NJ, 1981.
2. Hausman, M. R., Engineering Principles of Ground Modificc1tion, McGraw - Hill Publishing Company, New York, 1990.
3. Hoek, E., Brown, E.T., Underground excavations in rock, The Institution of Mining and Metallurgy, London, SW7 2BP, England, 1980.
4. Megaw T. M., and Bartlett, J. V., Tunnels: planning, design, construction by Ellis Horwood, 1983.

Course Outcomes(Cos):

At the end of the course, student will be able to:

1. Analyze the underground structures.
2. Design the underground structures.
3. Analyze and design various supporting systems that needs for underground construction.
4. Plan for Protect the adjacent building due to underground construction.
5. Planning to be followed in tunnel construction.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	2	2	1		1			2				3	2
CO2	3	3	3	2	1		1			2				3	2
CO3	3	3	2	2	1		1			2				3	2
CO4	3	3	2	2			1			2				3	2
CO5	3	3	2	2			1			2				2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E11 AIR POLLUTION AND CONTROL

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION:
Air pollution refers to any physical, chemical or biological change in the air. It is the contamination of air by harmful gases, dust and smoke which
affects plants, animals and humans drastically. There is a certain percentage of gases present in the atmosphere.

Course Educational Objectives(CEOs):

1. To teach the global effects of air pollution, air pollutants characteristics and sampling methods of air pollutants.
2. To know the effects caused by different air pollutants on human beings, animals, plants and materials.
3. To understand the meteorological aspects of air pollutants dispersion in the different dispersion modeling.
4. To teach the technologies used to reduce air pollution.
5. To understand the automobile pollution and evaluate their efficiency

UNIT – I

POLLUTION SOURCES: Anthropogenic and Natural sources of Air pollutants. Types of Air pollutants. Properties of Air pollutants –Particulates, Carbon monoxide, Oxides of sulphur, Nitrogen Oxides, Hydrocarbons.

GLOBAL EFFECTS: Acid Rains, Green house effect and Ozone layer depletion

AIR POLLUTION SAMPLING AND MEASUREMENT –Devices for sampling, Different sampling methods, Sampling of Particulate Matter and Sampling of stack gas. Analysis of air pollutants Sulphur Dioxide, Nitrogen Oxides, Carbon Monoxide, Oxidants and Ozone, Hydrocarbons, Particulate Matter.

UNIT – II

EFFECTS OF AIR POLLUTANTS:

Effects of Carbon monoxide, Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Hydrocarbon and photochemical oxidants on human beings. Effects on vegetation - Necrosis, Epinasty, Abscission and Chlorosis. Effects of Arsenic, Fluorine and Lead on animals. Effects of Air pollutants on metals, building materials, paints, textiles, electrical Materials, paper, leather, rubber and economy.

UNIT – III

METEOROLOGICAL ASPECTS OF AIR POLLUTANT DISPERSION:

Wind direction and speed, Temperature, Atmospheric stability, mixing height, Precipitation, Humidity, Solar radiation, Visibility, Inversions and plume behavior. The Gaussian Dispersion Model, Diffusion coefficients, Box model and Puff model.

UNIT - IV

AIR POLLUTION CONTROL METHODS:

CONTROL OF PARTICULATE MATTER-General methods of control - Zoning - Town planning. Control of particulate matter –Gravity settling chambers, Cyclones, Inertial seperators, scrubbers, bag-filter, Electrostatic Precipitators.

REMOVAL OF GASEOUS MATTER–Control of Sulphur Dioxide by Reinluft process and Westvaco process; Control of $NO_X$by combustion modification process, VOCs control by adsorption and condensation.

UNIT - V

AIR QUALITY AND EMISSION STANDARDS – Ambient Air Quality Standards

AUTOMOBILE POLLUTION:

Sources, emissions from diesel and petrol engines, Bharat VI standards, catalytic convertors, Management of automobile pollution.

AIR POLLUTION AND LEGISLATION: Salient features of Air Pollution Control Act, 1981, and Environment (Protection) Act, 1986.

TEXT BOOKS:

1. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw Hill Company.
2. K. V. S. G. Murali Krishna, Air Pollution and Control Laxmi Publications, New Delhi, 2015.
3. *C. S. Rao*, "*Environmental Pollution* Control Engineering," Wiley Eastern Limited, New Delhi.

REFERENCE BOOKS :

1. Crawford, M (1976). Air Pollution Control Theory, McGraw-Hill, New York.
2. H.C.Perkins (1974). Air Pollution, Mc-Graw Hill, Tokyo.
3. Wark, Kenneth and Cecil F. Warner (1976). Air Pollution : Its Origin and Control, Dun-Dunnelley,
New York.

Course Outcomes (COs):

After completion of course student can able to:

1. Describe the global effects of air pollution, air pollutants characteristics and sampling methods of air pollutants.

2. Capable of recognizing the effects caused by different air pollutants on human beings, animals, plants and materials.
3. Apply the meteorological aspects of air pollutants dispersion concepts in the different dispersion modeling.
4. Capable of applying suitable technologies to reduce air pollution.
5. To manage automobile pollution and evaluate their efficiency

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	**3**					**2**	**1**							**3**	**1**
CO2	**3**					**2**	**1**							**3**	**1**
CO3	**3**				**3**	**2**	**1**							**3**	**1**
CO4					**2**	**2**	**1**							**3**	**1**
CO5					**2**	**2**	**1**							**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

E12 NOISE POLLUTION AND CONTROL

Instruction Hours/week : 3 (P)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks: 60

DESCRIPTION:

Noise pollution is an invisible danger. It cannot be seen, but it is present nonetheless, both on land and under the sea. Noise pollution is considered to be any unwanted or disturbing sound that affects the health and well-being of humans and other organisms. Sound is measured in decibels.

Course Educational Objectives (CEOs)

2. To know the different sources of noise pollution
3. To know the different noise measuring instruments and techniques
4. To understand the impacts of noise pollution
5. To know various noise standards
6. To learn the advanced technologies to control the noise pollution

UNIT – I

ACOUSTICAL CONCEPTS : Nature of Sound - Sound propagation characteristics - Propagation of sound in air - Absorption of sound in air - Hearing mechanics - Measurement scale - Equal loudness contours.

NOISE CHARACTERISTICS AND SOURCES OF NOISE : Noise characterization - Sources of noise.

UNIT – II

MEASURING INSTRUMENTS AND TECHNIQUES: Methodology of noise measurements - Sound level meter - Noise dose meter - Audiometer - Noise survey techniques - Vehicular noise measurement techniques - Aircraft noise measurement techniques - Sound power determination techniques - Techniques for characterization of acoustical materials.

UNIT – III

HEALTH EFFECT OF NOISE: Annoyance - Sleep disturbance - Effect of noise on task performance and cardio-vascular system - Effect of noise on speech communication - Noise induced hearing loss (NIHL) : Effect of continuous sounds - Hearing damage due to impulse sounds.

UNIT – IV

NOISE STANDARDS: Introduction - Legal position in India - Environmental standards - Occupational / Industrial noise standards - Road vehicles noise standards - Noise vehicles noise standards - noise standards for construction equipment and domestic appliances - Impulse noise (Fireworks) exposure standards.

UNIT – V

NOISE CONTROL TECHNIQUES: Mechanism of noise generation - Control methodology - Noise control at source - Noise control along the path - Control on the receiver end.

NOISE STRATEGY: FUTURE GUIDELINES : Current trend - Noise control measures - Environmental noise management - Noise labeling - Diagnostics - Noise strategy - Problems for future investigations.

Text books

1.Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition
2.Noise Pollution and Control by S. P.Singhal , Narosa Pub House

Reference Books:

1. S.P.Singal, (1999) Noise Pollution and Control, Narosa Publishing House, New Delhi.
2. Cunniff, P.F. (1977), Environmental Noise Pollution, Wiley, New York.

3. Thumann, A., and R.K.Miller (1986). Fundamentals of Noise Control Engineering, Prentice Hall, Englewood Cliffs, N.J.

Course Outcomes

After completion of course student can

1. Able to describe about the sound propagation and noise characteristics
2. Able to assess noise levels
3. Able to classify different effects of noise on environment and human beings
4. Able to apply the noise standards
5. Able to plan suitable noise control technologies.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3					3		2	1					3	2
CO2	3					3		2	1					3	2
CO3	3					2		2	1					3	1
CO4	3					2		2	1					3	1
CO5	3				2	2		2	1					2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E13 ENVIRONMENT POLLUTION AND CONTROL

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION:
Environmental pollution controls often include the management of land development and the design of transportation systems so as to reduce pollution. Environmental planning, the management of land development, and the design of transportation systems are key components of environmental pollution control.

Course Educational Objectives(CEOs):

1) Impart knowledge on aspects of air pollution & control
2) Impart concepts of treatment of wastewater from industrial source.
3) To know the management of municipal solid waste
4) Introduce sanitation methods essential for protection of community health.
5) Provide basic knowledge on sustainable development.

UNIT- I:
Air pollution: Air pollution control methods- Particulate control devices – Methods of controlling Gaseous Emission -Air quality Standards.

UNIT-II:
Industrial waste water Management:
Strategies for pollution control - Volume and Strength reduction - Neutralization - Equalization -Proportioning - Common Effluent Treatment Plants - Recirculation of industrial wastes - Effluent standards.

UNIT-III:
Solid Waste Management: solid waste characteristics - basics of on-site handling and collection - separation and processing - Incineration- Composting-Solid waste disposal methods- fundamentals of Land filling.

UNIT - IV:
Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT-V:

Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability-Industrialization and ·sustainable development - Cleaner production in achieving sustainability- sustainable development.

Textbooks

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, Environmental Engineering, G.Mc-Graw Hill International Editions, New York 1985.
2. J. G. Henry and G.W. Heinke, Environmental Science and Engineering, Pearson Education.

References:

1. G. L. Karia and R.A. Christian, Waste water treatment- concepts and design approach, Prentice Hall of India
2. M. N. Rao and H. V. N. Rao, Air pollution, Tata Mc.Graw Hill Co npany.
3. Ruth F. Weiner and Robin Matthews Environmental Engineering, 4th Edition Elesevier, 2003.
4. K. V. S. G. Murali Krishna, Air Pollution and Control by, Kousal & Co. Publications, New Delhi.

Course Outcomes(Cos):

At the end of the course, the students will be able to:

1. Understand the controlling measures of air pollution and noise pollution
2. Differentiate the treatment techniques used for **industrial wastewater treatment**
3. Describe the different elements of solidwaste management
4. Introduce sanitation methods essential for protection of community health.
5. Provide basic knowledge on sustainable development.

.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3		2	3		2	2							3	1
CO2	3		2	3		2	2							3	1
CO3	3		2	3			1							3	2
CO4	3			2		2	1							2	2
CO5	3			2		2	2							2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E14 INDUSTRIAL WASTEWATER TREATMENT

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION:
Industrial wastewater treatment is the process of removing organic and inorganic contaminants from effluent generated by industrial sites. The treated water can either be released into the environment, discharged to sewer or reused in plant processes.

Course EducationalObjectives(CEOs):
I) To teach impact of industrial wastes on environment.
2) To impart knowledge on selection of treatment methods for industrial waste water
3) To teach characteristics of wastewater and treatment process involved in different industries
4) To provide knowledge on waste reduction practices and sludge management
5) To know the concepts of clean technologies

UNIT – I
INDUSTRIAL WASTE REGULATIONS
Industrial activity in India, Guidelines for siting of industries and industrial estates. Characteristics of industrial Wastewater. Differences between industrial wastes and domestic sewage.
IMPACT OF INDUSTRIAL WASTES ON ENVIRONMENT : Impact of acids and alkalies, suspended matter, organic matter (BOD), refractory organics, coloured matter, inorganic solids, heavy metals, foaming agents (detergents), nutrients, oil and greases, biological (pathogenic) wastes, thermal waters and nuclear wastes on the environment.

UNIT – II

TREATMENT METHODOLOGY

Neutralization, Equalization, Proportioning, Sedimentation, Flotation , Screening, coagulation, Evaporation, Ion Exchange, Reverse Osmosis, Lagooning, High –rate aerobic treatment, Trickling filtration ,Rotating biological contactors, Anaerobic digestion system.

UNIT-III

OUTLINES OF MANUFACTURING PROCESSES, SOURCES, VOLUMES, CHARCTERISTICS, AND TREATMENT PROCESSES OF MAJOR INDUSTRIES: Sugarcane, tannery, pulp and paper mills, textile mill industry and fruit processing industry.

UNIT – IV

INDUSTRIAL WASTE MINIMIZATION PRACTICES: Volume reduction, strength reduction, process changes, equipment modifications, chemical substitution, segregation of wastes, equalization of wastes, by product recovery, proportioning wastes.

MANAGEMENT OF INDUSTRIAL SLUDGES: Sources of production of industrial sludges, anaerobic and aerobic digestion, vacuum filtration, elutriation, drying beds, Sludge Lagooning, wet combustion process, drying and incineration, centrifuging, sanitary landfill.

UNIT – V

CLEAN MANUFACTURE PROCESS-Basic concepts of clean technologies, Zero pollution industrial complexes, Introduction to ISO 14000, Life cycle Analysis, pollution pays policy, common effluent treatment plants.

TEXT BOOKS

2. M. N. Rao and A. K. Dutta, Wastewater Treatment, Oxford & IBH, New Delhi.
3. K.V. S. G. Murali Krishna, Industrial Water and Wastewater Management

Reference Books :

1. Nemerow, N.L. (1977). Liquid waste of Industry, Theories, Practices and Treatment, Addision-Wesly Publishing Company, London.
2. Mahajan, S.P. (1990). Pollution Control Processing Industries. Tata Mc–Graw – Hill Publishing Company Limited, New Delhi.
3. Rao, M.N.andA.K.Datta. (1979). Wastewater Treatment. Rational Methods of Design and Industrial Practices. Oxford and IBH Publishing Co., New Delhi.

Course Outcomes (COs):

At the end of the course student can able to:

I) To describe the impacts of industrial wastewater on environment.
2) Capable of applying suitable treatment technology for industrial wastewater
3) To characterize the different industrial wastewater and apply suitable treatment methods
4) Capable of minimizing the industrial waste and manage industrial sludge
5) To apply concepts of clean manufacturing process.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3				3	2	2	2	1					3	2
CO2	3				3	2	2	2	1					3	2
CO3	3				2	2	2	1	1					3	2
CO4	3				3	2	2	2	1					3	2
CO5	3				2	2	1	2	1					3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E15 ENVIRONMENTAL QUALITY AND POLLUTION MONITORING TECHNIQUES

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION:

Environmental Monitoring Method or Procedure is to understand the level of harmful pollutants present in the atmosphere and its effects on the environment, human life, animals and trees.

Course Educational Outcomes(CEOs):

1. To study about the gravimetric methods for solids analysis
2. To know the different titrimetric methods for pollution monitoring
3. To teach the different instrumental methods for pollution monitoring.
4. To know the different biological methods for pollution monitoring
5. To teach the different air analysis methods of pollution monitoring

UNIT-I

INTRODUCTION- Importance of Quantative measurements, Character of Environmental Engineering and science problems, standards methods of analysis, scope of a course in analysis of environmental samples, expression of results. Gravemetric methods for solids analysis in water and wastewater.

UNIT-II

TITRIMETRIC METHODS

Determination of acidity, alkalinity, hardness, chloride and residual chlorine.

UNIT-III

INSTRUMENTAL METHODS

Optical methods of analysis, electrical methods of analysis, chromatographic methods, AAS, UV-VIS. Material characterization techniques- SEM, XRD, Determination of nitrogen and phosphate

UNIT-IV

BIOLOGICAL METHODS AND MICROBIOLOGY

Biochemical oxygen demand

MPN test for microbial pollution

Plate counts

UNIT-V

AIR POLLUTION ANALYSIS

Sampling techniques for air pollution measurements, analysis of particulates like PM_{10}, $PM_{2.5}$ and common chemical air pollutants like VOC, Hydrocarbons, oxides of nitrogen and sulphur.

Course Outcomes(Cos):

After completion of course student can

1. Able to do the gravimetric methods for solids analysis
2. Able to apply the different titrimetric methods for pollution monitoring
3. Able to use the different instrumental methods for pollution monitoring.
4. Able to apply the different biological methods for pollution monitoring
5. Able to use the different air analysis methods of pollution monitoring

Text books:

1.Chemistry for environmental engineering and science ,fifth edition, by clair N sawyer,PerrylMccarty and Gene F, Parkin.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3				3	3	2	2	2					3	1
CO2	3				3	3	2	2	2					3	1
CO3	3				3	3	2	2	2					3	1
CO4	3				3	3	2	2	2					3	1

CO5	**3**				**3**	**3**	**2**	**2**	**2**					**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

E16 WATERSHED MANAGEMENT

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION OF THE COURSE:
Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about hydrology, water shed and soil conservation concepts and applying this knowledge in management of different watersheds.

Course Educational Objectives (CEOs):

1. To learn about Rainfall-Runoff analysis and estimation and design of storm
2. To known about various types of soil erosions and their equations
3. To understand various concepts of watershed and their impacts on human
4. To understand various concepts of watershed management.
5. To know the concepts of soil conservation and water harvesting techniques.

UNIT I
WATERSHED HYDROLOGY:
Precipitation - Analysis –Runoff – Factors affecting- Estimation of runoff by different methods- Floods- estimation of floods.

UNIT II
SOIL EROSION:
Soil erosion – Erosion due to water and wind – Gully erosion – stream bank erosion-Factors affecting soil erosion–- Erosivity and Erodability- Universal soil loss equation.

UNIT III
WATERSHED CONCEPT
Definition- watershed characteristics-Classification of watersheds- watershed delineation and prioritizing- Coding of watershed- Human impacts on watershed – Flood control measures.

UNIT IV
WATERSHED MANAGEMENT
Watershed management principles and objectives- Factors affecting watershed management- Watershed inventory – Consultation process–Evaluation of constraints and criteria – Simple assessment methods - Participatory watershed management – Adaptive watershed management-

Community watershed management- Integrated watershed management.

UNIT V

SOIL CONSERVATIION AND WATER HARVESTING TECHNIQUES

Farm ponds – Percolation tanks – Drop spillway – Pipe spillway – Erosion control structures - Artificial recharge – Different Methods – Rainwater harvesting.

REFERENCE BOOKS:

1. Prof. R. Suresh, "Watershed Hydrology " Standard Publishers.
2. Isobel W. Heathiote. "Integrated Watershed Management – Principles and Practices".
3. Schwab, G.O. & others, "Soil and water Conservation Engineering".
4. Prof. R. Suresh, "Soil and water Conservation Engineering".(Standard Publishers).
5. Wayne A. Pettyjohu, "Introduction to Artificial Ground Water Recharge" Scientific Publishers, Jodhpur.

Course Outcomes (COs):

1. Able to explain about Rainfall-Runoff analysis and estimation and design of storm
2. Able to determine soil erosion and their classification
3. Able to classify different types of watersheds and their impacts
4. Able to compute watershed constraints and integrated watershed management.
5. Able to design harvesting structures..

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	1	2	1	-	-	-	-	-	-	-		3	2
CO2	2	2	1	2	1	-	-	-	-	-	-	-		3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-		3	2
CO4	2	2	2	2	1	-	-	-	-	-	-	-		3	2
CO5	2	2	2	2	1	-	-	-	-	-	-	-		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E17 HYDRAULIC STRUCTURES

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION OF THE COURSE:
Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about design of hydraulic structures, design of gravity dams and spillways.

Course Educational Objectives (CEOs):

1. To learn about Canal structures of falls, cross drainage works, regulators and outlets
2. To understand the concepts of design of diversion head works.
3. To know about different types of dams and reservoirs.
4. To learn design concepts of Gravity dam
5. To understand the concepts of spillways

UNIT 1
CANAL STRUCTURES
Falls – classification - selection of suitable site; C-D works - classification- selection of suitable site ; Regulators - classification- selection of suitable site ; Outlets-classification- selection of suitable type - Sensitivity and flexibility.

UNIT II
DIVERSION HEAD WORKS
Weirs – location - classification - causes of failure – Design of weirs using Bligh's theory and Khosla's theory- Design of vertical drop weir.

UNIT III

DAMS (GENERAL) AND RESERVOIRS

Dams – Classification – selection of suitable site - selection of suitable type – Reservoir – classification - Zones- Determination of reservoir capacity – life of reservoir.

UNIT IV

GRAVITY DAMS

Introduction – Forces acting – Stresses – causes of failure - Stability analysis – Elementary profile – limiting height of a gravity dam – Foundation treatment – Joints.

UNIT V

SPILLWAYS

Spillways – functional requirements – classification – Energy dissipation below the spillway for different positions of JHC and TWC – Stilling basins – Gates

TEXT BOOKS :

1. Irrigation Engineering and Hydraulic Structures - P.N.Modi.
2. Irrigation Engineering and Hydraulic Structures - S.K.Garg.
3. A text book of Irrigation Engineering and Hydraulic Structures - R.K.Sharma.
4. Irrigation and Water Power Engineering – B.C.Punmia and Dr.Pande.
5. Irrigation and Water Resources and Water Power Engineering – Dr. P.N.Modi.

Reference Books:

1. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers

2. Irrigation, Waterpower and Water Resources Engineering by K R Arora; Standard Publication,New Delhi 2010

3. Water resources engineering by Satyanarayana Murthy. Challa, New Age International Publishers 2020

Online Learning Resources:

https://nptel.ac.in/courses/105105110

Course Outcomes (COs):

1. Able to explain Canal structures of falls, cross drainage works, regulators and outlets
2. Able to design of diversion head works.
3. Able to classify different types of dams and reservoirs.
4. Able to design gravity dam.
5. Able to compute energy dissipations in spillways.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO3	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO5	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

E18 WATER RESOURCES SYSTEM ANALYSIS

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about concepts of system analysis, economics of water resources and linear and dynamic programming in water resources systems.

Course Educational Objectives (CEOs):

1) To learn the concepts of system analysis.
2) To understand the concepts of Economics of water resources projects.
3) To know about the systems approach to reservoirs.

4) To apply the linear programming concepts to water resources systems.
5) To apply the dynamic programming concepts to water resources systems.

UNIT I

Concept of System and System Analysis - Definition and Types of Systems-Basic Principles of Systems Approach and Analysis. Systems Techniques in Water Resources.

UNIT II

Introduction to Optimization, Linear and Dynamic Programming - Simulation - Economics of Water Resources Projects - Cost Benefit Analysis - Cost Allocation among various projects in a Multi-purpose Project.

UNIT III

Systems Approach to Reservoir - Deterministic Flows - Reservoir Sizing and Reservoir Operations. Basic Concepts of Random Flows- Reliability.

UNIT IV

Application of Linear Programming to Water Resources Systems - Irrigation Water Allocation for Single and Multiple Crops - Reservoir Operation for Irrigation.

UNIT V

Applications of Dynamic Programming to Water Resources Systems - Optimal Crop Water Application - Steady State Reservoir Operating Policy for Irrigation.

TEXTBOOKS:

1. Loucks, D.P. and Eelco Van Beek, Water Resources systems planning and management: An Introduction to methods, models and applications. (2005),UNESCO.

2.Vedula, S.and Mujumdar, P. Water resources Systems :Modeling techniques and analysis, (2005), Tata McGraw Hill,New Delhi.

REFERENCES:

1. Mays, L.W. and Tung, Y. K., Hydro-systems Engineering and Management,(1992). McGraw Hill, USA.
2. Simonovic, S.P.,Managing water resources:Methods and tools for a systems approach, (2009). UNESCO Publishing, France.
3. R. K. Sharma & T. K. Sharma, A Textbook of Irrigation Engineering, S. Chand and Company Limited, New Delhi

Course Outcomes (COs):

1. Able to explain the concepts of system analysis.
2. Able to apply the concepts of Economics of water resources projects.
3. Able to understand about the systems approach to reservoirs.
4. Able to apply the linear programming concepts to water resources systems.
5. Able to apply the dynamic programming concepts to water resources systems.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	3	3	2	2									3	2
CO2	3	3	3	2	2									3	2
CO3	3	3	3	2	2									3	2
CO4	3	3	3	2	2									3	2
CO5	3	3	3	2	2									3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E19 DESIGN AND DRAWING OF IRRIGATION STRUCTURES

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations
Marks : 60

DESCRIPTION OF THE COURSE:

Hydrology and Water Resources Engineering is considered as pre-requisite for this course. The students will be learning about concepts of different irrigation and hydraulic structures and design the same.

Course Educational Objectives (CEOs):

1. To understand the concepts of Surplus weir and design and draw the various components of the same.
2. To understand the concepts of Tank sluice with tower head and design and draw the various components of the same.
3. To understand the concepts of Canal drop notch type and design and draw the various components of the same.
4. To understand the concepts of Siphon well drop and design and draw the various components of the same.
5. To understand the concepts of Canal regulator and design and draw the various components of the same.

DESIGN AND DRAWING OF

1. Surplus weir
2. Tank sluice with a tower head
3. Canal drop-notch type
4. Siphon well drop
5. Canal regulator

TEXT BOOK:

1. "Water Resources Engineering principles and practices" – C.S. Murthy.

Course Outcomes (COs):

1. Able to design and draw Surplus weir
2. Able to design and draw Tank sluice with tower head
3. Able to design and draw Canal drop notch type
4. Able to design and draw Siphon well drop
5. Able to design and draw Canal regulator

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	3	2	2	-	-	-	-	-	-	-		3	1

CO2	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

E20 APPLICATIONS OF IOT TO CIVIL ENGINEERING

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION OF THE COURSE:
This course includes basics of IoT and applications of IoT in different fields in Civil Engineering.

Course Educational Objectives (CEOs):

1. To understand the basic concepts of IoT
2. To apply the knowledge of IoT in Environmental Engineering
3. To apply the knowledge of IoT in Geotechnical and Transportation Engineering
4. To apply the knowledge of IoT in Water management and RS and GIS
5. To apply the knowledge of IoT in Structural Engineering

UNIT I
BASICS OF IOT
Definition of IoT - Evolution to IoT - benefits and application areas of IoT- IoT devices communicating with each other in industry- Challenges in IoT - Future of IoT.

UNIT II
IOT IN ENVIRONMENTAL ENGINEERING
Application of IoT to planning and design of eco-friendly and smart cities, Green buildings, Environmental Impact assessment, Pollution studies, Treatment processes.

UNIT III

IOT IN GEOTECHNICAL AND TRANSPORTATION ENGINEERING

Application of IoT to studies on soil properties, settlements, foundation designs, design of pavements, traffic volume studies, smart signals.

UNIT IV

IOT IN WATER MANAGEMENT, RSAND GIS

Application of IoT to irrigation water management, soil moisture studies, scheduling of irrigation water, operation of pumps, operation of reservoir water, canal water supplies, various aspects of Remote Sensing, tools in GIS platform.

UNIT V

IOT IN STRUCTURAL ENGINEERING

Application of IoT to studies on building planning, design, structural stability, behaviour, smart buildings, Energy efficient buildings.

TEXT BOOKS:

1. Handbook of Research on Implementation and Deployment of IoT Projects in Smart Cities (Advances in Civil and Industrial Engineering) by Krishnan Saravanan (Editor), Golden Julie (Editor), Harold Robinson (Editor)
2. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
3. Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media, 2014.
4. "Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti

REFERENCE BOOKS:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

ONLINE REFERENCES:

1. Y. Mehta, "Will Internet of Things Technology Make Life Any Easier?" [online], source: http://iotworm.com/internet-thingstechnology-make-life-easier/, (2015).
2. B. Elyse, Internet of Things explained: Your complete guide to understanding IoT, [online], source: http://www.pocketlint.com/news/126559-internet-of-thingsexplained-what-is-it-and-can-it-reallychange-the-world, (2018).
3. Wikipedia contributors. "Internet of things." Wikipedia, The Free Encyclopedia. (2018).
4. NPTEL Videos and Lectures on IoT and its applications, https://archive.nptel.ac.in/courses/106/105/106105166/
5. YouTube videos and Power point presentations.

*****

Course Outcomes (COs):

1. Able to explain the basic concepts of IoT

2. Able to apply the knowledge of IoT in Environmental Engineering
3. Able to apply the knowledge of IoT in Geotechnical and Transportation Engineering
4. Able to apply the knowledge of IoT in Water management and RS and GIS
5. Able to apply the knowledge of IoT in Structural Engineering

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	2	1	3	-	-	-	-	-	-	-		2	1
CO2	3	2	2	1	3	-	-	-	-	-	-	-		2	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-		2	1
CO4	3	2	2	1	3	-	-	-	-	-	-	-		2	1
CO5	3	2	2	1	3	-	-	-	-	-	-	-		2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E21 TRAFFIC ENGINEERING AND MANAGEMENT

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION:

It focuses mainly on research for safe and efficient traffic flow, such as road geometry, sidewalks and crosswalks, cycling infrastructure, traffic signs, road surface markings and traffic lights. Traffic engineering deals with the functional part of transportation system, except the infrastructures provided.

Course Educational Objectives (CEOs):

1. To give an overview of Traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

UNIT I
TRAFFIC CHARACTERISTICS
Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India

UNIT II TRAFFIC SURVEYS
Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL
Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelisation – Grade separation - Traffic signs and road markings.

UNIT IV
TRAFFIC SAFETY AND ENVIRONMENT
Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

UNIT V
TRAFFIC MANAGEMENT
Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

Course Outcomes(Cos):
Students would have gained knowledge on
1. Characteristics of traffic elements
2. Various types of traffic survey and traffic significance
3. Apply traffic regulation and safety measures
4. Application of traffic management measures.

TEXTBOOKS:
1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros.,

Roorkee, Revised 10th Edition, 2014.
3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
4. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition,
5. Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
3. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Hobbs. F.D.Traffic Planning and Engineering,University of Brimingham, Peragamon Press Ltd, 1994.
5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
6. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elseevier, 1992.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-		**3**	**1**
CO2	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-		**3**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-		**3**	**1**
CO4	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-		**3**	**1**

1 - Slightly; 2 - Moderately; 3 – Substantially

E22 ESTIMATION & COSTING

Instruction Hours/week : 3(L)

Credits : 3

Sessional Marks : 40 Semester-end

Examination :60

DESCRIPTION:

Provides cost estimates/comparison costs for the value of goods that are provided by the supply chain. Overall Purpose of the Role: To collect and analyse data and information in order to estimate costs associated with manufacturing a product.

Course Educational Objective (CEOs):

1. To know about the building estimation
2. To understand different floorings, roof, wood work of building construction
3. To learn about the rate analysis.
4. To gain knowledge in contracts and valuation

UNIT - I

General items of work in building - Standard units - Principles of working out quantities for detailed and abstract estimates, approximate and detailed estimates of simple buildings

UNIT - II

Standard specifications for different items of building construction - Earth work for foundations, mortors, foundation concrete - Reinforced concrete, Brick work, Stone masonry, sand, cement, kankar, lime, mosaic flooring, terrozoic flooring, RCC roof and AC roof and GI sheets, plastering, painting, pointing and wood works.

UNIT - III

Rate analysis for the following items:

Earth work for foundations and basement of buildings
Mortars: Cement mortar (1:4)
Foundation Concrete: Cement Concrete (1:5:10)
Reinforced Concrete: Lintels, slabs, beams, columns (1:2:4)
Brick work: Constructed with first class bricks with L.M. (1:1.5) and C.M (1:6
Stone masonry: C.R.S - Ist sort constructed with C.M. (1:2) and R.R.Masonry C.M (1:2).
Flooring: (a) with Cuddapah or Shahbad slabs.
(b) Ellis pattern flooring with 10 cm.
Concrete and 20mm cement concrete surface - Mosaic flooring.
Roofing: (a) R.C.C roof 10cm thick, 2 courses of flat tiles to top.
(b) A.C. corrugated sheet roofing on steel purlins.
Plastering: a) C.M. (1:4) 12 mm thick.

Pointing : a) with C.M (1:3) flush pointing to R.R.masonry.
b) C.M (1:3) for brick masonry.
c) Pointing to Cuddapah slab flooring.
Painting: a) White washing and colour washing of walls: 2 coats.
b) Painting iron and wood work: 3 coats.
Wood work: Panelled doors and windows.

UNIT - IV

Contracts, Types of contracts, contract document, conditions of contracts, contract procedure, termination of contracts, specification important condition of contract, arbitration and tenders.

UNIT - V

Valuation:

Introduction, technique of valuation, elements of valuation and factors affecting valuation, methods of valuation of land property and building property, rate of interest for sale, purchase, mortgage, Fixation of rent.

Valuation – Gross income, Net income, Outgoings, Scrap value, Salvage value, Obsolescence, Annuity, Capitalized value, Year's purchase, Sinking fund, Depreciation; Determination of depreciation.

TEXT BOOKS:

1. Text book of estimating and costing - B.N.Dutta.
2. Estimating Costing by G.S.Biride.
3. Valuation by Rangwala.
4. A.P.D.S.S. Standard data book Vol.II.
5. A.P.Department standard specifications.
6. Professional practice - by Roshan Namvati

Course Outcomes (COs) :

After completion of the course the student will have:

1. To know about the approximate or detailed estimation of simple buildings.
2. To be thorough in standard specifications in building construction.
3. To work on rate analysis of different items of work of buildings.
4. To be able to estimate and contracts, tenders, specifications.
5. To be able to proficient in valuation of buildings.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	2	1	2	1	-	-	-	-	-	-	-		3	2
CO2	2	2	1	2	1	-	-	-	-	-	-	-		3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	-		3	2
CO4	2	2	2	2	1	-	-	-	-	-	-	-		3	2

CO5	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**3**	**2**

1 - Slightly; 2 - Moderately; 3 – Substantially

E23 BUILDING CONSTRUCTION PRACTICE

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION:
Building construction is the process of adding structure to real property. The vast majority of building construction projects are small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as laborer, paymaster, and design team for the entire project.

Course Educational Objectives (CEOs):

1. Impart in investigation of soil condition, Deciding and design of suitable foundation for different structures
2. Examining the good materials to be used for the construction work
3. To understand supervision of different types of masonry
4. Illustrate the methodology in selection of materials, design and supervision of suitable type of floor and roof.
5. To know the methodology of constructing advances structures

UNIT-I:
Structural Components:
Foundations - classification of Foundations - consideration in selection of foundation types - Masonry - Brick and block walls - Cavity walls - Damp-proof courses and membranes - Mortars - Arches and openings - Windows - Glass and glazing -Doors - Stairs - Types and Applications - Cladding to external walls - Flat roofs - Dormer windows - Formwork &

Scaffolding - Precast concrete frames - Portal frames - Types - components - Framed structures- Components - Construction Procedure - Panel walls - National Standards.

UNIT-II:
Internal Construction and Finishes
Internal elements - Internal walls - Construction joints - Internal walls, fire protection - separating walls - Partitions - Plasters and plastering - Domestic floors and finishes - Sound insulation - Timber, concrete and metal stairs-Internal doors - Door - Fire resisting doors - Plasterboard ceilings - Suspended ceilings -Paints and painting - Components of Paints - Types of Paint - Considerations in Selecting Paints - Cement Paints - Oil Paints -Emulsion - Paints - Whitewash and Colour wash -Application of Paints -Distempers - Varnishes - Safety-Joinery production - Composite boarding - National Standards.

UNIT- III:
Construction of high rise buildings:
Construction methods and techniques using different materials, Minerals, Admixtures in-situ concrete, Precast Concrete & Structural Steel, finished concrete, tunnel form, fire Fighting, Safety & Hazards, Job Safety Analysis. Innovative methods of construction - Slip form technology, Jump form technology, Aluform & Tunnel Form Technology, Dry wall technology, Plastering Machines.

UNIT-IV:
Concepts and components of bridges:
Bridges, Steel Bridges, Arch Bridges, Cantilever Bridges Segmental construction & Box Girders. Construction of special type of bridges such as cable stayed bridge, suspension and Pre-stressed bridge, construction of foundation and Super structure. Construction of Metro Railway & Monorail - Underground and over ground structures, different methods and techniques of construction. Problems and solutions - during maintenance and upkeep of structures. Fire, Ventilation, Dewatering and power supply, Subsidence, Vibration etc., Concept of Magrail.

UNIT-V:
Construction of Power Generating Structures
Atomic Power stations, Thermal power stations- Generation Power Plants, Windmills, Transmission towers, Chimneys (single and multi-flue), cooling towers - Natural draft cooling towers (NDCT) & induced draft cooling tower (IDCT), Ash handling system, Containment Structure, Electro Static Precipitator (ESP), Case study of Kaiga atomic power station, Madras atomic power station. Or Any other Case Study and Safety Hazards

TEXTBOOKS:

1. Peurifoy, Construction Planning, Equipment and methods, Tata McGraw Hill Publication
2. Roy Chudley and Roger Greeno, Construction Technology, Prenti e Hall, 2005.

REFERENCES

1. Mahesh Varma, Construction Equipment Planning and Applications-
2. Kumar Niraj Jha, - Formwork for Concrete Structures, Mc Graw Hill Publication
3. Sushi! Kumar "Building Materials and construction", 20th edition, reprint 2015, Standard Publishers
4. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi.

Course Outcomes(Cos):

At the end of the course, the student will be able to:

1. Classify suitable materials for buildings and adopt suitable construction techniques.
2. Adopt suitable internal finishes and maintenance work to enhance durability of buildings.
3. Design of high rise buildings.
4. Design of power generation structures

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	3	3	2	2	-	-	-	-	-	-	-		3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-		3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	-		3	2
CO4	3	3	3	2	2	-	-	-	-	-	-	-		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E24 CONSTRUCTION PLANNING & PROJECT MANAGEMENT

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION OF THE COURSE:

It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the

different work tasks. A good construction plan is the basis for developing the budget and the schedule for work.

Course Educational Objectives (CEOs):

1. Able to plan construction projects, schedule the activities determine and control the cost of the project, by creating cash flows and
2. Understand budgeting. the operation of construction
3. To know equipment. the labor and industry. safety laws, quality control and ethical audit in construction

UNIT I

INTRODUCTION:

Significance of construction management, Objectives and functions, Construction Resources, Stages in types, construction, personnel involved in construction planning and their Engineering drawings, roles, specifications and tender documents and their importance in planning. Scheduling and control, Advantages, Classification of scheduling, Methods of scheduling, Bar charts planning and (Gnat charts), and Mile stone charts.

UNIT II

CPM and PERT ,Comparison between CPM and PERT, Network and techniques terminology, Event activity, Network representation, AON and AOA and dummies system, Development of net-work, errors in net-work logic, calculation of network(CPM) times, floats and slacks, project scheduling and critical path, superficial path, Up-dating, Resources smoothening and leveling. Cost-time analysis in Net-work planning, Importance of time-cost analysis, Direct costs and Indirect costs, Operation time-cost Trade off graphs, Normal and erash Time-cost points, Project Trade, off curves, optimizing project costs, Recompression of multiple critical Crash paths, limit and free float limit, optimization of costs.

UNIT III

CONSTUCTION EQUIPMENT: Engineering Fundamentals ,classification, rolling resistance, Rim pull, Coefficient of friction ,Conditions of Management factor, Coefficient of traction swelling and shrinkage of soils, Selection of construction equipment, Depreciation, Methods of cost reduction in construction, Earth Moving Equipment, Excavating plants and equipment, Transporting equipment, earth compaction equipment, Earth spreading Equipment, Equipment for concrete construction.

UNIT IV

Progress control, purpose, Methods of recording progress, Recording and analysis of progress, corrective action, productivity and methods to increase productivity, work study, Time-study, operation analysis, process charts. Organizing construction: Types of organization, Details, Principles of organization, Details, Organizational relationship, organization charts, Functions of different personnel involved in organizing construction, Types of contracting firms, Temporary services, Job Layout.

UNIT V

Construction Labor: Status of construction worker, Types of labor, Wages, Trade unions, Trade union Act 1936,Labour welfare fund Act 1965,payment of wages Act, Minimum wages act,

Contract labor Act, Industrial dispute Act, Factories Act. Safety in construction Industry: Importance of safety, Accidents, causes and safety measures in construction Industry, Safety campaign.
ETHICAL AUDIT Introduction, Aspects of project realization, Ethical audit procedures, The decision makers, Variety of interests, Formulation of briefs, The environment ,The audit statement, The audit reviews.

TEXT BOOKS

1. Construction Planning and Management by P.S.Gohlot and B.M.Dhir, Wiley Eastern Limited, New Delhi (1992).
2. Construction Equipment and its Management by S.C.Sarma, (1995).
3. Engineering Ethics by M.Govinda Rajan, S.Natarajan and V.S.Senthilkumar, PrenticeHall of India Pvt. Ltd. (2004), New Delhi (Chapters 4 and 7).
4. Construction Management and Accounts by J.L Sharma, Satya Publications, New Delhi.
5. Construction Engineering and Management by S.Seetharaman, Delhi (1997).
6. Construction Management and Accounts by Harpal Singh, Tata Publishing Limited, New Delhi.
7. PERT and CPM: Principles and Application.3" edn.-L.S.Srinath Affliated East-West press pvt.Ltd. New Delhi.
8. Planning and control with PERT and CPM -Richard,Levin and Charles A.Kirkpatrick Tata McGraw-Hill publishing Co.Ltd,New Delhi.

Course Outcomes (Cos) :

1. Compute and sketch CPM and PERT diagram.
2. Assemble and sketch scheduling of construction activities in construction industry.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	1	1	1	-	-	-	-	-	-	-		2	2
CO2	3	2	1	1	1	-	-	-	-	-	1	-		2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E25 PROJECT FORMULATIONS AND APPRAISAL

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know about project starting from project formulation, costing, appraisal, risk analysis in capital budgeting and project financing.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the basic concepts of project formulation.
2. To know and solve basic concept of project costing.
3. To understand and analyze the project appraisal.
4. To understand and compute risk analysis in capital budgeting.
5. To understand the concept of project financing.

UNIT I PROJECT FORMULATION

Project – Concepts – Capital Budgeting - Generation and Screening of Project Ideas - Project identification –Pre Feasibility Report and its Clearance - Project Estimates and Techno-Economic Feasibility Report- Detailed Project Report.

UNIT II PROJECT COSTING

Project Cash Flows – Time Value of Money – Cost of Capital.

UNIT III PROJECT APPRAISAL

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal

UNIT IV RISK ANALYSIS IN CAPITAL BUDGETING

Introduction, Types and Sources of Risk in Capital Budgeting, Risk Adjusted Discount Rate, Certainty Equivalent Approach, Probability Distribution Approach, Sensitivity Analysis, Simulation Analysis, Decision Tree Approach

UNIT V PROJECT FINANCING

Project Finance – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios – Public Private Partnership.

COURSE OUTCOMES (COs):

1. Able to perform project formulation
2. Able to solve basic concept of project costing
3. Able to analyze the project appraisal
4. Able to compute risk analysis in capital budgeting
5. Able to explain the concept of project financing.

REFERENCES:

1. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation Review", McGraw Hill Publishing Company Ltd., 8th Edition, New Delhi. 2014.
2. Joy P.K., "Total Project Management - The Indian Context", New Delhi, Macmillan India Ltd., 2010.
3. Rajiv Srivastava, Anil Misra, "Financial Management", Oxford University Press, 2nd Edition, New Delhi, 2015.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	3	2	1	1	2	-	-	-	-	-	-	-		2	2
CO2	3	2	1	1	2	-	-	-	-	-	3	-		2	2
CO3	3	3	2	3	2	-	-	-	-	-	2	-		2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO5	3	3	2	3	2	-	-	-	-	-	3	-		2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E26 OPTIMIZATION TECHNIQUES

Instruction Hours/week : 3(L)

Credits : 3

Sessional Marks : 40 Semester-end Examination :60

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know the various optimization techniques which can be adopted in design, construction and maintenance of any engineering system. Linear

Programming, Non Linear Programming, Dynamic Programming techniques are explained in detail. Advanced optimization techniques such as Genetic algorithm, Evolutionary search algorithm, Simulated Annealing and Ant Colony Optimization are briefly introduced.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the basic concepts of mathematical models and constraints in optimization method.
2. To know and solve basic concept of linear programming
3. To understand and analyze the basic concept of non-linear programming
4. To understand and compute Dynamic programming and network analysis.
5. To understand and analyze the concepts of non traditional methods of optimization techniques.

UNIT I
INTRODUCTION

Activity- Design methodology - Mathematical models -Design Variables, Objective Function, Unconstrained functions – Single variable – Several variables – Equality Constraints – In-equality constraints - Problem Formulation – Generalized Newton Raphson method

UNIT II
LINEAR PROGRAMMING (LP)

Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming, Transportation & Assignment Problems, Integer linear programming.

UNIT III
NON-LINEAR PROGRAMMING

Optimality criteria – unconstrained function of single variables –several variables- Uni-directional search - Direct search methods – pattern search method - constrained function of single variable – several variables – Gradient Based Methods.

UNIT IV
DYNAMIC PROGRAMMING AND NETWORK ANALYSIS

Pipeline network problem –solution of network – optimality – allocation process -probability in PERT analysis, project time cost trade off, introduction to resource smoothing and allocation – optimization by dynamic programming – simulation methods.

UNIT V
NON-TRADITIONAL METHODS

Simulated Annealing – Algorithm- Boltzmann's equation – stability – Genetic Algorithm and Evolutionary Strategy –Choice of population – genetic operators- survival of the fittest – two bar pendulum – generation – Ant Colony Optimization –probability – finding the short path – pheromone trail.

COURSE OUTCOMES (COs):

1. Able to formulate the basic mathematical model in optimization technique.
2. Able to analyze the concepts in linear programming.
3. Able to analyze the concepts in Non-linear programming
4. Able to solve the problems in dynamic programming and network analysis.
5. Able to analyze the non-traditional methods in optimization method.

TEXT BOOKS:

1. Rao, S.S: "Engineering Optimization: Theory and Practice", John Wiley & Sons,Inc, 2009.
2. Taha, H.A,"Operations Research: An Introduction, Pearson,2013.
3. N D Vohra, Quantitative Techniques in management, Tata McGraw Hill, 2006.

REFERENCES:

1. Goldberg, D.E, "Genetic Algorithms in search, Optimization and Machine Learning", Eddison and Wesley, 1989.
2. Dorigo, M and Stutzle, T," Ant Colony Optimization", MIT Press, Cambridge, 2004.
3. Deb, K, Optimization for Engineering Design, Prentice Hall of India.2012.
4. Ravindran, A , Ragsdell, K.M, Reklaitis, G.V, "Engineering Optimization: Methods and Applications", Wiley, New York,2006.
5. Hadley, G,"Linear programming", Narosa Publishing House, New Delhi, 1992.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-		2	2
CO5	3	3	2	3	2	-	-	-	-	-	-	-		2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

E27 ORGANIZATIONAL BEHAVOIUR

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester
Examinations Marks : 60

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know the various management techniques in organizational behavior such as Role of management, planning process, organization structure and design, perception and learning, group dynamics and Leadership and Organizational Culture and Climate.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. To understand the concepts of role of management, planning, policies and strategies
2. To know the concept of organizational structure and design
3. To understand the concept of perception and learning
4. To know about group dynamics
5. To understand the concept of Comparative Management Styles and approaches

UNIT I

Nature of Management - Social Responsibility ties of Business - Manager and Environment Levels in Management - Managerial Skills - Planning - Steps in Planning Process - Scope and Limitations - Short Range and Long Range Planning - Flexibility in Planning ¬Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies - Scope and Formulation - Decision Making - Techniques and Processes.

UNIT II

Organizing - Organization Structure and Design - Authority and Responsibility Relationships - Delegation of Authority and Decentralization - Interdepartmental Coordination - Emerging Trends in Corporate Structure, Strategy and Culture - Impact of Technology on Organizational design - Mechanistic vs Adoptive Structures - Formal and Informal Organization.

UNIT III

Perception and Learning - Personality and Individual Differences - Motivation and Job Performance - Values, Attitudes and Beliefs - Stress Management - Communication Types-Process - Barriers - Making Communication Effective.

UNIT IV

Group Dynamics - Leadership - Styles - Approaches - Power and Politics - Organizational Structure - Organizational Climate and Culture - Organizational Change and Development.

UNIT V

Comparative Management Styles and approaches - Japanese Management Practices Organizational Creativity and Innovation - Management of Innovation - Entrepreneurial Management -

Benchmarking - Best Management Practices across the world - Select cases of Domestic & International Corporations - Management of Diversity.

Reference Books:

1. Organizational Behavior, Stephen P. Robbins, Pearson Education.
2. Organizational Behaviour, S.S.Khanka, S.Chand
3. Organizational Behavior , Mishra .M.N ,Vikas
4. Management and Organizational behavior, Pierce Gardner, Cengage.
5. Principles of Management, Koonz, Weihrich and Aryasri, Tata McGraw Hill.
6. Management and Organizational Behaviour, Subbarao P, Himalaya Publishing House.
7. Organizational Behaviour, Sarma, Jaico Publications.
8. Principles of Management, Murugesan, Laxmi Publications.

Course Outcomes (COs):

After completion of the course the student will be able to:

1. Able to explain the concepts of role of management, planning, policies and strategies
2. Able to explain the organizational structure and design
3. Able to explain the concept of perception and learning
4. Able to explain about group dynamics
5. Able to explain the concept of Comparative Management Styles and approaches

.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO(2)
CO1	-	-	-	-	-	2	-	2	-	2	2	-		-	1
CO2	-	-	-	-	-	2	-	2	-	2	2	-		-	1
CO3	-	-	-	-	-	2	-	2	-	2	2	-		-	1
CO4	-	-	-	-	-	2	-	2	-	2	2	-		-	1
CO5	-	-	-	-	-	2	-	2	-	2	2	-		-	1

1 - Slightly; 2 - Moderately; 3 – Substantially

E28 ENTREPRENEURSHIP AND INCUBATION

Instruction Hours/Week : 3(L)
Credits : 3
Sessional Marks : 40 End Semester Examinations Marks : 60

DESCRIPTION OF THE COURSE:

This course gives an opportunity for the students to know the various concepts on Entrepreneurship and incubation such as fundamentals of entrepreneurship, ideation and evaluation of value proposition of business ideas, business organizations and venture establishment, business incubation and mentoring and financing.

COURSE EDUCATIONAL OBJECTIVES(CEOs):

1. To understand the basic concept on fundamentals of Entrepreneurship.
2. To know the concept of ideation and evaluation of value proposition of business ideas.
3. To understand the concepts of business organizations and venture establishment.
4. To know the concept of Business incubation.
5. To understand the concept of mentoring and financing

Unit I: Fundamentals of Entrepreneurship

Fundamentals of Entrepreneurship - Evolution and Theories of Entrepreneurship - Characteristics of Entrepreneurs -Myths of Entrepreneurship - Kakinada Experiment - Elements of leadership -Role of Entrepreneurs in Indian economy - Social and Ethical Perspectives of Entrepreneurship - Corporate entrepreneurship - Social Entrepreneur

Caselets: Business cases of TATA, Infosys, Bajaj Auto.

Unit II: Ideation and Evaluation of Value Proposition of Business Ideas

Opportunity identi cation -. Ideations process.- Sources of business ideas - Role of creativity _ Sources of Innovation - Busmess Idea Evaluation - Product/ Service design_ Design Thinking_ Customer Value Proposition (CVP) - Business models

Caselets: Business cases of OYO, Paytm and Flipkart/ Sma11mart Activity: Idea generation in groups and CVP

Unit Ill: Businccs Organizations and Venture Establishment

Forms of business organisations/ownership - Techno-economic feasibility assessment- Financial feasibility - Market feasibility - Preparation of Business plan - Business canvas & Lean c-anvas - Challenges & Pitfalls in selecting new venture

Activity: Preparation of business plan (draft)

Unit IV: Business Incubation

Fundamentals of business incubation - Business incubator models & business environment - Services of incubators - Pre requisites of incubator - Famous incubator centers - Legal challenges for Entrepreneurship - Intellectual Property Protection

Activity: Business plan presentation.

Unit V: Mentoring & Financing

Principles and practices of business incubation - Types of incubators and benefits - Corporate & Educational institutional incubators - Expectation from the incubators - Sources of finance - Bootstrapping -Debt Financing - Equity Financing - Government Support - Financial & Non-financial- Venture Capitalists & Angel Investors

Activity: Business plan final version

COURSE OUTCOMES (COs):

1. Able to explain the basic concept on fundamentals of Entrepreneurship.
2. Able to explain the concept of ideation and evaluation of value proposition of business ideas.
3. Able to explain the concepts of business organizations and venture establishment.
4. Able to explain the concept of Business incubation.
5. Able to explain the concept of mentoring and financing.

Text Book:

I. T.V Rao, Donald F. Kuratko, Entrepreneurship,A South-Asian Perspective, Cengage Leaming, 2012
2. Datsy Davies,Jndian Startups, Amazon Asia-Pacific Holdings Private Limited, 2016

Reference Books:

l. P.N.Rath, Sarjue Pandita, Entrepreneurship: Startup India & Stand up India, Lexicon Pub!ishing House, 2018
2. Madhurima Lall, Shikha Sahai, Entrepreneurship, Excel Books (P).Ltd. 2008
3. Rajeev Roy, Entrepreneurship, Oxford Higher Eaucation. 2011
4. H. Nandan, Fundamentals of Entrepreneurship, PHI Learning (P) Ltd, 2013

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO(1)	PSO(2)
CO1	-	-	-	-	2	2	1	-	-	-	-	-		-	3

CO2	-	-	-	-	2	2	1	-	-	-	-	-		-	3
CO3	-	-	-	-	2	2	1	-	-	-	-	-		-	3
CO4	-	-	-	-	2	2	1	-	-	-	-	-		-	3
CO5	-	-	-	-	2	2	1	-	-	-	2	-		-	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Skill Development Courses (R20 Regulations)

S. No	Course Name
1	COMPUTER SKILLS
2	PYTHON PROGRAMMING
3	ARCHITECTURAL CAD
4	STAAD.Pro
5	MAT LAB AND SIMULINK
6	WEB PROGRAMMING
7	DATABASE MANAGEMENT SYSTEMS
8	INTERNET OF THINGS IN CIVIL ENGINEERING

SC1 COMPUTER SKILLS

Instruction Hours/week: 2 (P)
Credits :1
Sessional Marks : 40 End Semester Examinations Marks : 60

Course Educational Objectives (CEOs):

1. To learn and use MSWORD.
2. To learn and use MSEXCEL,MSPOWERPOINT
3. To learn and browse the INTERNET and EMAIL

EXERCISE – 1:

MS WORD: Text Basics, Text Formatting and saving file, working with Objects

EXERCISE – 2 :

MS WORD: Header & Footers, Working with bullets and numbered lists, Tables

EXERCISE –3:

MS WORD: Styles and Content, Merging Documents, Sharing and Maintaining Document

EXERCISE –4 :

MS WORD: Sharing and Maintaining Document, : Proofing the document, Printing

EXERCISE –5:

MS EXCEL: Introduction to Excel, Formatting excel work book

EXERCISE –6

MS EXCEL: Perform Calculations with Functions, Sort and Filter Data with Excel.

EXERCISE – 7:

MS EXCEL: Create Effective Charts to Present Data Visually, Analyze Data Using PivotTables and Pivot Charts, Protecting and Sharing the work book

EXERCISE – 8:
MS EXCEL: Use Macros to Automate Tasks, Proofing and Printing

EXERCISE – 9:
MS POWER POINT: Setting Up PowerPoint Environment, Creating slides and applying themes, Working with bullets and numbering, Working with Objects, Slide show option and print

EXERCISE – 10:
INTERNET AND EMAIL: What is Internet, Receiving Incoming Messages , Sending Outgoing Messages, Email addressing , Email attachments, Browsing, Search engines , Text chatting, Job Searching.

Course Outcomes (COs):
After completion of the course the student will be able to:
1. Use MS WORD, MS EXCEL AND POWER POINT in any civil engineering project works and for personal works.

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	2	2	2	1	2	1		1	1	2		1

* * * * *

SC2 PYTHON PROGRAMMING

Instruction Hours/Week: 1(T) +2(P)
Credits : 2.0
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives (CEOs):

1. Computer programming skills are now becoming part of basic education as these skills are increasingly of vital importance for
future job and career prospects.
2. The Python programming language which is one of the most popular programming languages worldwide.
3. The course shows you how to use the free open-source Python to write basic programs and high-level applications using concepts such as Class, BIF of Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm.
4. This course will be of great interest to all learners who would like to gain a thorough knowledge and understanding of the basic components of computer programming using the Python language – and might be a gentle introduction to programming for those who think they might have a longer-term interest in the subject area.

UNIT I

Introduction to Python Programming Language: Introduction to Python Language: What is Python? Why Python? Installing Python on Windows, Python IDLE, Python Literals, Python Data Types Basic Input-Output operations, Operators in Python, Decision making in Python, Conditional execution in Python, Logical and bit operations in Python, Naming Conventions, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Data type conversion, Built in Functions.

UNIT II

Python Built-in Data Structures: Introduction, List, Tuples, Dictionary, Sets, List Operations append, extend, insert, remove, pop, slice, and reverse, List Comprehension, Dictionary operations, Sorting Dictionaries, Copying Collections, Set operations. Standard python modules math, time, IO and time, Regular expressions, multi-threading.

UNIT III

Classes in Python, Principles of Object Oriented programming, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes.

UNIT IV

Functions, I/O, Exception Handling in Python

Introduction:Defining your own functions, keyword and optional parameters, mapping functions, lambda functions,

Data Streams: Creating Your Own Data Streams · Access Modes · Writing Data to a File · Reading Data From a File · Additional File Methods · Using Pipes as Data Streams · Handling IO Exceptions · Working with Directories · Metadata · Errors · Run Time Errors · The Exception Model · Exception Hierarchy · Handling Multiple Exceptions

UNIT V

Python API development.

Introduction to API, Python API programming, Python web application frameworks, REST API, Python Flask, Flask Environment, Routing, Cookies, Sessions, Running Flask Application, Testing API with POSTMAN client

Course Outcomes (COs):

Upon completion of this course, students should be able to :

1. Apply the OOP principles and best practices of python programming.
2. Write clear and effective pythonic code.
3. Create applications using python programming.
4. Implementing databases using SQLite and Access databases using python programming.
5. Understand and feel comfortable in working with web application frameworks.
6. Develop APIs required for the web applications using web frameworks like Flask and Fast API.

Reference Books:

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. Programming Python, 4th Edition by Mark L

Fundamentals of Python Programming, Richard L. Halterman Updated content of the book is maintained under the URL:http://python.cs.southern.edu/pythonbook/pythonbook.pdf

The official Python Tutorial. http://docs.python.org/tut/ How to think like a computer scientist (interactive) http://interactivepython.org/runestone/static/thinkcspy/index.html

How to think like a computer scientist http://openbookproject.net/thinkcs/python/english3e/

Code Academy Python http://www.codecademy.com/tracks/python A useful hands-on book: http://anh.cs.luc.edu/python/hands-on/3.1/Hands-onPythonTutorial.pdf

4. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)
5. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173
6. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016) Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1 st edition (6th February 2009

PO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)
CO1	**1**			**1**	**2**						**2**	**2**
CO2		**2**			**1**	**2**		**1**			**2**	**2**
CO3	**1**			**2**	**2**					**1**	**2**	**2**
CO4	**1**			**1**	**2**				**1**		**2**	**2**
CO5		**2**			**1**	**2**	**1**				**2**	**2**
CO6	**1**			**2**	**2**			**1**			**2**	**2**

SC3 MAT LAB AND SIMULINK

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester
Examination Marks : 60

Course Educational Objectives (CEOs):

1. To learn the MATLAB environment and its programming fundamentals
2. Students learned features of MATLAB as a programming tool. They are fully familiar to all the features of MATLAB software and easily handle the software.
3. Students learned graphic features of MATLAB and they are able to use this feature effectively in the various applications.

UNIT-I

MATLAB Introduction (8 HOURS), Fundamentals of MATLAB programming, Variables, Arrays, Matrices, MATLAB operators: Arithmetic operators, Relational operators, Logical operators, Operators precedence's, Examples

UNIT-II

MATLAB graphics(8 HOURS), **:** Plots, Sub plots, Other types of plots, Multiple plots in a graph, Logarithmic plots a graph, Various types of two dimensional plots, Plotting complex numbersensional plots, Three dimensional plots, Examples

UNIT-III

Branching & looping functions: Branching functions, If Function, Switch Function
Try/catch function, The error function, Looping functions, For function, While function
Break & continue functions, Examples.
Miscellaneous functions: String functions, Input/output functions, Input functions
Output functions, Examples
Script Files: Example of a script file(8 HOURS)

UNIT-IV

MATLAB Applications(8 HOURS),**:** Solving a linear systems, Finding Eigen values and Eigen vectors, Matrix factorizations, Single value decomposition, Examples

UNIT-V

Fundamentals of SIMULINK(8 HOURS),**:** Introduction, Application block sets, Application toolboxes, The symbolic Math toolbox, Constructing a SIMULINK model, Taking variables from MATLAB, Running &analyzing a SIMULINK model, Discrete time systems, Examples

TextBooks:

1. MATLAB and SIMULINK for Engineers by Agam Kumar Tyagi, Oxford university press
2. Getting started with MATLAB by RudraPratap, Oxford university press
3. Hanselman and Littlefield, "MasterigMatlab 7", Pearson EducationEtter, Kuncickly,Hull, "Introduction to Matlab 6", Pearson Education.

Course Outcomes(Cos):

1. Ability to write Programs using commands and functions
2. Able to handle and solve the problems using mat lab and Able to draw the plots
3. Able to create Simulink model

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1	2		2		2						2			3	1
CO2		1				2	2		1					3	
CO3	3		2											3	2

SC4 STAAD.Pro

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

1. Learn complete object-oriented instinctive 2D/3D graphic model generation.
2. Introduce to isometric & perspective views and 3D shapes.
3. Learn how to generate graphics/text input.
4. Learn how to achieve user-specified design parameters to customize a design.
5. Learn the procedure for design concrete beams/columns/slabs/footings.

Exercise 1:
Design of 2D and 3D Frame Analysis

Exercise 2:
Beam Design

Exercise 3:
Design of Multi Level Frame Analysis

Exercise 4:
Column Design

Exercise 5:
Design of a Cantilever Beam with UDL

Exercise 6:
Design of a Cantilever Beam with UDL and Point Load

Exercise 7:
Design of a Simply Supported Beam with UVL

Exercise 8:
Design of a Over Hanging Beam

It may be advisable to conduct Lab demonstrations along with Lab practices.
Software: STAAD.Pro

Course Outcomes(Cos):

6. Able to complete object-oriented instinctive 2D/3D graphic model generation.
7. Can make isometric & perspective views and 3D shapes.
8. Can how to generate graphics/text input.
9. Can achieve user-specified design parameters to customize a design.
10. Design concrete beams/columns/slabs/footings .

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1		3	3		3				1	2		3		3	3
CO2		3	3		3				1	2		3		3	3
CO3		2	2		2				1	3		1		3	2
CO4		3	3						1			2		3	2

CO5		**3**	**3**						**1**			**2**		**3**	**2**

1 - Slightly; 2 - Moderately; 3 – Substantially

SC5 ARCHITECTURAL CAD

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester Examination Marks : 60

Course Educational Objectives(CEOs):

1. To learn software like AutoCAD, Invertor/ Pro E/ Uni-graphics and to produce basic concepts to make 2D drafting.
2. To apply basic concept to drawing, edit, dimension, hatching etc. to develop 2D & 3D Modelling.
3. To make 3D modelling, Assembling, modification & manipulation along with detailing.
4. To prepare surface modelling and sheet metal operations through various exercises
5. To understand and resolve the one dimensional problem using FEM.

Exercise 1:
INTRODUCTION: Building Information Modeling (BMI) – User Interface – Creating a new Project – Floor Plans - Properties

Exercise 2:
BASIC ARCHITECTURAL MODELING: Adding of Walls – Doors – Windows – Floors – Roofs – Modify Elements

Exercise 3:
BASIC STRUCTURAL MODELING: Grids – Columns – Floors - Slabs – Slab Edges – Foundations

Exercise 4:
DEVELOP A PROJECT: Interior Layout – Rooms- Room Schedule – Door Schedule – Furniture – Equipment – Custom Wall Types – Curtain Walls

Exercise5:
VIEW CREATION AND PROPERTIES: Creating Plans – Elevations – Sections – View Properties – Perspective Camera Views

Exercise 6:
DETAILING : Annotating Detail Views – Importing CAD Details – Detail Lines / Components

Exercise 7:

Vertical Circulation & Penetrations: Stairs – Ramps – Elevators –Railings – Multi Level vs Single Storey – Sketch Stairs – Component Stairs - Shaft Openings

Exercise 8:
OUTPUT: Printing – PDF – Settings – Export to DWG / DWFx – Export Images

It may be advisable to conduct Lab demonstrations along with Lab practices.
Softwares: REVIT ARCHITECTURE (or) ARCHI CAD

Books:
1. Elements of Workshop Technology Hajra & Choudhary, Media Promoters & Publisher.
2. Workshop Practice HS Bawa, Tata McGraw Hill 2nd ed. India.
3. Mechanical Workshop Practice, K.C. John, PHI Learning New Delhi.
4. Workshop Technology, W.A.J.Chapman, CBS Publisher & Distributor New Delhi.

Reference:
1. Workshop manual prepared by Department of Mechanical Engineering.

Course Outcomes(Cos):

Upon successful completion of this course, the student shall be able to:

1. Able to use software like AutoCAD, Invertor/ Pro E/ Unigraphics.
2. Learned basic concept to drawing, edit, dimension, hatching etc. to develop 2&3D Modelling.
3. Able to make 3D modelling, Assembling, modification & manipulation along with detailing.
4. Able to prepare surface modelling and sheet metal operations through various exercises
5. Able to understand and resolve the one dimensional problem using FEM

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1		3	3		3				1	2		3		3	3
CO2		3	3		3				1	2		3		3	3
CO3		3	3		3				1	2		3		3	3
CO4		3	3						1			2		3	2
CO5		3	3						1			2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

SC6 WEB PROGRAMMING

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester
Examinations Marks : 60

Course EducationalObjectives(CEOs):

On completion of this course,

1. A student will be familiar with client server architecture and able to develop a web application using java technologies.
2. Students will gain the skills and project-based experience needed for entry into web application and development careers.

UNIT I

HTML- Basic HML, The document body, Text, Hyperlinks, Adding More Formatting, Lists, Using Color and Images, Images, Tables, Frames, Forms-Toward Interactivity . Cascading Stylesheets - Introduction, Inline Styles, Embedded Style Sheets, Linking external sheets, Backgrounds, text flow and box model.

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definitions, XML Schemas, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in Java.

UNIT – II

Introduction to JavaScript: JavaScript language – declaring variables, Scope of variables, functions, event handlers (on click, on submit etc.), Document Object Model, Form validation.

UNIT – III

Introduction to Servlets: Common Gateway Interface(CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlets Parameters and Initialization Parameters, Handling HTTP Request and Responses, Using Cookies and Sessions.

UNIT – IV

Introduction to JSP: The anatomy of a JSP, JSP Processing, Declarations, Directives, Expressions, Code Snippets, Implicit Objects, Using Beans in JSP Pages, Using Cookies Session and Session Tracking.

UNIT – V

Introduction to PHP: Declaring Variables, data types, arrays, strings, operators, expressions, control structures, functions. Reading data from web from controls like text boxes, radio buttons etc.,
File Handling in PHP: File operations and modes.

Text Books:

1. Internet& World Wide Web- H. M. Deitel, P.J. Deitel, A. B. Goldberg-Third Edition
2. Web Technologies , Uttam K Roy, Oxford University press.
3. www.w3schools.com

Course Outcomes(Cos):

1. Students are able to develop a dynamic webpage by the use of java script and DHTML.
2. Students will be able to write a well formed / valid XML document.
3. Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
4. Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.
5. Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1		3	3		3				1	2		3		3	2
CO2		3	3		3				1	2		3		3	2
CO3		3	3		3				1	2		3		3	2
CO4		3	3		3				1	2		3		3	2
CO5		3	3		3				1	2		3		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

SC7 DATABASE MANAGEMENT SYSTEMS

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester Examinations Marks : 60

Course Educational Objectives(CEOs):

1. The main objective of this course is to enable students to the fundamental concepts of database analysis and design.
2. To recognize the importance of database analysis and design in the implementation of any Database application and to understand the process of drawing the ER-Diagrams.
3. It also gives the knowledge of the roles of transaction processing and concurrency control.

UNIT – I

Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- Levels, Mappings, Database, users and DBA

DATABASE DESIGN: Database Design Process, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, extended ER features, Generalization, Specialization, Aggregation, Conceptual design with the E-Rmodel.

UNIT – II

Data models, schemas and instances: Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – III

Relational Model and Relational Algebra : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update 46 Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – IV

SQL: Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Save point, cursors, stored procedures, Triggers

UNIT – V

SCHEMA REFINEMENT AND NORMAL FORMS: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization, schema refinement in database design, case studies.

TEXT BOOKS:

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi,India.
2. Elmasri Navate, Fundamentals of Database Systems, Pearson Education,India.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5th edition, McGraw-Hill, New Delhi,India.
2. Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7thedition.

Course Outcomes(Cos):

On completion of this course Student will able to

1. Understand the basic principles of database management systems.
2. Draw Entity-Relationship diagrams to represent simple database application scenarios
3. write SQL queries for a given context in relational database.
4. Discuss normalization techniques with simple examples.
5. Describe transaction processing and concurrency control concepts.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1			3	2								3		3	2
CO2			3	2								3		3	2
CO3			3	2								2		3	2
CO4			3	2								2		3	2
CO5			3	2								2		3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

SC8 INTERNET OF THINGS IN CIVIL ENGINEERING

Instruction Hours/Week : 3(L)
Credits : 1.5
Sessional Marks : 40 End Semester Examinations Marks : 60

Course Educational Objectives(CEOs):

1. Learn the basics of IoT.
2. Learn Python program and interfacing for Raspberry Pi.
3. Learn Program and configure Arduino boards for various designs.
4. Know the basic sensor protocols in IoT.
5. Enable IoT applications considering various privacy and security aspects.

UNIT – I Introduction to Internet of Things:

Overview of IoT: The Internet of Things: An Overview, The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices, Calm and Ambient Technology, Privacy, Keeping Secrets, Whose Data Is It Anyway?, Characteristics of IoT ,Web Thinking for

Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT – II Python programming and Raspberry Pi:
Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

UNIT – III IoT in Construction Industry:
Applications and Benefits: IoT in Construction, Applications of IoT: Sensors, Wearable's- wearable technologies include DAQRI Smart Helmet, Sole Power Work boot and Site Watch. **, Maintenance Systems, Real-Time Site Map, Productivity, Safe and Security, UAVs and Autonomous Vehicles (**Autonomous TMA Truck, Volvo Trucks, Smart Construction by Komatsu). Concrete Curing, Waste Management and Structural Health Monitoring, BIM Optimization and Digital Twins SmartVid, Egnyte, Dodge Data and Analytics and PCL Construction. Benefits of IoT: **Safety Concerns .** Resources Management and Budgeting – IoT in the Manufacturing Industry, Waste Management , Daily Remote Management.

UNIT – IV Introduction to sensors for IoT:
Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device.
Seven generations of IoT sensors: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

UNIT – V Privacy and Security in IoT:
IoT security (vulnerabilities, attacks, and countermeasures), security engineering for IoT development, IoT security lifecycle. IoT as Interconnection of Threats: Malware Propagation and Control in Internet of Things- Solution-Based Analysis of Attack Vectors on Smart Home Systems.
Internet of Things Security: Security and Impact of the Internet of Things (IoT) on Mobile Networks-Networking Function Security-IoT Networking Protocols, Secure IoT Lower Layers, Secure IoT Higher Layers, Secure Communication Links in IoTs, Back-end Security -Secure Resource Management, Secure IoT Databases, Security Products-Existing Test bed on Security and Privacy of IoTs, Commercialized Products

Text Books:

1. Timothy Chou,. Precision: Principles, Practices and Solutions for the Internet of Things, Cloudbook Inc., USA. April-13 2020
2. Maggie Lin and Qiang Lin., Internet of Things Ecosystem: 2nd Edition,. January 19, 2021., independently published
3. 2.Hu, Fei. Security and privacy in Internet of things (IoTs): Models, Algorithms, and Implementations, 1 st edition,CRC Press, 2016.
4. Russell, Brian, and Drew Van Duren. Practical Internet of Things Security, 1 st edition, Packt Publishing Ltd, 2016

Reference Book:

Whitehouse O. Security of things: An implementers' guide to cyber-security for internet of things devices and beyond, 1 st edition, NCC Group, 2014

Course Outcomes(Cos):

Upon completing this course, the student will be able to:

1. Know the basics of IoT.
2. Develop Python program and interfacing for Raspberry Pi.
3. Program and configure Arduino boards for various designs.
4. Know the basic sensor protocols in IoT.
5. Design IoT applications considering various privacy and security aspects.

PO&PSO / CO	PO(1)	PO(2)	PO(3)	PO(4)	PO(5)	PO(6)	PO(7)	PO(8)	PO(9)	PO(10)	PO(11)	PO(12)		PSO (1)	PSO (2)
CO1					3				1			3			1
CO2					3							3			3
CO3												3			2
CO4												2			2
CO5												2			3

1 - Slightly; 2 - Moderately; 3 – Substantially