SCHEME OF INSTRUCTION
AND
SYLLABUS

B.TECH
IN
CIVIL ENGINEERING

w.e.f 2017– 2018 (VR17)

DEPARTMENT OF CIVIL ENGINEERING
VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(An Autonomous Institution affiliated to Jawaharlal Nehru Technological University Kakinada, Kakinada
NBA Accredited & ISO 9001:2008 Certified)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada-520007, A.P. India

INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

To impart teaching, research and develop consultancy that serves the society and to strive continuously for excellence in education.

DEPARTMENT MISSION

To provide quality education for successful career and higher studies in Civil Engineering that emphasizes academic and technical excellence in profession and research, effective communication, team work and leadership to meet the challenges of the society.

Program Educational Objectives(UG)

PEO1:

Graduates will have fundamentals for successful profession and/or for higher education in civil engineering based on mathematical, scientific and engineering principles.

PEO2:

Graduates will adapt to the modern engineering tools for planning, design, execution and maintenance of works with sustainable development in their profession.

PEO3:

Graduates will exhibit professionalism, ethical attitude, communication and managerial skills, team work and social responsibility in their profession and adapt to current trends by engaging in lifelong learning.

Program Specific Outcomes

1. Graduates will have an ability to design components of diverse civil structures like buildings, roads, bridges, hydraulic structures etc.,

2. Graduates will have an ability to understand the materials and processes involved in various domains of civil engineering.

Program Outcomes(UG)

POs describe what students are expected to know or be able to do by the time of graduation from the program.

List of Program Outcomes for Civil Engineering

PO1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: 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.

PO5. Modern tool usage: 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.

PO6. The engineer and society: 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.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO11. Project management and finance: 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.

PO12. Life-long learning: 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.

VELAGAPUDI RAMAKRISHNA **12.05.2019**
SIDDHARTHA ENGINEERING COLLEGE
SCHEME OF INSTRUCTION FOR FOUR-YEAR UG PROGRAMME [VR17]
CIVIL ENGINEERING

SEMESTER I **Contact Hours: 26**

S.No	Course Code	Title of the Course	L	T	P	Credits
1.	17MA1101	Matrices And Differential Calculus	3	1	0	4
2.	17CH1102	Engineering Chemistry	3	0	0	3
3.	17CS1103	Problem Solving Methods	2	1	0	3
4.	17ME1104A 17ME1104B	Engineering Mechanics – I(ME and CE) Mechanics for Engineers (EEE)	3	0	0	3
5.	17ME1105	Engineering Graphics	2	0	4	4
6.	17CH1151	Engineering Chemistry Laboratory	0	0	3	1.5
7.	17CS1152	Computing and Peripherals Laboratory	0	0	2	1
		Total	**13**	**2**	**9**	**19.5**
8.	17MC1106B	Professional Ethics& Human Values	2	0	0	-
9.	17MC1107	Induction Program				**-**

SEMESTER II **Contact Hours: 27**

S.No	Course Code	Course	L	T	P	Credits
1.	17MA1201	Laplace Transforms And Integral Calculus	3	1	0	4
2.	17PH1202	Engineering Physics	3	0	0	3
3.	17CS1203	Programming in C	3	0	0	3
4.	17ME1204 17EE1204	Engineering Mechanics – II(ME and CE) Network Analysis-1 (EEE)	3	0	0	3
5.	17HS1205	Technical English and Communication Skills	2	0	2	3
6.	17PH1251	Engineering Physics Laboratory	0	0	3	1.5
7.	17CS1252	Computer Programming Laboratory	0	0	3	1.5
8.	17ME1253	Basic Workshop	0	0	3	1.5
		Total	**14**	**1**	**11**	**20.5**
9.	17MC1206A	Technology and Society	1	0	0	-

L – Lecture, T – Tutorial, P – Practical, C – Credits

SEMESTER III **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17MA1301A	Mathematics III	Complex Analysis and Numerical Methods	3	1	0	4
2	17CE3302	Programme Core	Introduction to Mechanics of Solids	3	1	0	4
3	17CE3303	Programme Core	Fluid Mechanics	3	1	0	4
4	17CE3304	Programme Core	Surveying&Geomatics	4	0	0	4
5	17CE3305	Programme Core	Engineering Geology	2	0	0	2
6	17TP1306	Soft Skills 1	Logic and Reasoning	0	0	2	1
8	17CE3351	LABORATOTY 1	Surveying Laboratory	0	0	2	1
9	17CE3352	LABORATOTY 2	SM Laboratory	0	0	2	1

	17CE3353	LABORATOTY 3	Engineering Geology Laboratory	0	0	2	1
10	17MC1307B	HS	Indian Constitution	2	0	0	
				Total Credits			22

SEMESTER IV **CONTACT HOURS:27**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17CE3401	Programme Core	Building materials and construction	3	0	0	3
2	17CE3402	Programme Core	Concrete technology	3	0	2	4
3	17CE3403	Programme Core	Mechanics of Materials	3	1	0	4
4	17CE3404	Programme Core	Hydraulics and Hydraulics machines	3	1	0	4
5	17TP1405	Soft Skills 2	English for Professionals	0	0	2	1
6	17HS2406	Humanities Elective		1	0	0	1
7	17CE3451	LABORATORY 1	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
8	17CE3452	LABORATORY 2	Building Planning and Design Lab	0	0	2	1
9	17HS1453	LABORATORY 3	Communication Skills Laboratory	0	0	2	1
10	17MC1407A	HS	Environmental Studies	2	0	0	
				Total Credits			20

List of Humanities Electives

A	Yoga & Meditation	G	Film Appreciation
B	Music	H	Sanskrit Bhasa
C	Human Rights and Legislative Procedures	I	Foreign Languages (German/French)
D	Philosophy	J	Law for Engineers
E	Development of societies	K	Psychology
F	Visual Communication		

SEMESTER V **CONTACT HOURS: 25**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17CE3501	Programme Core	Water Resources Engineering	3	0	0	3
2	17CE3502	Programme Core	Environmental Engineering	3	0	0	3
3	17CE3503	Programme Core	Structural Analysis	3	0	0	3
4	17CE2504	Open Elective -I		3	0	0	3
	17CE2504 A		Geospatial Technologies				
	17CE2504 B		Quality Control and Quality Assurance				
5	17CE2505	Open Elective –II		3	0	0	3

		(Inter Disciplinary Elective)					
	17CE2505 A		Air and Noise Pollution				
	17CE2505 B		Environmental Impact Studies				
6	17CE2506	Open Elective –III (Self Learning Elective Course)		0	0	0	2
	17CE2506/A		Green buildings and sustainability				
	17CE2506/B		Advanced Construction Materials				
7	17TP1507	HS	Personality Development & Campus Recruitment Training	0	0	2	1
8	17CE3508	Programme core	Geotechnical Engineering	2	0	2	3
9	17CE3509	Programme Core	Design of Concrete Structures	2	0	0	2
10	17CE3551	LABORATORY 1	Environmental Engineering Lab	0	0	2	1
				Total Credits			24

*Students can opt any one of the self-learning courses prescribed by the Department. Students register and complete the opted course in approved MOOCS platform on or before the Last Instruction Day of V semester. They have to submit the certificate before the Last Instruction Day of V semester

SEMESTER VI **CONTACT HOURS: 29**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17CE3601	Programme Core	Design of Steel Structures	2	0	0	2
2	17CE3602	Programme Core	Transportation Engineering	3	0	2	4
3	17CE4603	Programme Elective -1		3	0	0	3
4	17HS1604	HS	Engineering Economics and Finance	2	0	0	2
5	17CE2605	Open Elective –IV		3	0	0	3
	17CE2605/A		Traffic Safety				
	17CE2605/B		Building Services Engineering				
6	17TP1606	HS	Quantitative Aptitude	0	0	2	1
7	17MC1607	HS	Biology for Engineers	2	0	0	0
8	17CE3608	Programme Core	Foundation Engineering	3	0	0	3
9	17CE3651	LABORATORY 1	Computer Applications in Civil Engg Lab-1	0	0	2	1

10	17CE3652	LABORATORY 2	Advanced Surveying Lab	0	0	2	1
11	17CE5653	Project work	Engineering Project for Community Services	0	1	2	2
				Total Credits			22

* Students will go to the society (Villages/ Hospitals / Towns etc,.) to identify the problem and survey the literature for a feasible solution. The work will be carried out during summer vacation after IV Semester. The student is encouraged to take up real life problems leading to innovative model building

SEMESTER VII **CONTACT HOURS: 23**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17CE3701	Programme Core	Construction Engineering and Management	3	0	0	3
2	17CE4702	Programme Elective -2		3	0	0	3
3	17CE4703	Programme Elective -3		3	0	0	3
4	17CE4704	Programme Elective -4		3	0	0	3
5	17CE4705	Programme Elective -5		3	0	0	3
6	17CE3706	Programme Core	Estimation, Costing and Valuation	2	0	0	2
8	17CE4751	LABORATORY 1	Computer Applications in Civil Engg Lab-II	0	0	2	1
9	17CE5752	Mini Project*	Design Project 1	0	0	4	2
10	17CE6753	A) Internship B) Industry Offered Course C) Global Professional Certification					2
				Total Credits			22

SEMESTER VIII **CONTACT HOURS: 19**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	17CE4801	Programme Elective -6		3	0	0	3
2	17CE2802	Open Elective –V*		3	0	0	3
	17CE2802/A		Water Quality Engineering				
	17CE2802/B		Appropriate Course will be offered based on Certificate Courses offered by NPTEL at that point of time				
3	17CE5851	Major Project**	Project work	0	5	8	9
Total				6	5	8	15

List of Open Electives

OPEN ELECTIVE-I (Open for All)

SEMESTER-V

17CE2504

A) Geospatial Technologies
B) Quality Control and Quality Assurance

OPEN ELECTIVE-II (Inter Disciplinary Elective)

SEMESTER-V
17CE2505
A) Air and Noise Pollution
B) Environmental Impact Studies

OPEN ELECTIVE-III (Open for All- Self Learning Elective)

SEMESTER-V
17CE2506
A) Green Building and Sustainability
B) Advanced Construction Materials

OPEN ELECTIVE-IV (Open for All)

SEMESTER-VI
17CE2605
A) Traffic Safety
B) Building Services Engineering

OPEN ELECTIVE-V (Open for All, option for Self-Learning)

SEMESTER-VIII
17CE2802
A) Water Quality Engineering
B) Appropriate Course will be offered based on Certificate Courses offered by NPTEL at that point of time

Sl.No	Specialization	Program Electives					
		Elective 1	Elective 2	Elective 3	Elective 4	Elective 5	Elective 6
1	Structural Engineering	Advanced structural analysis	Advanced Design of concrete structures	Advanced Design of steel structures	Design of prestressed concrete	Finite element analysis	Earthquake resistant design
2	Geotechnical Engineering		Soil dynamics and machine foundations		Environmental Geo-technology		Ground improvement techniques
3	Environmental Engineering	Advanced environmental engineering	Solid waste management	Industrial effluent treatment		Environmental impact assessment	Air pollution and control
4	Transportation Engineering	Airport planning and Design	Railway Engineering, Docks and Harbor Engineering	Pavement design and construction	Traffic Engineering	Highway safety	Urban transport planning

5	**Hydrology & Water Resources Engineering**	Irrigation structures			Open channel flow and river engineering		Ground water Hydrology
6	**Miscellaneous**	Remote sensing and GIS	Town planning and Architecture	Instrumentation and Sensor technology in Civil Engineering	Construction equipment and automation	Repair and rehabilitation of structures	
7				Forensics in Civil Engineering		Disaster preparedness and planning management	

17MA1101
MATRICES AND DIFFERENTIAL CALCULUS

Course Category:	Institutional Core	**Credits:**	4
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 1 - 0
Prerequisites:	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation.	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Determine Eigen values, Eigen vectors of a matrix.
CO2	Estimate Maxima and Minima of Multi Variable Functions
CO3	Solve the Linear differential equations with constant coefficients.
CO4	Solve the Linear differential equations with variable coefficients.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**			**L**	**H**						**M**			
CO2	**H**			**L**	**H**						**M**			
CO3	**H**			**L**	**H**						**M**			
CO4	**H**			**L**	**H**						**M**			

COURSE CONTENT

UNIT I

Matrices: Rank of a Matrix, Elementary transformations, Inverse of a Matrix (Gauss Jordan Method), Consistency of Linear System of Equations, Linear Transformations, Vectors, Eigen values, Properties of Eigen values, Finding Inverse and Powers of a Matrix by Cayley-Hamilton Theorem. Reduction to Diagonal form, Reduction of Quadratic form to Canonical form, Nature of a Quadratic form, Complex matrices.

UNIT II

Differential Calculus: Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Taylor's Theorem, Maclaurin's Series.

Application: Curvature, Radius of Curvature**.**

Functions of two or more Variables: Partial Derivatives, Change of Variables, Jacobians, Taylor's

Theorem for Function of two Variables, Maxima and Minima of Functions of two Variables, Lagrange's Method of Undetermined Multipliers.

UNIT III

Differential Equations of First Order: Formation of a Differential Equation, Solution of a Differential Equation, Linear Equations, Bernoulli's Equation, Exact Differential Equations, Equations Reducible to Exact Equations.

Applications: Orthogonal Trajectories, Newton's Law of Cooling.

Linear Differential Equations of Higher Order: Definitions, Operator D, Rules for Finding the Complementary Function, Inverse Operator, Rules for finding Particular Integral, Working Procedure to Solve the Equation.

UNIT IV

Linear Dependence of Solutions, Method of Variation of Parameters, Method of Undetermined Coefficients, Equations Reducible to Linear Equations with Constant Coefficients: Cauchy's Homogeneous Linear Equation, Legendre's Linear Equation, Simultaneous Linear Differential Equations with Constant Coefficients.

Applications: L-C-R Circuits.

TEXT BOOKS

[1] B.S.Grewal , "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2014.

REFERENCE BOOKS

[1].Pal Bhunia, Engineering Mathematics, Oxford University Press, 2015.
[2].Erwin Kreyszig , " Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2015
[3].B.V.Ramana, "Higher Engineering Mathematics", Tata MC Graw Hill, 1st Edition, 2007
[4].N.P.Bali, Dr.Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 9th Edition, 2014.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1]. www.nptel videos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S)
[2]. nptel.ac.in/courses/122104017
[3]. nptel.ac.in/courses/111105035
[4]. Engineering Mathematics Open Learning Project.
www.3.ul.ie/~mlc/support/Loughborough%20website/

17CH1102
ENGINEEERING CHEMISTRY

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Knowledge of Chemistry at Intermediate level	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Analyze various water treatment methods and boiler troubles.
CO2	Apply the principles of spectroscopic techniques to analyse different materials and apply the knowledge of conventional fuels for their effective utilisation.
CO3	Apply the knowledge of working principles of conducting polymers, electrodes and batteries for their application in various technological fields.
CO4	Evaluate corrosion processes as well as protection methods.

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3- High)

	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		**H**												
CO2	**M**													
CO3														
CO4			**M**						**H**					

COURSE CONTENT

UNIT I

Water technology-I: WHO standards - Water treatment for drinking purpose - sedimentation, coagulation, filtration, disinfection by chlorination, breakpoint chlorination and its significance - Desalination of brackish water - principle and process of electrodialysis and reverse osmosis, advantages and disadvantages.

Water technology-II: Boiler troubles - scales-formation, disadvantages and internal conditioning methods - phosphate conditioning, calgon conditioning and sodium aluminate, caustic embrittlement- reasons, mechanism and its control, and boiler corrosion – causes and control.

UNIT II

Spectroscopic Techniques and Applications: Interaction of electromagnetic radiation with matter - Ultraviolet-visible spectroscopy: Frank-Condon principle, types of electronic transitions, Lambert-Beer's law – definition and numerical problems, problems on interpretation of UV-visible spectra of simple molecules of arenes, aldehydes and ketones. Infrared (IR) spectroscopy: Principle, types of vibrations, problems on interpretation of IR spectra of simple molecules of amines, alcohols, aldehydes and ketones.

Fuel Technology: Fuel-definition, calorific value- lower and higher calorific values, analysis of coal – proximate analysis and ultimate analysis, refining of petroleum, flue gas analysis by Orsat's apparatus, numericals based on calculation of air required for combustion

UNIT III

Conducting polymers: Definition, examples, classification-intrinsically conducting polymers and extrinsically conducting polymers- mechanism of conduction of undoped polyacetylene, doping of conducting polymers- mechanism of conduction of p-doped and n-doped polyacetylenes – applications of conducting polymers.

Electrochemistry: Construction and working of Calomel electrode, silver-silver chloride electrode and principle, construction and working of glass electrode, determination of pH using glass electrode - Chemistry of modern batteries - $Li/SOCl_2$ battery and $Li_xC/LiCoO_2$ battery - construction, working and advantages, Chemistry of H_2-O_2 fuel cell-advantages.

UNIT IV

Corrosion principles: Introduction, definition, reason for corrosion, examples – electrochemical theory of corrosion, types of electrochemical corrosion - hydrogen evolution and oxygen absorption – corrosion due to dissimilar metals, galvanic series – differential aeration corrosion – pitting corrosion and concept of passivity.

Corrosion control methods: Cathodic protection- principle and types - impressed current method and sacrificial anode method, anodic protection-principle and method, corrosion inhibitors – types and mechanism of inhibition – principle, process and advantages of electroplating and electroless plating.

TEXT BOOKS

[1] Shikha Agarwal, "Engineering Chemistry – Fundamentals and Applications", Cambridge University Press, New Delhi, 1st edition (2015).

REFERENCE BOOKS:

[1] Sunita Rattan , "A Textbook of Engineering Chemistry", S.K. Kataria & Sons, New Delhi, First edition 2012.

[2] P.C. Jain , "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Limited, New Delhi, 15th edition.

[3] B.S. Bahl, G. D. Tuli and Arun Bahl, "Essentials of Physical Chemistry", S. Chand and Company Limited, New Delhi.

[4] O. G. Palanna, " Engineering Chemistry", Tata McGraw Hill Education Pvt. Ltd., New Delhi.

[5] Y.Anjaneyulu, K. Chandrasekhar and Valli Manickam, Text book of Analytical Chemistry, , Pharma Book Syndicate, Hyderabad.

[6] H. Kaur, Spectroscopy, I Edition, 2001, Pragati Prakashan, Meerut.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] http://www.cip.ukcentre.com/steam.htm

[2] http://corrosion-doctors.org/Modi;es/mod-basics.htm

[3] http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR%2063%289%29%20715-728.pdf

[4] https://chem.libretexts.org/Core/Analytical_Chemistry/Electrochemistry/Basics_of_Electrochemistry

[5] http://www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/

[6] https://www.khanacademy.org/test-prep/mcat/physical-processes/infrared-and-ultraviolet-visible-spectroscopy/e/infrared-and-ultraviolet-visible-spectroscopy-questions

[7] NPTEL online course, "Analytical Chemistry", offered by MHRD and instructed by Prof. Debashis Ray of IIT Kharagpur.

[8] NPTEL online course, "Corrosion Part-I" offered by MHRD and instructed by Prof. Kallol Mondal of IIT Kanpur

17CS1103
PROBLEM SOLVING METHODS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	2 -1- 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

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

CO1	Understand the Computer problem solving approaches, efficiency and analysis of algorithms
CO2	Apply the factoring methods to solve the given problem
CO3	Apply the array techniques to find the solution for the given problem
CO4	Solve the problems using MATLAB

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	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	**H**	**M**							**L**					
CO2	**L**		**H**											
CO3	**L**		**H**											
CO4	**L**	**L**							**H**					

COURSE CONTENT

UNIT - I

Introduction to Computer Problem Solving: Programs and Algorithms, characteristics of an algorithm, Requirements for solving problems by computer; Flowchart, pseudo-code **The Problem – Solving Aspect**: Problem definition phase, Getting started on a problem, Similarities among problems, Working backwards from the solution, General problem-solving strategies; **Top-Down design**: Breaking a problem into sub-problems, Construction of loops, Establishing initial conditions for loops, Finding the iterative construct, Termination of loops;

The Efficiency of Algorithms: Redundant Computations, Referencing array elements, Inefficiency due to late termination, Early detection of desired output conditions, Trading storage for efficiency gains;

Analysis of Algorithms: Computational complexity, The order notation, Worst and average case behavior.

UNIT - II

Fundamental Algorithms: Problem, Algorithm Development, Algorithm Description **-** Exchanging values of two variables, Counting, Summation of a set of numbers, Factorial computation, Generation of Fibonacci sequence, Reversing the digits of an Integer. Using pseudo-codes and flowcharts to represent fundamental algorithms.

Factoring Methods: Finding the Square Root of a number: Smallest Divisor of an Integer, GCD of two Integers, Generating Prime numbers, Computing the Prime Factors of an Integer, Raising a Number to a Large Power, Pseudo random number generation, Computing n^{th} Fibonacci number.

UNIT – III

Array Techniques: Introduction, Array Order Reversal, Array counting, Finding the maximum number in a set, Removal of duplicates from an ordered array, Partitioning an array, Finding The K^{th} Smallest Element.

Merging, Sorting and Searching: Sorting By Selection, Sorting By Exchange, Linear Search, Binary search;

UNIT – IV

Introduction to MATLAB: MATLAB Environment, **Constants, Variables and Expressions:** Data types, Constants and Variables, Operators, Built-in Functions, **Vectors and Matrices:** Introduction, Scalars and Vectors, Matrix Manipulations, **Control Structures:** Loops, Branches.

Input-Output Statements: Reading/Storing File Data, **MATLAB Graphics:** Introduction, Two-Dimensional Plots.

TEXT BOOKS

[1] R.G. Dromey , "How to Solve it By Computer", Prentice-Hall International Series in Computer Science,1982.

[2] Bansal.R.K, Goel.A.K, Sharma.M.K, "MATLAB and its Applications in Engineering", Pearson Education, 2012.

REFERENCE BOOKS

[1] Michael Schneider, Steven W. Weingart, David M. Perlman, "An Introduction to Programming and Problem Solving With Pascal", John Wiley and Sons Inc ,1984.

[2] David Gries, "The Science of Programming", Springer Verlag, 1981.

[3] ReemaThareja, "Computer Fundamentals and C Programming", Oxford, 2012

E-RESOURCES AND OTHER DIGITAL MATERIAL

MATLAB Getting Started Guide http://www.mathworks.com/help/pdf_doc/ matlab/getstart.pdf

17ME1104A
ENGINEERING MECHANICS-I

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:	Basic Mathematics, Physical Science	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Analyze coplanar concurrent forces
CO2	Analyze coplanar parallel forces and determine centroids for plane figures.
CO3	Analyze coplanar general case of force systems
CO4	Analyze spatial concurrent and parallel forces

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**				**M**									
CO2	**H**				**M**									
CO3	**H**				**M**									
CO4	**H**				**M**									

COURSE CONTENT

UNIT I

Concurrent Forces in a Plane: Principles of statics, Force, Addition of two forces: Parallelogram Law – Composition and resolution of forces – Constraint, Action and Reaction. Types of supports and support reactions. Free body diagram. Equilibrium of concurrent forces in a plane – Method of projections –Moment of a force, Theorem of Varignon, Method of moments.

UNIT II

Parallel Forces in a Plane: Introduction, Types of parallel forces, Resultant. Couple, Resolution of Force into force and a couple. General case of parallel forces in a plane. **Centroids:**Introduction, Determination of centroids by integration method, Centroids of composite plane figures. Distributed forces in a plane.

UNIT III

General Case of Forces in a Plane: Composition of forces in a plane – Equilibrium of forces in a plane -

Plane Trusses**:** Method of joints

Friction: Introduction, Laws of dry friction. Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, Frictional forces on wheel, Wedge friction.

UNIT IV

Force System In Space: Components of a force, defining a force by its magnitude and two points on its line of action, components of a vector, work done by a force, Resultant of system of concurrent and parallel forces in space, Moment of a force, Component of a vector and moment about an axis, Equilibrium of concurrent and parallel forces in space.

TEXT BOOKS

[1] S.Timoshenko, D.H.Young, J.V.Rao & Sukumar Pati, "Engineering Mechanics", Vth edition, Mc Graw Hill Education (India) Pvt Ltd, 2013 (For Concepts and symbolic Problems).

[2] A.K.Tayal , "Engineering Mechanics Statics and dynamics", Umesh Publications, XIIIth edition, 2006 (For numerical Problems using S.I.System of Units).

REFERENCE BOOKS

[1] Beer and Johnston, "Vector Mechanics for Engineers Statics and Dynamics", Tata McGraw Hill, IIIrd edition, 2010.

[2] SS Bhavikatti and KG Rajasekharappa, "Engineering Mechanics", New Age International Private Limited, IVth Edition, 2012

[3] K.Vijaya Kumar Reddy and J Suresh Kumar, " Singer's Engineering Mechanics Statics and Dynamics", BS Publications, IIIrd Edition 2010.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] http://emweb.unl.edu/, Accessed On 15-06-2017

17ME1105
ENGINEERING GRAPHICS

Course Category:	Institutional Core	**Credits:**	4
		Lecture-Tutorial –Practice:	2-0-4
Course Type:	Theory & Practice	**Continuous Evaluation:** **Semester end Evaluation:**	30 70
Prerequisites:		**Total Marks:**	100

COURSE OUTCOMES:

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

CO1	Understand the Scales, conics and Cycloidal curves.
CO2	Draw Orthographic projections of points, Lines, Planes and Solids
CO3	Understand Sectional views of Solids, Development of surfaces and their representation
CO4	Construct isometric scale, isometric projections ,isometric views and convert pictorial views to orthographic projections

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**			**H**							**L**			
CO2	**M**			**H**							**M**			
CO3	**M**			**M**							**M**			
CO4	**L**			**H**							**M**			

COURSE CONTENT

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance

Scales: Construction of plain and diagonal Scales

Conic Sections: Construction of ellipse, parabola and hyperbola (Treatment is limited to Eccentricity or General method only)

Engineering Curves: Cycloidal curves - Cycloid, Epicycloid and Hypocycloid

UNIT – II

Orthographic Projections: Principles of Orthographic Projections –Projections of Points, Lines (Treatment is limited to First Angle Projection) and Projections of Plane regular geometric figures (Up to Plane Inclined to both of the Reference planes)

UNIT – III

Projections of Solids: Projections of simple solids such as Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to Solid Inclined to one of the Reference planes)

Sections of Solids: Sections of solids such as Cubes, Prisms, Pyramids, Cylinders and Cones. True shapes of sections(Limited tothe solids perpendicular to one of the Principal Planes)

UNIT – IV

Development of Surfaces: Lateral development of cut sections of Cubes, Prisms, Pyramids, Cylinders and

Cones

Isometric Projections: Isometric Projection and conversion of isometric views into Orthographic Projections (Treatment is limited to simple objects only)

Conventions Auto CAD: Basic principles only (Internal assessment only)

Text Books

[1] N.D. Bhatt & V.M. Panchal, "Elementary Engineering Drawing", Charotar Publishing House, Anand. 49th Edition – 2006

Basanth Agrawal & C M Agrawal," Engineering Drawing", McGraw Hill Education Private Limited, New Delhi

Reference Books

[1] K. L. Narayana & P. Kannaiah, "Text Book on Engineering Drawing", Scitech publications (India) Pvt. Ltd.,Chennai, 2nd Edition - fifth reprint 2006

[2] K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New Age International, New Delhi

[3] D M Kulkarni, AP Rastogi, AK Sarkar, "Engineering Graphics with Auto CAD", PHI Learning Private Limited, Delhi Edition – 2013

E-Resources and other digital material

[1] http://www.youtube.com/watch?v=XCWJ XrkWco, Accessed On 01-06-2017.

[2] http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# isodrawing, Accessed On 01-06-2017.

[3] http://www.slideshare.net, Accessed On 01-06-2017.

[4] http://edpstuff.blogspot.in, Accessed On 01-06-2017.

17CH1151

ENGINEERING CHEMISTRY LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:	Knowledge of chemistry practicals at intermediate level	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Analyze quality parameters of water samples from different sources
CO2	Perform quantitative analysis using instrumental methods.
CO3	Apply the knowledge of mechanism of corrosion inhibition, metallic coatings and photochemical reactions.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1			**H**											
CO2									**M**					
CO3		**M**												

COURSE CONTENT

List of Experiments:

1. Determination of total alkalinity of water sample
2. Determination of chlorides in water sample
3. Determination of hardness of water sample
4. Determination of available chlorine in bleaching powder
5. Determination of copper in a given sample
6. Determination of Mohr's salt – Dichrometry
7. Determination of Mohr's salt – Permanganometry
8. Determination of purity of boric acid sample
9. Conductometric determination of a strong acid using a strong base
10. pH metric titration of a strong acid vs. a strong base
11. Determination of corrosion inhibition efficiency of an inhibitor for mild steel
12. Chemistry of Blue Printings
13. Preparation of Urea-Formaldehyde resin

REFERENCE BOOKS

[1] S.K. Bhasin and Sudha Rani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
[2] Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria & Sons, New Delhi, 2nd edition.

17CS1152

COMPUTING AND PERIPHERALS LABORATORY

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 – 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Understand and Apply MS Office tools
CO2	Configure the components on the motherboard and install different operating systems
CO3	Understand and configure different storage media
CO4	Perform Networking, troubleshooting and system administration tasks

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**								**L**					
CO2		**H**	**M**											
CO3	**H**		**L**											
CO4		**M**							**M**					

COURSE CONTENT

CYCLE - I:Word Processing, Presentations and Spread Sheets

1. **Word Processing:**
   a) Create personal letter using MS Word.
   b) Create a resume using MS Word.
   c) Creating project abstract**:** Features to be covered:- Table of Content, List of Tables, Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check,Track Changes.
   d) Creating a Newsletter: Features to be covered:- Table of Content, List of figures, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphsand Mail Merge in word.
2. **Spread Sheets:**
   a) Create a worksheet containing pay details of the employees.
   b) Creating a Scheduler: Features to be covered:- Gridlines, Format Cells, Summation, auto fill,Formatting Text
   c) Create a worksheet which contains student results: .Features to be covered:- Cell Referencing,

Formulae in excel – average, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting

d) Create a worksheet importing data from database and calculate sum of all the columns.

3. Presentations:

a) Create a presentation using themes.

b) Save, edit, print and import images/videos to a presentation.

c) Create a power Point presentation on business by using master layouts, adding animation to a presentation and see the presentation in different views.

4. MS Access:

a) Create simple table in MS Access for results processing.

b) Create a query table for the results processing table.

c) Create a form to update/modify the results processing table.

d) Create a report to print the result sheet and marks card for the result.

CYCLE - II: Hardware Experiments

1. Identification of System Layout: Front panel indicators & switches and Front side & rear side connectors. Familiarize the computer system Layout: Marking positions of SMPS, Motherboard, FDD,HDD, CD, DVD and add on cards. Install Hard Disk. Configure CMOS-Setup. Partition and Format Hard Disk.
2. Install and Configure a DVD Writer or a Blu-ray Disc writer.
3. Install windows operating system and check if all the device (graphics, sound, network etc.) drivers are installed.
4. Install Linux operating system and check the working of all devices (graphics, sound, network etc.) in the computer.
5. Assemble a Pentium IV or Pentium Dual Core Pentium Core2 Duo system with necessary peripherals and check the working condition of the PC.
6. PC system layout: Draw a Computer system layout and Mark the positions of SMPS, Mother Board, FDD, HDD, and CD-Drive/DVDDrive add on cards in table top / tower model systems.
7. Mother Board Layout: Draw the layout of Pentium IV or Pentium Dual core or Pentium Core2 DUO mother board and mark Processor, Chip set ICs. RAM, Cache, cooling fan, I/O slots and I/O ports and various jumper settings.
8. Configure BIOS setup program to change standard and advanced settings to troubleshoot typical problems.
9. Install and configure Printer/Scanner/Web cam/Cell phone/bio-metric device with system. Troubleshoot the problems

CYCLE – III : Netwroking

1. Prepare an Ethernet/UTP cable to connect a computer to network switch. Crimp the 4 pair cable with RJ45 connector and with appropriate color code.
2. Manually configure TCP/IP parameters (Host IP, Subnet Mask andDefault Gateway) for a computer and verify them using IPCONFIG command. Test connectivity to a server system using PING command.
3. Creating a shared folder in the computer and connecting to that folder using Universal Naming Convention (UNC) format. (Ex: computername sharename)
4. Connects computers together via Switch/ Hub
5. Connect different devices via Switch/Hub
6. Statically configure IP address and subnet mask for each computer
7. Examine non-existent IP address and subnet conflicts
8. Configure a computer to connect to internet (using college internetsettings) and troubleshoot the problems using PING, TRACERT and NETSTAT commands.
9. Using scan disk, disk cleanup, disk Defragmenter, Virus Detectionand Rectifying Software to troubleshoot typical computer problems.

10.Configure DNS to establish interconnection between systems and describe how a name is mapped to IP Address.
11.Remote desktop connections and file sharing.
12. Installation Antivirus and configure the antivirus.
13. Introducing Ethereal , a packet capture tool.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Numerical Methods and Programing by Prof.P.B.Sunil Kumar,Department of Physics, IIT Madras https://www.youtube.com/ watch?v=zjyR9e-#1D4&list=PLC5DC6AD60D798FB7
[2] Introduction to Coding ConceptsInstructor: Mitchell Peabody View the complete course: http://ocw.mit.edu/6-00SCS11

17MC1106B

PROFESSIONAL ETHICS & HUMAN VALUES

Course Category:	Mandatory Learning	**Credits:**	-
Course Type:	Theory	**Lecture -Tutorial-Practice:**	2 - 0 - 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

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

CO1	Know the moral autonomy and uses of ethical theories.
CO2	Understand morals, Honesty and character.
CO3	Understand about safety, risk and professional rights.
CO4	Know the ethics regarding Global issues related to Environment, Computers and weapon's development.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**M**													
CO2								**L**						
CO3						**M**								
CO4									**M**					

COURSE CONTENT

UNIT I

Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issues- types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory -Gilligan's theory - consensus and controversy - Models of Professional Roles -theories about right action - Self-interest - customs and religion- uses of ethical theories.

UNIT II

Human Values:Morals, Values and Ethics - Integrity- Work Ethic – Service Learning - Civic Virtue - Respect for Others - Living Peacefully - caring – Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment –Empathy - Self-Confidence - Character - Spirituality .

UNIT III

Engineering as Social Experimentation: Engineering as experimentation – engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study, Safety, Responsibilities and Rights: Safety and risk - assessment of safety and risk - risk benefit analysis and

reducing risk – the three mile island and chernobyl case studies. Collegiality and loyalty – respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT IV

Global Issues: Multinational corporations- Environmental ethics- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York (1996).
2. Govindarajan M, Natarajan S, Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi(2004).

REFERENCE BOOKS

[1] Baum, R.J. and Flores, A., "Ethical Problems in Engineering, Center for the studyof the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute,Troy, New York, 335 pp. eds. (1978)

[2] Beabout, G.R., Wennemann, D.J. , "Applied Professional Ethics: A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175 pp (1994).

17MA1201

LAPLACE TRANSFORMS AND INTEGRAL CALCULUS

Course Category:	Institutional Core	**Credits:**	4
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 1 - 0
Prerequisites:	Vectors, Curve Tracing.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

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

CO1	Solve Linear Differential Equations using Laplace Transforms.
CO2	Examine the nature of the Infinite series.
CO3	Evaluate areas and volumes using Double, Triple Integrals.
CO4	Convert Line Integrals to Area Integrals and Surface Integrals to Volume Integrals.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**				**M**									
CO2	**H**				**M**									
CO3	**H**				**M**									
CO4	**H**				**M**									

COURSE CONTENT

UNIT I

Laplace Transforms: Introduction, Definition, Conditions for Existence, Transforms of Elementary functions, Properties of Laplace Transforms, Transforms of Periodic functions, Transforms of Derivatives, Transforms of Integrals, Multiplication by t^n, Division by 't', Inverse Transforms, Method of partial fractions, Other methods of finding Inverse Transform, Convolution Theorem, Unit Step and Unit Impulse functions.

Applications: Evaluation of Improper Integrals, Solving Differential equations by Laplace Transform.

UNIT II

Partial Differential Equations: Introduction, Formation of Partial Differential Equations, Solutions of a Partial Differential Equations, Equations Solvable by Direct Integration, Linear Equations of First Order.

Sequence and Series: Convergence of series, Comparison test, Integral test, D'Alembert's Ratio test,

Cauchy's Root Test, Alternating series test, Absolute and Conditional convergence.

UNIT III

Integral Calculus: Double Integrals, Change of Order of Integration, Double Integrals in Polar Coordinates, Triple Integrals, Change of Variables. **Applications:** Area enclosed by Plane Curves, Volumes of Solids.

Special Functions: Beta Function, Gamma Function, Relation between Beta and Gamma Function, Error Function.

UNIT IV

Vector Calculus: Scalar and Vector point functions, Del applied to Scalar point functions, Del applied to Vector point functions, Physical interpretation of Divergence, Del applied twice to point functions, Del applied to products of point functions. Integration of Vectors, Line Integral, Surface Integral, Green's Theorem in a plane, Stokes's Theorem, Volume Integral, Gauss Divergence Theorem, Irrotational Fields.

TEXT BOOKS

[1] B.S.Grewal, "Higher Engineering Mathematics, Khanna Publishers", 43rd Edition, 2014.

REFERENCE BOOKS

[1].Erwin Kreyszig , "Advanced Engineering Mathematics" , John Wiley & Sons, 10th Edition,2015
[2].B.V.Ramana, "Higher Engineering Mathematics", Tata MC Graw Hill, 1st Edition,2007
[3].N.P.Bali, Dr.Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 9th Edition,2014

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1]. www.nptel videos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S)
[2]. nptel.ac.in/courses/122104017
[3]. nptel.ac.in/courses/111105035
[4]. Engineering Mathematics Open Learning Project.
www.3.ul.ie/~mlc/support/Loughborough%20website/

17PH1202
ENGINEERING PHYSICS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 - 0 - 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

COURSE OUTCOMES

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

CO1	Analyse and understand various types of crystal structures and their characterization.
CO2	Understand various concepts of acoustics and thermal performance.
CO3	Understand the classification, properties, preparation and applications of various engineering materials.
CO4	Understand the fabrication of nanomaterials and carbon Nanotubes.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	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	**H**													
CO2	**H**		**M**											
CO3	**H**													
CO4	**H**	**L**												

COURSE CONTENT

Unit – I

Crystallography: Introduction, Fundamental terms of crystallography, Types of crystals: Bravais lattices, Miller indices; Relation between inter planar distance and inter atomic distance, Crystal structures of materials: SC, BCC, FCC.

Characterization of materials: Introduction, diffraction of X-rays (Derivation for Bragg's law, Bragg's X-ray spectrometer), Determination of crystal structure by Powder crystal method.

Unit – II

Acoustics: Introduction, Classification of sound, Sound absorption: Absorption coefficient, Sabine's formula for reverberation time and its limitations, Factors effecting acoustics of building and their remedies and acoustic design of a hall.

Thermal Performance: Heat transfer through fenestrations, thermal insulation and its benefits- heat gain and heat loss estimation- factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices-central

heating. **Unit – III**

Engineering Materials: Composite materials: Introduction, classification, processing technique for composite materials (Fiber reinforced) and applications.
Ceramics: Introduction, classification, ceramic fabrication (Isostatic pressing) and applications.
Dielectric Materials: Fundamental definitions, Types of Polarization: Electronic and Ionic polarizations, ferroelectric materials and their applications.
Shape memory alloys: Introduction, properties, commercial shape memory alloys (Ni-Ti and copper based alloys) and applications.
Unit- IV
Nanotechnology: Basic concepts of Nanotechnology, Nano scale, Introduction to nano materials, Surface to volume ratio, General Properties of Nano materials, Fabrication of nano materials: Plasma Arcing, Chemical vapour deposition, Characterization of nano materials: SEM, TEM. Carbon nano tubes: SWNT, MWNT, Formation of carbon nanotubes: Arc discharge, Laser ablation, Properties of carbon nano tubes, Applications of CNT's & Nanotechnology.

TEXT BOOKS

[1]. V. Rajendran, Materials science, Mc Graw Hill Publications, 4th Edition, 2014.
[2]. M.N. Avadhanulu & P.G. Kshirsagar, Engineering Physics, S. Chand publications, Revised Edition, 2014.

REFERENCE BOOKS

[1]. S.O. Pillai, "Solid State Physics", New age international publishers, 7th Edition, 2015.
[2]. M.R. Srinivasan, "Engineering Physics", New age international publishers, First Edition, 2011.
[3]. Severns, W.H. & Fellows, J.R., "Air Conditioning and Refrigeration", John Wiley and sons, London, 1988. (Unit-I).

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. http://nptel.ac.in/courses/112106227/
2. https://ocw.mit.edu/courses/materials-science-and-engineering/3-60-symmetry-structure-and-tensor-properties-of-materials-fall-2005/video-lectures/introduction-to-crystallography-part-1/
3. *https://architecture.mit.edu/subject/spring-2014-4431*
4. http://freevideolectures.com/Course/3048/Physics-of-Materials/36
5. https://www.peterindia.net/NanoTechnologyResources.html

17CS1203
PROGRAMMING IN C

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 -0 – 0

Prerequisites:	Problem Solving Methods	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Understand the fundamentals and structure of a C programming language
CO2	Apply the loops, arrays, functions and string concepts in C to solve the given problem.
CO3	Apply the pointers and text input output files concept to find the solution for the given applications.
CO4	Use the Enumerated, Datatypes, Structures and Unions.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**M**				**L**			**L**						
CO2	**M**				**L**			**L**						
CO3	**H**				**M**			**L**			**L**			
CO4	**H**				**H**			**L**			**L**			

COURSE CONTENT

UNIT - I

Introduction to the C Language : Background, C Programs, Identifiers, Types, Variables, Constants, Input/Output, Programming Examples.

Structure of a C Program: Expressions, Precedence and Associatively, Evaluating Expressions, Type Conversion, Statements, Sample Programs.

Selection: Storage Class,Logical Data and Operators, Two -Way Selection, Multiway Selection, More Standard Functions

UNIT - II

Repetition: Concept of a Loop Loops In C, Loop Examples, Recursion, The Calculator Program.

Arrays: Concepts, Using Array in C, Inter-Function Communication, Array Applications, Two Dimensional Arrays, Multidimensional Arrays.

Functions: Functions in C, User Defined Functions, Inter Function Communication, Standard Functions, Scope.

Strings: String Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions, String- Data Conversion.

UNIT - III:

Pointers: Introduction, Pointers For Inter Function Communications, Pointers to Pointers, Compatibility,

Lvalue and Rvlaue.

Pointer Applications: Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocations Functions, Array of Pointers.

Text Input/output: Files, Streams, Standard Library Input/Output Functions, Formatting Input/output Functions and Character Input/Output Functions, Command-Line Arguments.

UNIT - IV:

Enumerations: The Type Definition(Typedef) , Enumerated Types: Declaring an Enumerated Type , Operations on Enumerated Types, Enumeration Type Conversion, Initializing Enumerated Constants, Anonymous Enumeration: Constants, Input/Output Operators.

Structures: Structure Type Declaration, Initialization, Accessing Structures, Operations on Structures, Complex Structures, Structures and Functions, Sending the Whole Structure, Passing Structures through Pointers.

Unions: Referencing Unions, Initializers, Unions and Structures, Internet Address, Programming Applications.

TEXT BOOKS

Behrouz A. Forouzan & Richard F. Gilberg , "Computer Science A Structured Programming Approach using C" , CENGAGE Learning, Third Edition.

REFERENCE BOOKS

[1] Kernighan and Ritchie , "The C programming language" , The (Ansi C Version), PHI, second edition.

[2] Yashwant Kanetkar , "Let us C" , BPB Publications, 2nd Edition 2001.

[3] Paul J. Dietel and Dr. Harvey M. Deitel, "C: How to Program", Prentice Hall ,7th edition (March 4,2012).

[4] Herbert Schildt, "C:The Complete reference", McGraw Hill, 4th Edition, 2002.

K.R.Venugopal, Sundeep R Prasad, "Mastering C", McGraw Hill, 2nd Edition, 2015

17ME1204

ENGINEERING MECHANICS – II

Course Category:	Engineering Sciences	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3 -0 - 0
Prerequisites:	Basic Mathematics, Physical Science, Engineering Mechanics-I (Statics)	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Analyze the rectilinear motion of particles.
CO2	Analyze the curvilinear motion of particles.
CO3	Evaluate the moment of inertia of areas and material bodies.
CO4	Analyze the motion of rigid bodies.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**				**M**									
CO2	**H**				**M**									
CO3	**H**													
CO4	**M**				**H**									

COURSE CONTENT

UNIT – I

Kinematics of Rectilinear Translation: Introduction, displacement, velocity and acceleration. Motion with Uniform and Variable acceleration.
Kinetics of Rectilinear Translation: Equations of rectilinear motion. Equations of Dynamic Equilibrium: D'Alembert's Principle. Work and Energy, Conservation of energy, Impulse and Momentum, Impact-Direct central Impact.

UNIT – II

Kinematics of Curvilinear Motion: Introduction, rectangular components of velocity and acceleration. Normal and Tangential acceleration, Motion of projectiles.
Kinetics of Curvilinear Motion: D'Alembert's Principle, and Work and Energy in curvilinear motion.

UNIT –III

Moment of Inertia of Plane Figures: Moment of Inertia of a plane figure with respect to an axis in its plane – Moment of inertia with respect to an axis perpendicular to the plane of the figure, Radius of gyration – Parallel axis theorem, MI of composite plane figures.
Moment of Inertia of Material Bodies: Moment of inertia of a rigid body – Moment of inertia of slender bar, laminas (2D), Radius of gyration, Parallel axis theorem, Moment of inertia of 3D bodies-cone, cylinder, sphere and parallelepiped.

UNIT – IV

Kinematics of Rigid Body:
Rotation: Linear and angular Velocity, linear and angular acceleration in uniformly accelerated rotation.
Plane motion: Concepts of relative velocity and Instantaneous center.
Kinetics of Rigid Body:
Rotation: Equation of motion for a rigid body rotating about a fixed axis – Rotation under the action of a constant moment.

TEXT BOOKS

[1] S. Timoshenko & D. H. Young , "Engineering Mechanics" , McGraw Hill International Edition. (For Concepts and symbolic Problems), 4th Edition, 2007.
[2] A. K. Tayal, "Engineering Mechanics Statics and dynamics" , Umesh Publication, Delhi, (For numerical Problems using S.I.System of Units),13th Edition, 2006.

REFERENCE BOOKS

[1] Beer and Johnston, "Vector Mechanics for Engineers Statics and Dynamics", Tata McGraw Hill, IIIrd edition 2010.
[2] SS Bhavikatti and KG Rajasekharappa, "Engineering Mechanics", New Age International Private Limited, IVth Edition 2012
[3] K.Vijaya Kumar Reddy and J Suresh Kumar, " Singer's Engineering Mechanics Statics and Dynamics", BS Publications, IIIrd Edition 2010.

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] http://emweb.unl.edu/, Accessed On 15-06-2017

17HS1205
TECHNICAL ENGLISH &COMMUNICATION SKILLS

Course Category:	Institutional Core	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	2 - 0 - 2

Prerequisites:	Basic understanding of the language skills ,viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Develop administrative and professional compilations including web related(On-line) communication with felicity of expression
CO2	Demonstrate Proficiency in Interpersonal Communication, in addition to standard patterns of Pronunciation
CO3	Apply the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment
CO4	Execute tasks in Technical communication with competence

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1			**M**	**M**		**H**	**H**	**M**	**M**	**H**	**L**	**M**		
CO2				**M**		**H**	**H**	**H**	**M**	**H**		**M**		
CO3	**M**			**M**		**H**	**H**	**H**	**H**	**H**	**L**	**M**		
CO4	**L**	**M**		**M**		**H**	**H**	**H**	**H**	**H**	**L**	**M**		

COURSE CONTENT

UNIT I

Professional Writing Skills

Professional Letter- Business, Complaint and Transmittal ,
Essay Writing- Descriptive and Analytical ,
Administrative and On-line drafting skills –Minutes and Web notes including e-mail

UNIT II

Interpersonal Communication Skills

Communicative Facet- Speech acts- Extending Invitation, Reciprocation, Acceptance, Concurrence, Disagreeing without being disagreeable ,
Articulation-oriented Facet- Transcription using International Phonetic Alphabet, Primary Stress.

UNIT III

Vocabulary and Functional English

A basic List of 500 words – Overview ,
Verbal analogies, Confusables, Idiomatic expressions and Phrasal Collocations,
Exposure through Reading Comprehension- Skimming, Scanning and Understanding ,
the textual patterns for tackling different kinds of questions ,
Functional Grammar with special reference to Concord, Prepositions, use of Gerund and Parallelism .

UNIT IV

Technical Communication skills:

Technical Proposal writing,
Technical Vocabulary- a representative collection will be handled ,
Introduction to Executive Summary ,
Technical Report writing(Informational Reports and Feasibility Report.

TEXT BOOKS

[1] Martin Cutts, " Oxford guide to Plain English", Oxford University Press, 7th Impression 2011.
[2] TM Farhathullah, "Communication skills for Technical Students", Orient Longman, I Edition 2002
[3] John Langan, "College Writing Skills", McGraw Hill, IX Edition, 2014.
[4] "Eclectic Learning materials offered by the Department"

REFERENCE BOOKS

[1] Randolph Quirk, "Use of English", Longman, I Edition (1968) Reprinted 2004.
[2] Thomson A.J & A.V, Martinet, "Practical English Grammar", Oxford University Press, III Edition 2001
[3] V.Sethi and P.V. Dhamija, "A Course in Phonetics and Spoken English", PHI, II Edition 2006

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] https://www.britishcouncil.org/english *Accessed on 15th June 2017*
[2] www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=online *Accessed on 15th June 2017*
[3] https://www.uni-marburg.de/sprachenzentrum /selbstlernzentrum/ /apps_for _esl. pdf *Accessed on 15th June 2017*

17MC1206A
TECHNOLOGY AND SOCIETY

Course Category:	Institutional Core	**Credits:**	-
Course Type:	Theory	**Lecture -Tutorial-Practice:**	1 - 0 – 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Understand the origins of technology and its role in the history of human progress.
CO2	Know the Industrial Revolution and its impact on Society
CO3	Interpret the developments in various fields of technology till Twentieth Century.
CO4	Distinguish the impacts of Technology on the Environemnt and achievements of great scientists.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**H**								**L**					
CO2	**H**							**M**						
CO3	**H**								**L**					
CO4	**H**							**M**						

COURSE CONTENT

UNIT – I

Introduction: Origins of technology, The Agriculture revolution, Technological contributions of ancient civilizations- Mesopotamian, Egyptians, Greeks, Romans, Indians and Chinese.

UNIT - II

Industrial revolution: The social and political background, The technical background, Steam: The power behind the Indistrial Revolution, The revolution in Textile Indistry, The Imapact of Indutrial Revolution on Society.

UNIT - III

The Flowering of modern technology: Manufacturing Technologies, Prime Movers, Internal Combustion engines, Production of Metals and Allyos, The Birth of Electrical Technology, Twentieth Century: The Flowering of modern technology

UNIT - IV

Technology, Science and Society: Impact of technology on society, The Impacts of Technology on the environment, Sustainable development.

Achievements of famous scientists:

(**World**): Einestein, Newton, Faraday, Graham Bell, Edison, S.Hawking.

(**India**): CV Raman, S.Chandrasekhar, Aryabhatta, Homi J Bhabha, Vikram Sarabhai, APJ Abdulkalam, S.Ramanujan, M.Visweswarayya.

TEXT BOOKS

[1] Dr. R.V.G Menon, "Technology and Society", Pearson Education, 2011

REFERENCE BOOKS

[1] Quan-Haase, A., " Technology and Society: Inequality, Power, and Social Networks", Oxford University Press, 2013.

17PH1251

ENGINEERING PHYSICS LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Use spectrometer and travelling microscope in various experiments
CO2	Determine the V-I characteristics of solar cell and photo cell and appreciate the accuracy in measurements
CO3	Test optical components using principles of interference and diffraction of light

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1				**H**										
CO2	**M**			**H**										
CO3				**H**										

COURSE CONTENT

1. Melde's apparatus- Determine the frequency of tuning fork
2. Wedge method- Measurement of thickness of a foil
3. Variation of magnetic field along the axis of current-carrying circular coil
4. Fibre Optics- Determination of Numerical aperture
5. Photo cell-Study of V-I Characteristics, determination of work function
6. Solar cell –Determination of Fill Factor
7. Torsional Pendulum-Determination of Rigidity modulus
8. Determination of Dielectric constant of a sample
9. Diffraction grating-Measurement of wavelength of mercury source
10. Hall effect –Hall coefficient measurement
11. Compound pendulum-Determination of 'g'
12. Figure of merit of a galvanometer

TEXT BOOKS

[1] Madhusudhan Rao, "Engineering Physics Lab Manual", Ist ed., Scitech Publications, 2015

[2] Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010

E-RESOURCES

[1] http://plato.stanford.edu/entries/physics-experiment
[2] http://www.physicsclassroom.com/The-Laboratory
[3] http://facstaff.cbu.edu/~jvarrian/physlabs.html

VIRTUAL LAB REFERENCES

[1] http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1
[2] http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1
[3] http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

17CS1252
COMPUTER PROGRAMMING LABORATORY

Course Category:	Institutional Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 – 3

Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Implement the use of programming constructs in a structured oriented programming language
CO2	Implement conditional and iterative statements through C Language
CO3	Analyze and implement user defined functions to solve real time problems
CO4	Implement the usage of pointers and file operations on data
CO5	Implement the user defined data types via structures and unions to solve real life problems

Contribution of Course Outcomes towards achievement of Program Outcomes
(L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**H**													
CO2	**L**													
CO3	**M**				**H**			**L**			**L**			
CO4	**M**				**L**									
CO5	**H**				**L**									

COURSE CONTENT

CYCLE – I : PROGRAMMING CONSTRUCTS AND CONTROL STRUCTURES

1. Introduction to C Pogramming:
   a) Use of Turbo C IDE
   b) The Structure of C Program with Sample program
2. Data Types and Variables:
   a) Programs to usage of keywords and identifiers in c
   b) Programs on declaration of variables, rules for naming a variable, constants and different type of constants, data types
   c) Programs to perform on various operators in C
3. Branching and Selection:
   a) To specify the conditions under which a statement or group of statements should be executed.
   b) To choose exactly one out of two statements (possibly compound statements) to be executed; specifies the conditions under which the first statement is to be executed and provides an alternative statement to execute if these conditions are not met.
   c) To choose one statement (possibly compound) to be executed from among a group of state- ments (possibly compound); specifies the conditions under which each statement may be executed and may contain a default statement (in an else clause at the end) to be executed if none of these conditions are met. Note that in the absence of a final else clause, it may be the case that none of the statements are executed.
4. Unconditional control Transfer statements in C:
   a) Design and develop programs that use of goto Statement
   b) Design and develop programs that the use of Break Statement
   c) Design and develop programs that use of Continue Statement
5. Looping constructs:
   Design and develop programs based on
   a) Iterative loops using While, Do While, For, Nested For
   b) Selection Statement using the switch-case Statement
   c) Multiple way selections that will branch into different code segments based on the value of a variable or expression
6. Arrays
   a) Design and develop programs which illustrates the implementation of single-dimensional arrays and Multi dimensional arrays

7. Strings
   a) Create programs to initialize strings and usage of them for various input, output operations.
   b) Design and develop programs to handle String functions

CYCLE - II: ADVANCED PROGRAMMING CONSTRUCTS

1.Concept of user defined functions
   a) Design and develop programs depending on functions both user defined and standard library functions in C with different approaches.
2. File handling operations
   a) FILE structure
   b) Opening and closing a file, file open modes
   c) Reading and writing operations performed on a file
   d) File Pointers: stdin, stdout and stderr
   e) FILE handling functions: fgetc(), fputc(), fgets() and fputs() Functions
3. Pointers:
   a) Programs on declaration of pointers and their usage in C

b) Programs to relate between arrays and pointers and use them efficiently in a program
c) To pass pointers as an argument to a function, and use it efficiently in program

4. Command Line Arguments
   a) Design and develop programs that accept arguments from command line to perform different kinds of operations
5. Structures and Unions
   a) Programs to define, declare and access structure and union variables
   b) Design and develop programs to work with pointers to access data within a structure
   c) Programs to pass structure as an argument to a function

TEXT BOOKS

[1] Ashok N Kamthane, "C And Data Structures", Pearson Education; First edition, 2008

REFERENCE BOOKS

[1] Brain W Kernighan and Dennis Ritchie, "The C Programming language", Pearson Education India,2015
[2] David Griffiths and Dawn Griffiths, "Head First C":A Brain Friendly Guide, O:Reilly media, 2012

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[1] Introduction to Programming C: http://nptel.ac.in/courses/106104128/
[2] C-Programming - IIT Kharagpur lectures https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLeCxvb23g7hrw27XlekHtfygUTQ0TmFfP
[3] Numerical Methods and Programing by Prof.P.B.Sunil Kumar, Department of Physics, IIT Madras https://www.youtube.com/watch?v=zjyR9e-N1D4& list=PLC5DC6AD60D798FB7

17ME1253
BASIC WORKSHOP

Course Category:	Engineering Sciences	**Credits:**	1.5
Course Type:	Laboratory	**Lecture -Tutorial-Practice:**	0 - 0 - 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUTCOMES

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

CO1	Model and develop various basic prototypes in the Carpentry trade.
CO2	Develop various basic prototypes in the trade of Welding.
CO3	Model and develop various basic prototypes in the trade of Tin Smithy.
CO4	Familiarize with various fundamental aspects of house wiring.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**H**	**H**									**L**			
CO2	**M**	**H**									**L**			
CO3	**M**	**H**									**L**			
CO4	**L**	**H**									**L**			

COURSE CONTENT

UNIT I
Carpentry:

a. Study of tools & operations and various carpentry joints.
b. Practice of open bridle joint, Cross half lap joint, Half LapT Joint, and Dove tail joint
c. Simple group exercise like preparation of single widow frame.

UNIT II
Welding:

a. Study of tools and operations of Gas welding and arc welding.
b. Practice of various joints like weld layer practice, V- Butt Joint, Double parallel fillet joint, T-Joint, and Corner Joint.

UNIT III
Tin Smithy:

a. Study of tools & operations

b. Practice of various joints like Saw Edge, Wired Edge, Lap Seam, and Grooved Seam.
c. Simple exercise like Fabrication of square tray.

UNIT IV

House Wiring:

a. To connect one lamp with one switch.
b. To connect two lamps with one switch.
c. To connect a fluorescent Tube.
d. Stair case wiring.
e. Godown wiring.
f. Study of single phase wiring for a office room.
g. Nomenclature & measurement of wire gauges and cables.
h. Estimation of cost of indoor wiring for a wiring diagram (plan of a building).
i. Test procedure for continuity of wiring in a electric installation.
j. Measurement of electric energy by using meter.

TEXT BOOKS

[1] Kannaiah P. & Narayana K. C., "Manual on Workshop Practice", Scitech Publications, Chennai, 1999.
[2] Venkatachalapathy, V. S., "First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999.

REFERENCE BOOKS

[1] Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice – Theory, Practice and Work Book", Suma Publications, Chennai, 2005.

17MA1301A

COMPLEX ANALYSIS & NUMERICAL METHODS

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 1 - 0
Prerequisites:	Algebra of Complex numbers, convergence of infinite series, theory of equations	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Determine analytic and non analytic functions and understand the concept of complex integration.
	CO2	Analyze Taylor and Laurent series and evaluation of real definite integrals using residue theorem and understand the concept of transformations.
	CO3	Solve Algebraic and transcendental, system of equations and understand the concept of polynomial interpolation.
	CO4	Understand the concept of Numerical differentiation and integration. Solve initial and boundary value problems numerically.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	H				M		M							
CO2	H				M		M							
CO3	H	M			H						M			
CO4	H	M			H						M			

Course Content

UNIT I:

Complex Analysis: Introduction, continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula

UNIT II:

Taylor's series, Laurent's series, Zeros and singularities.Residue theorem, calculation of residues, evaluation of real definite integrals (by applying the residue theorem).

Standard transformations: Translation - Magnification and Rotation – Invertion and reflection - Bilinear transformation.

UNIT III:

Numerical Methods: Solution of Algebraic and Transcendental Equations: Introduction, Newton - Raphson method, Solution of simultaneous linear equations – Gauss Elimination Method - Gauss - Seidel iterative method.

Interpolation: Introduction, Finite Differences – Forward, Backward, Central Differences, Symbolic Relations, Differences of a polynomial, Newton's formulae for interpolation, Central difference interpolation formulae –Gauss's, Sterling's, Bessel's formulae Interpolation with unequal intervals – Lagrange's and Newton's Interpolation formulae.

	UNIT – IV **Numerical Differentiation And Integration**: Finding first and second order differentials using Newton's formulae. Trapezoidal rule and Simpsons 1/3 Rule **Numerical Solutions of Differential Equations**: Taylor's series method Picard's method. Euler's method, Runge - Kutta method of 4th order, Boundary value problems, Solution of Laplace's and Poisson's equations by iteration.
Text books and Reference books	**Text Book:** [1] B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition Khanna Publishers, 2012. **Reference Books:** [1] Krezig, "Advanced Engineering Mathematics", 8th Edition, JohnWiley & Sons.2007, [2] R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishers. [3] N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics", 1st Edition, Lakshmi Publications (P) Limited, 2011 [4] H.K.Das, Er. RajnishVerma, "Higher Engineering Mathematics", 1st Edition, S.Chand& Co., 2011. [5]S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI , 2005.
E-resources and other digital material	[1]. faculty.gvsu.edu/fishbacp/complex/complex.html. [2]. nptelvideolectures/iitm.ac.in

17CE3302
INTRODUCTION TO MECHANICS OF SOLIDS

Course Category:	Institutional Core	**Credits:**	4
Course Type:	Mandatory course	**Lecture -Tutorial-Practice:**	3-1-0
Prerequisites:	Engineering Mechanics 17ME1104A	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes		
	Upon successful completion of the course, the student will be able to:	
	CO1	Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships;
	CO2	Define the characteristics and calculate the magnitude of principal stresses and strain, shear force and bending moment diagrams.
	CO3	Calculate the bending stresses and deflection at any point on a beam subjected to a combination of loads.
	CO4	Understanding the shear stress in beams, torsion in shafts and spring

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M-Medium, H - High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**M**	**M**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**		
CO2	**H**	**H**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**L**	**-**		
CO3	**M**	**M**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**L**	**-**		
CO4	**M**	**M**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**L**	**-**		

Course content

UNIT I :

Stresses and Strains

Stress and strain - Hooke's law -tension -compression and shear-Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses- Simple problems.

UNIT II:

Principal Stresses and Strains

Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress. Principal strains and principal axis of strain, circle of strain. –Simple problems.

	Shear Force and Bending Moment diagrams of statically determinate beams Types of beams and supports, shear force and bending moment diagram–Simple problems. **UNIT III:** **Flexural Stresses** Theory of simple bending – Assumptions – Derivation of bending equation - Neutral axis – Determination of bending stresses – Section modulus of across various beam sections. **Slope and deflection** Relationship between moment, slope and deflection, Double integration method, Macaulay's method Moment area method, conjugate beam method Use of these methods to calculate slope and deflection for determinant beams–Simple problems. **UNIT IV:** **Shear Stresses and Torsion** Derivation of formula of shear stress– Shear stress distribution across various beam sections - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, Torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs- Simple problems.
Text books and Reference Books	**Text Books:** 1. Strength of Materials (Mechanics of solids) by Er. R.K.Rajput; S.Chand&Company Ltd., New Delhi. 2. Strength of Materials by S Ramamrutham& R Narayan; DhanpatRai Publishing Co.(P) Ltd, New Delhi. **Reference Books:** 1. Structural analysis by S SBhavikatti – V K Publishers 2. Theory of structures by S P Timoshenki& D H Young. 3. Mechanics of materials by E P Popov; Prentice-Hall of India Pvt. Ltd.,New Delhi.

17CE 3303
FLUID MECHANICS

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 1- 0
`	17MA 1101 & 17 MA 1201 - Maths 17PH 1202 – Engineering Physics 17ME 1204 – Engineering Mechanics - II	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Measure the pressure of the flowing fluid.
	CO2	Understand the kinematic and dynamic behavior of flow.
	CO3	Measure the flow of fluid through pipes and Orifices/ Mouthpieces.
	CO4	Analyze the flow through pipes.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
	CO1	**H**	**M**	**H**											**H**
	CO2	**H**	**M**	**H**											**H**
	CO3	**H**	**M**	**H**										**M**	**H**
	CO4	**H**	**M**	**H**										**M**	**H**

Course Content

UNIT I:

Properties of Fluid: Introduction; Properties of Fluid; Units of measurement; Fluid Continuum; Newtonian and Non - Newtonian fluids; Vapour pressure, Surface Tension and Capillarity.

Fluid Statics: Variation of static pressure; Pressure the same in all directions – Pascal's Law; Atmospheric, Absolute and gauge pressure; Pressure measurement by manometers; Hydrostatic pressure on horizontal, vertical and inclined plane surfaces.

UNIT II:

Kinematics of Fluid Flow: Methods of describing fluid motion; Classification of flow; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; Three, two and one dimensional flows; Irrotational and rotational flows; Stream line; Path line; Streak line; Continuity equation; Velocity potential and stream function.

Dynamics of Fluid Flow: Euler's equation of motion; Bernoulli's equation; Energy correction factor; Momentum principle; Application of Momentum equation; Force exerted on a pipe bend.

UNIT III:

Measurement of Flow through Pipes: Measurement of flow through Pipes – methods and various devices; Discharge through Venturi meter; Discharge through orifice meter; Measurement of velocity by Pitot tube.

Measurement of Flow through Orifices and Mouthpieces: Flow through orifices; Determination of

	coefficients for an orifice; Flow through small orifice and large rectangular orifice; Classification of mouthpieces; Flow through external cylindrical mouthpiece. **UNIT – IV** **Analysis of Flow through Pipes:** Energy losses in pipelines; Darcy – Weishbach equation; Minor losses in pipelines; Concept of equivalent length; Pipes in series and parallel. **Laminar Flow:** Relation between shear and Pressure Gradients in Laminar Flow; Reynold's experiment; Critical velocity; Steady laminar flow through a circular pipe – Hagen Poiseuille's Law; Laminar Flow between Parallel Plates – Both plates at rest.
Text books and Reference books	**Text Books:** [1] P.N. Modi& S.N. Seth, "Hydraulics & Fluid Mechanics", 18th ed., Standard Book House, New Delhi, 2015. [2] A.K. Jain, "Fluid Mechanics", 11th ed., Khanna Publishers, New Delhi, 2014. **Reference Books:** [1] R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 9th et., Laxmi Publications; New Delhi, 2015. [2] Rajput R.K., "Fluid Mechanics and Hydraulic Machines", 3rd ed., S.Chand and Company Ltd., New Delhi, 2014. [3] K. Subramanya, "Theory and Applications of Fluid Mechanics", 3rd ed., Tata McGraw Hill Publishing Company, New Delhi, 2013.
E-resources and other digital material	[1] Dr. T. I. Eldho, IIT/Bombay – Fluid Mechanics – "www.nptel.ac.in / courses/ 105101082/" [2] Dr. SubhashivaDutta& Dr. N. Sahoo, IIT/Guwahati – Fluid Mechanics – "www.nptel.ac.in/courses/105103095/"

17CE3304
SURVEYING & GEOMATICS

Course Category:	**Programme Core**	Credits:	4
Course Type:	**Theory**	**Lecture - Tutorial - Practice:**	4 - 0- 0
Prerequisites:	**Mathematics, Science**	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	**On successful completion of the course, the student will be able to:**	
	CO1	Understand the principles of surveying.
	CO2	Measure horizontal and vertical angles in surveying.
	CO3	Compute areas and volumes of a given section
	CO4	Understand the concepts of leveling and location of contour.

	CO5	Understand the principles of modern field survey system.
	CO6	Setting out of a simple curve.

Contribution of Course Outcomes towards achievement of program Outcomes (L-Low, M-Medium, H-High)

	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	**L**													
CO2	**L**				**H**				**M**		**M**			
CO3	**L**				**H**				**M**		**M**			
CO4	**L**				**H**				**M**		**M**			
CO5	**L**								**M**		**M**			
CO6	**L**								**M**					

Course Content

UNIT – I

BASICS OF SURVEYING:

Surveying: Definition; Classification; Principles of surveying; Plan and map; Scales used for Maps and plans. Accuracy; Precision; Sources of errors; Types of errors;

CHAIN SURVEYING:

Principles of chain surveying; Basic definitions; Different methods; Ranging out; Chaining a line on a flat ground; Chaining on an uneven or a sloping ground; Chain & Tape corrections.

UNIT-II

AREAS & VOLUMES:

Introduction; Boundaries with offsets at irregular intervals ; Planimeter: Area of cross sections- two level sections only; Trapezoidal rule; Prismoidal formula; Capacity of a reservoir.

THEODOLITE SURVEYING:

Basic definitions, fundamental lines, Temporary adjustments; Measurement of a horizontal angle by repetition and reiteration. Measurement of vertical angle; Source of errors in Theodolite survey.

UNIT – III

LEVELLING:

Basic definitions; Different methods of leveling; Classification of direct leveling methods; Auto level; Leveling staff; Level field book; Profile leveling; Cross sectioning; Height of Instrument and rise and fall method. Sources of errors in leveling.

CONTOURING:

Contouring; contour interval; Characteristics of contours; Methods of locating contours; Interpolation and Sketching of contours; Uses of contour maps;

UNIT-IV

MODERN FIELD SURVEY SYSTEMS:

Principle of Electronic Distance Measurement,Types of EDM instruments, Total Station: GPS- Applications of GPS in Civil Engineering,

	CIRCULAR CURVES: Basic definitions; Designation of a curve; Relationship between radius and degree of curve; Elements of a simple curves; setting out of simple curve.
Text books and Reference books	**Text Books:** 1. Surveying Vol I & II by K R Arora, 15th Edition, 2015; Standard Book house. 2. Plane Surveying by AM Chandra, New Age International (P) Ltd. **Reference Books:** 1. Surveying Vol.I & II by B.C. Punmia, Laxmi Publications. 2. Fundamentals of surveying by S.K. Roy 1999, Prentice- Hall of India, New Delhi. 3. Advanced Surveying, by S. Gopi, R.S. Kumar and N. Madhu, 2007, Pearson education, New Delhi.
E-resources and other digital material	http://nptel.ac.in/courses/webcourse-contents/IIT-ROORKEE/SURVEYING/home.htm

17CE3305-ENGINEERING GEOLOGY

Course Category:	**Programme Core**	**Credits:**	2
Course Type:	**Theory**	**Lecture -Tutorial-Practice:**	2 - 0 - 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	**On successful completion of the course, the student will be able to:**	
	CO1	acquire basic knowledge on geology in civil engineering
	CO2	Understand the geological process influence the civil engineering projects
	CO3	Understand the geological and geophysical methods for planning and designing projects
	CO4	identify the solution of geological problems in the context of major civil engineering projects

Contribution of Course Outcomes towards achievement of program Outcomes (L-Low, M-Medium, H-High)															
	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	**H**													**H**
CO2	**H**													**H**
CO3	**H**	**H**		**H**										**H**
CO4	**H**	**H**		**H**										**H**

Course Content

UNIT-I

FUNDAMENTALS OF MINERALS, ROCKS AND SOILS

Introduction of Engineering Geology Branches of Geology useful to Civil Engineering: Scope of geological studies in various Civil engineering projects: Central and State Departments dealing with geology

Mineralogy -Introduction to mineralogy Mineral Identification by Physical properties . Modern Methods of mineral identification- SEM, XRD, EPMA and XRF. Physical properties of rock forming minerals

Petrology -Rock cycle Igneous rocks – Formation –Classification and Textures Sedimentary rocks – Formation –Classification and Textures, Metamorphic rocks and metamorphism – Formation –Classification and Texture, Engineering concerns of rocks

UNIT-II

GEOLOGICAL PROCESS

	Physical geology-Weathering-Erosion- Denudation, Engineering classification of weathered rocks ; Types of Land forms- Alluvial- Glacial- Desert and Coastal **Geological Hazards- Land slides -**Type of landslides **,**Factor of Safety **,**Slope Protection and Maintenance **Earthquakes -** Causes and effects of earthquakes Earthquake Magnitude and intensity scales. seismic zones of India: **Groundwate**r- Factors control water bearing capacity of rocks; **Deformation and strength Behavior of Rocks –** Stress –strain behavior of rock, Concept of rock deformation Rock outcrops- Types- strike and Dip **Folds**- Types-Effects on construction **Faults**-Types-Effects on construction **: joints**-Types- Effects on construction **UNIT-III** **Sub surface investigation Methods** **Maps and their interpretation-** Topographic Map and Geological Map **Geophysical Methods-** Principles of exploration geophysical Methods Electrical Resistivity method- Interpretation, Seismic refraction method- Interpretation **Rock mechanics**- Rock mass as construction material- Definition of rock mass, Engineering characters of rock mass ,Measurement of velocity in rocks-Core logging- Rock quality designation Index **UNIT-IV** **Geology for Major projects** **Dams -** Site selection for dams **,** Geological investigation methods for dams **Reservoirs-** Failure of reservoirs **,** Reservoir suitable rocks, Reservoir induced seismicity **Tunnels-** Site selection for tunnels **,** Geological investigation methods for Tunnels
Text books and Reference books	**Text Books:** 1. F.G. Bell, Fundamental of Engineering Geology , BS Publications PVT Ltd, Hyderabad. 2. Parbin Singh, " Engineering and General Geology ", Katson Publication House, 1987. 3. Principals of Engineering Geology by K.V.G.K. Gokhale – B.S publications 4. Engineering Geology by N.Chennkesavulu, Mc-Millan, India Ltd. 2005.

	Reference Books: 1.Krynine and Judd, " Engineering Geology and Geo techniques ", McGraw Hill Book Company, 1990. 2. Legeet, " Geology and Engineering ", McGraw Hill Book Company, 1998. 3. Blyth, " Geology for Engineers ", ELBS, 1995. 4. GoodmanR.F-Introduction to rockmechanics, JohnWiley, Chichestor 5. Engineering Geology by SK Duggal,HK Pandey And N.Rawal –McGraw Hill Education
E-resources and other digital material	**NPTEL Courses**

17TP1306 LOGIC & REASONING

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Learning by Doing	**Lecture -Tutorial-Practice:**	0 - 0 - 2

Prerequisites:		Continuous Evaluation:	100
		Semester end Evaluation:	0
		Total Marks:	100

COURSE OUTCOMES

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

CO1	Think reason logically in any critical situation
CO2	Analyze given information to find correct solution
CO3	To reduce the mistakes in day to day activities in practical life
CO4	Develop time-management skills by approaching different shortcut methods
CO5	Use mathematical based reasoning to make decisions
CO6	Apply logical thinking to solve problems and puzzles in qualifying exams in any competitive exam.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	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						**M**								
CO2		**M**												
CO3								**M**						
CO4									**M**					
CO5	**M**													
CO6	**L**													

COURSE CONTENT

UNIT I :

1. Series Completion,
2. Coding-Decoding,
3. Blood Relation Blood,
4. Puzzles test

UNIT II:

1. Direction sense test,
2. Logical Venn diagrams,

3. Number test, ranking test,
4. Mathematical operations

UNIT III:

1. Arithmetical Reasoning,
2. Inserting missing character,
3. Syllogism.

UNIT IV: Non – Verbal:

1. Water images,
2. Mirror images,
3. Paper folding,
4. Paper cutting,
5. Embedded Figures,
6. Dot situation,
7. Cubes & Dice

TEXT BOOK

R. S. Aggarwal, " Verbal and non-verbal reasoning", Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6

17CE3351 SURVEYING LABARATORY

Course Category:	**Programme Core**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture -Tutorial-Practice:**	**0-0-2**
Prerequisites:	**Mathematics, Science**	**Continuous Evaluation:**	**30**
		Semester end Evaluation:	**70**
		Total Marks:	**100**

Course outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Determine the areas by using linear measurement methods.

	CO2	Plot the traverse and determine the bearings by using Compass.
	CO3	Project the traverse from ground, on to the sheet by using plane table
	CO4	Determine the horizontal & vertical angles by using Theodolite.
	CO5	Determine the elevations by using different leveling instruments.

Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
	CO1	**L**								**L**	**L**				**L**
	CO2	**L**								**L**	**L**				**L**
	CO3	**L**								**L**	**L**				**L**
	CO4	**L**								**L**	**L**				**L**
	CO5	**L**								**L**	**L**				**L**

Course Content

CHAIN SURVEY:

1. Survey of an Area by chain survey (Closed Traverse).
   Practical Application : To find the area of a given feild
2. Chaining across Obstacles.
   Practical Application : To find the obstacles length

COMPASS SURVEY

1. Surveying of a given area by prismatic compass (Open Traverse).
   Practical Application: To find the horizontal angles between the objects.
2. Surveying of a given area by prismatic compass (Closed Traverse).
   Practical Application: To find the horizontal angles between the objects.

PLANE TABLE SURVEY:

1. Traversing by plane table survey.
   Practical Application: To plot the given area.

THEODOLITE:

1. Measurement of horizontal angles by using Repetition Method.
   Practical Application: To find the horizontal angles between the two points.

2. Measurement of horizontal angles by using Reiteration Method.
   Practical Application: To find the horizontal angles between more than two points.

3. Measurement of Vertical angles.
   Practical Application: To find the height of the object using vertical angles.

LEVELLING:

1. Differential Levelling:

	Practical Application: To find the R.L's of the ground for laying the pipe line using any leveling Instrument. 2. Reciprocal Levelling: **Practical Application**: Elevation difference between two points on both sides of river banks.
Text books and Reference books	1. Surveying Vol I & II by K R Arora, Standard Book house. 2. Plane Surveying by AM Chandra, New Age International (P) Ltd. 3. Surveying Vol.I & II by B.C. Punmia, Laxmi Publications. 4. Fundamentals of surveying by S.K. Roy 1999, Prentice- Hall of India, New Delhi.
E-resources and other digital material	http:/gauravtandon.wikspacaes.com

17CE3352 STRENGTH OF MATERIALS LABORATORY

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	**0-0-2**
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	do tests on steel and find its properties to ascertain suitability as per IS codes of practice.
	CO2	conduct tests on wood as per IS Codes of practice and its use in works
	CO3	evaluate the strains and stresses experimentally using electrical resistance strain gauges.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**L**			**M**					**L**	**M**				**L**
CO2	**L**			**M**					**L**	**M**				**L**
CO3	**L**			**M**	**M**				**L**	**M**				**L**

Course Content	1. Study the stress-strain characteristics of mild steel/tor steel by Universal testing machine. 2. Determine the ultimate shear strength of mild steel rod in single and double shear. 3. Find the Brinnel's hardness number and Rockwell's hardness number of the given material.

	4. Find the Young's modulus of the given material (Wood/Steel/Aluminum) by conducting bending test on simply supported beam. 5. Find the Young's modulus of the given material by conducting bending test on cantilever beam and propped cantilever. 6. Find the impact resistance of the given material by conducting Charpy test and IZOD test on Impact testing machine. 7. Find the modulus of rigidity by conducting torsion test on solid circular shaft. 8. Determine the modulus of rigidity of the material of the spring. 9. Determine the ductility of steel wire. 10. Tests on timber. 11. Strain gauge application and evaluation of stress.
Text books and Reference books	1. Strength of Materials by S Ramamrutham& R Narayan; DhanpatRai Publishing Co.(P) Ltd, New Delhi.
E-resources and other digital material	https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf

17CE3353-ENGINEERING GEOLOGY LABORATARY

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	**0-0-2**
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	**On successful completion of the course, the student will be able to:**	
	CO1	Identify the common rocks and minerals and their engineering properties
	CO2	Interpret the subsurface geological structures using models
	CO3	Practice the topographic and geologic cross sections
	CO4	Calculate the engineering parameters from the rock samples

Contribution of Course Outcomes towards achievement of program Outcomes (L-Low, M-Medium, H-High)		**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	**H**													**H**
	CO2	**H**													**H**
	CO3	**H**	**H**		**H**										**H**
	CO4	**H**	**H**		**H**										**H**

Course Content

EXP.1.Identification of the following common rock forming Minerals by Physical properties
a).Quartz group b) Feldspar group c) Mica group d) Carbonate group

EXP.2. Identification of the following common rocks by Texture
a).Granite b) Basalt c)Sandstone d) Limestone e)Marble f)Gneiss

EXP.3 Identification and sketching of the structural models
a)Folds b) Faults c) Un conformities d) Tunnels in geological structures

EXP.4. Drawing and interpretation of geological cross sections.
a)Topographic maps b) Geological maps

	EXP.5. Determination of point load strength index of rocks **EXP.6.** Determination of tensile strength of rocks from Brazilian test. **EXP.7**. Determination of Compressive strength of rocks..
Text books and Reference books	Engineering Geology by SK Duggal,HK Pandey And N.Rawal –McGraw Hill Education
E-resources and other digital material	https://www.fugro.com/our-services/land-site-characterisation/testing-monitoring/laboratory-testing-of-soils-and-rocks

17MC1307 B – INDIAN CONSTITUTION

Course Category:	Humanities elective	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2- 0 - 0
Prerequisites:		**Continuous Evaluation:**	**100M**

<table>
<tr><td>Course outcomes</td><td colspan="14">Upon successful completion of the course, the student will be able to:</td></tr>
<tr><td></td><td>CO1</td><td colspan="13">Know the fundamental law of the land</td></tr>
<tr><td></td><td>CO2</td><td colspan="13">Understand how fundamental rights are protected</td></tr>
<tr><td></td><td>CO3</td><td colspan="13">Perceive the structure and formation of the Indian Government System</td></tr>
<tr><td></td><td>CO4</td><td colspan="13">Explain when and how an emergency can be imposed and what are the consequences.</td></tr>
<tr><td rowspan="5">Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)</td><td></td><td>PO 1</td><td>PO 2</td><td>PO 3</td><td>PO 4</td><td>PO 5</td><td>PO 6</td><td>PO 7</td><td>PO 8</td><td>PO 9</td><td>PO 10</td><td>PO 11</td><td>PO 12</td><td>PSPO 1</td><td>PSPO 2</td></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Course Content</td><td colspan="14">UNIT I:
Introduction to Constitution of India: Meaning of the Constitution Law and Constitutionalism, Historical perspective of constitution of India, Salient features of Constitution of India.

UNIT II:
Fundamental rights: Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under Article 19, scope of the right of life and personal liberty under Article 21, writs jurisdiction.

UNIT III: Nature of the Indian constitution: Federal structure and distribution of legislative and financial powers between the Union and states
Parliamentary form of government in India: The Constitution powers and status of the President of India, Amendment of the Constitutional powers and Procedure, Historical Perspectives of the constitutional amendments in India
Local Self Government: Constitutional Scheme in India

UNIT IV:
Emergency Provisions: National Emergency, President rule, financial emergency.</td></tr>
<tr><td>Text books and Reference books</td><td colspan="14">Text Book(s):
[1] Dr. J.N. Pandey, Constitutional Law of India published by Central law Agency, Allahabad, Edition 2018</td></tr>
</table>

17CE3401

BUILDING MATERIALS & BUILDING CONSTRUCTION

Course Category:	**Programme Core**	**Credits:**	**3**
Course Type:	**Theory**	**Lectures; Tutorials; Practicals**	**3-0-0**
		Continuous Evaluation:	**30**
		Semester end Evaluation:	**70**
		Total Marks:	**100**

COURSE OUT COMES	**On successful completion of the course, the student will be able to:**	
	CO1	Understand physical properties, uses, manufacturing processes of building materials that are used in structural components.
	CO2	Understand application of protective materials for structural members.
	CO3	Distinguish different types of constructional procedures for different components of a building.
	CO4	Apply the knowledge of different support systems for construction and repairs.

Contribution of Course Outcomes Towards achievement of Program Outcomes (L – Low, M-Medium, H – High)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO l1**	**PO l2**	**PSO 1**	**PSO 2**
CO1	**L**		**M**		**L**		**M**	**L**						**H**
CO2	**L**		**M**			**M**	**M**							**H**
CO3	**L**		**M**		**H**									**M**
CO4	**L**				**H**	**H**								**M**

Course Content

UNIT – I

STONES:
Qualities of a good building stone; Stone quarrying; Tools for blasting; Materials for blasting; Process of blasting; Precautions in blasting; Common building stones of India.

BUILDING BLOCKS:
BRICKS: General; Composition of good brick earth; Manufacture of bricks; Comparison between clamp burning and kiln burning; Qualities of good bricks; Tests for bricks; Classification of bricks; Colours of bricks, Size and weight of bricks; Shape of bricks; Fire – clays; Fire – bricks; AAC blocks.

CONCRETE BLOCKS: Raw materials; manufacturing; advantages; **FLY ASH BRICKS:** Fly-

	Ash; use of fly ash; fly ash building bricks; **TIMBER:** Definition; Structure of a tree; Defects in timber; Qualities of good timber; Decay of timber; Preservation of timber; Fire resistance of timber; Seasoning of timber; Advantages of timber construction; Use of timber. Indian timber trees. **UNIT – II** **STEEL:** General; Manufacture of steel; Uses of steel; Market forms of steel; Properties of mild steel; Properties of hard steel; **PAINTS, VARNISHES AND DISTEMPERS:** General; Painting; Varnishing; Distempering; Wall paper; White washing; Colour washing; Emulsion Paints. **UNIT – III** **BRICK MASONRY:** Technical terms; Types of bonds in brickwork- Stretcher, header, English, Flemish. **STONE MASONRY:** Technical terms; Classification of stone masonry. **WALLS AND LINTELS** Classification of walls, Classification of Lintels- timber, stone, brick, steel, reinforced concrete lintels. **UNIT – IV** **DAMPNESS AND DAMP PROOFING:** Causes of dampness; Methods of preventing dampness; Damp proofing materials and their classification; **FLOORS:** Technical terms; Types of flooring materials. **ROOFS:** Technical terms; Types of roofs; Trusses- king post, queen post, combination of king post & queen post trusses, mansard roof truss; Steel sloping roofs; Roof covering materials; Types of flat roofs; **SCAFFOLDING, SHORING, UNDER PINNING AND FORM WORK:** Types of scaffolding; Types of shoring; Methods of underpinning; Types of form work;
Text books and Reference books	**Text Books:** 1. Engineering Materials by S. C. Rangwala; Charotar Publishing House. 2. Building construction by B. C. Punmia -Laxmi Publications, New Delhi. **Reference books:** 1. Building construction and construction materials by G.S.Birdie and T.D.Ahuja, Dhanpathrai publishing company,newdelhi..

E-resources and other digital material	http://nptel.ac.in/courses/105102088/

17CE3402 CONCRETE TECHNOLOGY

Course Category:	**Programme Core**	**Credits:**	**4**
Course Type:	**Theory**	**Lectures; Tutorial; Practicals:**	**3-0-2**
		Continuous Evaluation:	**30**
		Semester end Evaluation:	**70**
		Total Marks:	**100**

COURSE OUT COMES	**On successful completion of the course, the student will be able to:**	
	CO1	Understand the manufacturing process of cement, types of cements and chemical composition of cement.
	CO2	Understand the properties of the constituent materials in concrete
	CO3	Know the properties of fresh and hardened concrete including strength and durability.
	CO4	Understand various concreting methods.
	CO5	Design concrete mixes using Indian Standard method and apply statistical quality control techniques to concrete quality.

Contribution of Course Outcomes Towards achievement of Program Outcomes (L – Low, M- Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO l1	PO l2	PSO 1	PS O2
CO1	L				L		L	L					L	H
CO2	L	L		M			M	L					M	H
CO3	L	H		M	M	L	L						L	M
CO4	L			L	M	M							L	M
CO5	L	H	H	M	L	L							H	L

Course Content

UNIT- I

CEMENT:

General; Cement and lime; Chemical composition of ordinary Portland cement; Functions of cement ingredients; Hydration of cement; Water requirements for hydration, Storage of cement; Uses of cement. Types of cements including blended cements, properties and their applications; Field tests for cement; Grades of cement as per IS specifications.

LABORATORY TESTS: fineness of cement, specific gravity, consistency, initial and final setting time.

AGGREGATES:

Classification; Fine aggregate-Natural and artificial; coarse aggregate, Source; Grading of Aggregates; IS: 383 requirements for aggregates; Alkali – Aggregate reaction.

LABORATORY TESTS: sieve analysis, sp.gravity, bulk density of both fine and coarse

aggregate, bulking of sand.

UNIT-II

WATER:

General; Quality of water; Use of sea water; IS: 456 requirements.

MORTAR:

Functions of sand in mortar; Classification of mortars; Properties of good mortar mix and mortar; Uses of mortar; Precautions in using mortar; Selection of mortar;

LABORATORY TESTS: compressive strength, adhesiveness.

CONCRETE:

Definition; Proportioning of concrete; Water – cement ratio.

ADMIXTURES IN CONCRETE:

General; Air–entraining agents; Plasticizers; Mineral and chemical admixtures; Accelerators; Retarders; Miscellaneous admixtures for damp proofing and Surface hardening.

FRESH CONCRETE:

Workability of concrete; Segregation; Bleeding; Yield of Concrete.

LABORATORY TESTS: workability tests: slump cone, compaction factor;

UNIT – III

MANUFACTURE OF CONCRETE:

Batching of concrete; Mixing; Transporting Concrete; Placing concrete; Compaction of concrete; Curing of concrete; Finishing.

HARDENED CONCRETE:

General; Water – cement ratio; Gel / space ratio; Gain of strength with age; Maturity concept of concrete; Effect of maximum size of aggregate on strength.

TESTS ON HARDENED CONCRETE:

Compression test; Failure of compression specimen; Effect of height / diameter ratio on strength; Flexural strength of concrete; Tensile strength of concrete; Non – destructive testing methods- Rebound Hammer Test, Ultrasonic Pulse Velocity Test; Elastic properties of concrete; Relation between modulus of Elasticity and strength; Factors affecting modulus of elasticity; Creep; Factors affecting creep; Shrinkage; Plastic shrinkage; Mechanism of shrinkage; Factors affecting shrinkage.

LABORATORY TESTS: Compressive strength, flexural strength, split tensile test, NDT tests.

UNIT – IV

DURABILITY OF CONCRETE:

Permeability of concrete; Sulphate attack; Methods of controlling sulphate attack; Durability

	of concrete in sea water; Corrosion mechanism of reinforcement in concrete. **SPECIAL CONCRETES & CONCRETING METHODS:** Light weight concrete and No fines concrete; High density concrete; Polymer concrete and Fiber reinforced concrete; Cold weather concreting, Hot weather concreting, Gunite or shotcrete; Ferro cement; Vacuum concrete, Vacuum Dewatered Concrete, Self compacting concrete, Self healing Concrete. **CONCRETE MIX DESIGN:** Concept of mix design; Variables in proportioning; List of Mix design methods; Indian standard method of mix design. Ready Mixed Concrete.
Text books and Reference books	**Text Book:** 1. Concrete Technology by M. S. Shetty; S. Chand & Company (Pvt.) Ltd., New Delhi. **Reference Books:** 2. Properties of Concrete by A. M. Neville; Published by Dorling Kindersley(India) Pvt. Ltd. Licensees of Pearson Education in south Asia, New Delhi. 3. Concrete Technology by M. L. Gambhir; Tata Mc Graw – Hill Publishing Company Ltd., New Delhi. 4. Concrete Technology by A.R.Santhakumar; Oxford University press-New Delhi. Concrete Microstructure, Properties and Materials., by P.Kumar Mehta, Paulo J.M.Monteio, Mc.Graw Hill Publications.
E-resources and other digital material	http:/nptel.ac.in/courses/105102012

17CE3403 MECHANICS OF MATERIALS

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lecture : Tutorial :Practice:**	3-1-0
Prerequisites:	Engineering Mechanics 17ME1104A Introduction to Solid Mechanics 17CE3302	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUT COMES	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the analysis of trusses and cylinders
	CO2	Understand the compound stresses and behaviour of columns under various end conditions
	CO3	Understand the various failure theories, strain energy, shear centre and composite beams
	CO4	Understand the energy methods used to derive the equations to solve engineering problems

Contribution of Course Outcomes Towards achievement of Program Outcomes (L – Low, M-Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO l1**	**PO l2**	**PSO 1**	**PSO2**
	CO1	**H**				**H**								**L**	**H**
	CO2	**H**				**H**								**L**	**H**
	CO3	**H**				**H**								**L**	**H**
	CO4	**H**				**H**								**L**	**H**

Course Content	**UNIT - I** **Analysis of statically determinate trusses;** Analysis of statically determinate trusses using method of sections **Thin Cylinders and Spheres** Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures, strain calculations Simple problems. **Thick wall cylinders** Introduction, Stresses in thick walled cylinders, variation of stresses.

	UNIT – II **COMPOUND STRESSES:** Introduction; Principle of superposition and its limitation; Stress distribution on various cross sections of members due to eccentric loads and lateral loads. Middle third rule; Core or Kernel of a section. **COLUMNS:** Introduction; Stability of equilibrium; The Euler's formula for columns with different end restraints, Limitations of the Euler's formulas; Generalized Euler buckling – load formulas; The Secant formula; Rankine's Empirical formula. **UNIT III** **STRAIN ENERGY:** Introduction, Derivation of expressions for elastic strain energy in uni-axial stress, elastic strain energy in pure bending, elastic strain energy for shearing stresses, elastic strain energy of a bar in pure torsion and strain energy for multi-axial states of stress only. **FAILURE THEORIES:** Introduction; Maximum normal stress theory; Maximum shearing stress theory; Maximum strain energy theory; Maximum distortion energy theory; Comparison of theories. **Stresses in beams (Advanced topic**); Introduction, analysis of composite beams, shear centre. **UNIT IV** **DISPLACEMENTS OF DETERMINATE STRUCTURES USING ENERGY METHODS:** Maxwell's reciprocal theorem; Maxwell – Betti's generalized reciprocal theorem; Castigliano's theorems; Application of Castigliano's theorem for calculating deflection of beams, frames and trusses; Virtual work method for deflections.
Text books and Reference Books	**Text Books:** 1. Strength of Materials (Mechanics of solids) by Er. R.K.Rajput; S.Chand&Company Ltd., New Delhi. 2. Strength of Materials by S Ramamrutham& R Narayan; DhanpatRai Publishing Co.(P) Ltd, New Del **Reference Books:** 1. Structural analysis by S SBhavikatti – V K Publishers 2. Theory of structures by S P Timoshenki& D H Young. 3. Mechanics of materials by E P Popov; Prentice-Hall of India Pvt. Ltd.,New Delhi. 4. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" Mc Graw Hill, Tokyo, Japan. 5. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, NewYork, USA. 6. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India. 7. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice

	Hall, 2004 8. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979 9. Gere, J. M., and S. P. Timoshenko. Mechanics of Materials. 5th ed. Boston: PWS Kent Publishing, 1970. 10. Ashby, M. F., and D. R. H. Jones. Engineering Materials, An Introduction to their Properties and Applications. 2nd ed. Butterworth Heinemann. 11. Collins, J. A. Failure of Materials in Mechanical Design. 2nd ed. John Wiley & Sons,1993. 12. Courtney, T. H. Mechanical Behavior of Materials. McGraw-Hill, 1990. 13. Hertzberg, R. W. Deformation and Fracture Mechanics of Engineering Materials. 4th Ed. John Wiley & Sons, 1996. 14. Nash, W. A. Strength of Materials. 3d ed. Schaum's Outline Series, McGraw-Hill 1994.
E-resources and other digital material:	http://nptel.ac.in/courses/105105108/ http://nptel.ac.in/courses/105106116/13

17CE 3404 HYDRAULICS & HYDRAULIC MACHINES

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 1 – 0
Prerequisites:	17CE 3303 – Fluid Mechanics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Determine the most economical dimensions of different channel sections.
	CO2	Analyze the flow through an open channel.
	CO3	Formulate an equation for a phenomenon using dimensional analysis.
	CO4	Analyze and select suitable type of turbine / Pump.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
	CO1	**H**	**M**	**H**										**H**	
	CO2	**H**	**M**	**H**											**H**
	CO3	**H**	**M**	**H**											**H**
	CO4	**H**	**M**	**H**										**M**	**H**

Course Content

UNIT I:

Open Channel Flow: Uniform Flow: Introduction, Classification of flows and channels; Chezy, Manning's, Bazin, Kutter's Equations; Hydraulically efficient channel sections - Rectangular, Trapezoidal and Circular channels; Velocity distribution; Pressure distribution.

Non-Uniform Flow: Concept of specific energy; Specific energy curves; Critical flow; Critical flow in a rectangular channel; Critical slope; Different slope conditions; Channel transitions; Momentum principle applied to open channel flow; Specific force; Specific force curve.

UNIT II:

Gradually Varied Flow: Dynamic equation; Types of Surface Profiles; Computation of surface profiles by single step method; Back water Curves and Draw down curves.

Rapidly Varied Flow: Hydraulic jump; Elements and characteristics of hydraulic jump; Types of hydraulic jumps; Applications of hydraulic jump; Energy loss in a hydraulic jump.

UNIT III:

Dimensional Analysis and Similitude: Dimensional homogeneity; Rayleigh's method; Buckingham – Pi theorem; Geometric, Kinematic and dynamic similarities; Reynold's, Froude, Euler, Mach and Weber numbers; Model laws; Scale effect.

Impact of Jets: Force exerted by fluid jet on stationary and moving flat plates and curved plates; Force

	exerted by fluid jet on series of flat vanes; Angular momentum principle; Torque exerted on a wheel with radial curved vanes. **UNIT – IV** **Hydraulic Turbines:** Classification; Impulse; Reaction; Radial, Axial, mixed and tangential flow turbines; Pelton, Francis and Kaplan turbines; Velocity triangles; Head and efficiency; Draft tube theory; Characteristic curves; Concept of specific speed and unit quantities. **Centrifugal Pumps:** Types of pumps, Manometric head; Losses and efficiencies; Working Principle and Work done; Priming; Velocity triangles; Characteristic curves; Multistage pumps; Specific speed; Cavitation.
Text books and Reference books	**Text Books:** [1] P.N. Modi& S.N. Seth, "Hydraulics & Fluid Mechanics", 18th ed., Standard Book House, New Delhi, 2015. [2] A.K. Jain, "Fluid Mechanics", 11th ed., Khanna Publishers, New Delhi, 2014. **Reference Books:** [1] Jagadhishlal, "Hydraulic Machines",9th ed., Metropoliton Company, New Delhi, 2012. [2] R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 9th ed., Laxmi Publications; New Delhi, 2015. [3] Rajput R.K., "Fluid Mechanics and Hydraulic Machines", 3rd ed., S.Chand and Company Ltd., New Delhi, 2014. [4] K. Subramanya, "Flow in Open Channels" – 3rd ed., Tata McGraw Hill Publishing Company, New Delhi, 2013.
E-resources and other digital material	[1] Prof. Arup Kumar Sharma, IIT/ Guwahati – Hydraulics – "www.nptel.ac.in / courses/ 105103096/" [2] Prof. B.S. Murthy and Dr. B.S. Thandaveswara, IIT/Madras – Hydraulics – "www.nptel.ac.in / courses/ 105106114/"

17TP1405

ENGLISH FOR PROFESSIONALS

Course Category:	Institutional Core	**Credits:**	1
Course Type:	Learning by Doing	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

COURSE OUTCOMES	
Upon successful completion of the course, the students will be able to:	
CO1	Present themselves effectively in the professional world
CO2	Introduce themselves as well as others appropriately.
CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills

CO4	Involve in practical activity oriented sessions.
CO5	Learn about various expressions to be used in different situations.
CO6	Respond positively by developing their analytical thinking skills.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	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										H	H			
CO2									H	H	H			
CO3										H	H			
CO4								M		H	H			
CO5										H	H			
CO6														

COURSE CONTENT:

UNIT-I

1. Beginners, Functional, Situational Conversations
2. Practicing on Functional Conversations.

UNIT-II

1. Errors in usage of Parts of Speech with a thrust on Verbs, Adjectives and Conjunctions, Idioms/Phrases.
2. B. Introducing Basic Grammar
3. C. Practicing on Functional Conversations.

UNIT-III

1.Introducing Self & Others
2. Structures and Forming Sentences
3. Telephonic Etiquette, Social Etiquette and Table Manners
4. Practicing on Functional Conversations.

UNIT-IV

1. Direct, Indirect/Reporting Speech
2. Public Speaking Basics
3. Versant Test Preparation
4. Practicing on Situational Conversations.

Standard References

1. Swaroopa Polineni, "Strengthen Your Communication Skills", I ed., Maruthi Publications, 2013. ISBN:978-81-907052-2-6
2. Mamta Bhatnagar&Nitin Bhatnagar, "Communicative English", I ed., Pearson India, 2010. ISBN:8131732045

17HS2406/A– Yoga & Meditation

Course Category:	Humanities elective	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial - Practice:**	1- 0 - 0
Prerequisites:		**Continuous Evaluation:**	**100M**

Course outcomes		Upon successful completion of the course, the student will be able to:
	CO1	Equip better attitude and behaviour.
	CO2	Imbibe set of values enabling a balanced life focused on an ethical material life.
	CO3	Develop levels of concentration through mediation
	CO4	Apply conscience for the missions of life

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
	CO1						**M**								
	CO2						**M**								
	CO3						**M**								
	CO4						**M**								

Course Content	**UNIT I :** **Understanding Yoga :** Orientation, Introduction to Values , The positive impact of yoga , Application of Values in real life , Universal values (**Lec-demo pattern with illustrations representing Yogic Postures and value system related pictorial is followed**)
	UNIT II: **Yogic Practices: Y**oga, Self and Ultimate goal of yoga, Introduction to various types of yoga, Integration of values in Yoga **(Activity based processes with Assasanas and Pranayama are implemented).**
	UNIT III: **Practice of Meditation:** Art of Meditation, Observation, Introspection, Contemplatio Meditation and Concentration **(Activity based processes involving Mediation sessions followed by demonstrations ar implemented)**

	UNIT IV: **Towards professional excellence through Yoga and meditation:** Stress Management, Choices we make, Excellence and Integration **(Lec-demo pattern is followed).**
Text books and Reference books	**Text Book(s):** 1. Common Yoga protocol, Ministry of Ayush, Govt of India 2. Journey of the Soul- Michael Newton, 2003, Llewellyn **Reference Books**: 1. Lectures from Colombo to Almora, Swami Vivekakanada, 2010 Ramakrishna Mission 2. Essays of Ralph Waldo Emerson, 1982, Eastern press 3. Eclectic materials Offered by English Dept.
E-resources and other digital material	www.heartfulness.org accessed on 27th April 2018 www. *ayush.gov.in accessed on* 27th April 2018 www. belurmath.org *accessed on* 27th April 2018

Course Category:	**Humanities elective**	**Credits:**	1
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1- 0 - 0
Prerequisites:		**Continuous Evaluation:**	**100M**

Course outcomes		**Upon successful completion of the course, the student will be able to:**													
	CO1	Understand major philosophical issues.													
	CO2	Appreciate the philosophical doctrines of western thinkers.													
	CO3	Understand the eminence of Indian classical thought.													
	CO4	Aappreciate relation between science and values.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium , H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSPO 1**	**PSP O2**
	CO1						**M**								
	CO2						**M**								
	CO3						**M**								
	CO4								**M**						

Course Content	**UNIT I** What's Philosophy **:** Definition, Nature, Scope and Branches **UNIT II:** Introduction to Western philosophy **:** Ancient Greek and Modern philosophy **UNIT III:** Introduction to Indian Thought**:** Six systems – Modern philosophers **UNIT – IV:** Philosophy of science & Technology : Human values and professional Ethics
Text books and Reference books	**Text Book:** [1] — The story of philosophy ǁ,Will Durant, Simon & Schuster 1926 [2] — An Introduction to philosophy ǁ,O.O.Fletcher, Word Public Library,2010 **Reference Books:** [1] — Six systems of Indian Philosophy ǁ, DH Dutta , [2] — The pleasures of philosophy, Will Duran, Simon & Schuster,1929
E-resources and other digital material	[1]J. K. Author. (day, month, year). Title (edition) [Type of medium]. Available: http://www.(URL)

17HS2406/I – Foreign Language (German)

Course Category:	**Humanities elective**	**Credits:**	1
Course Type:	Theory/Practical	**Lecture - Tutorial - Practice:**	1- 0 - 0
Prerequisites:		**Continuous Evaluation:**	100M

Course outcomes		**Upon successful completion of the course, the student will be able to:**
	CO1	Learn basics of German Language.
	CO2	Write German Writing
	CO3	Understand German Hearing
	CO4	Form sentence in Present , past and future tense

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
	CO1										**M**				
	CO2										**M**				
	CO3										**M**				
	CO4										**M**				

Course Content	**UNIT I:** Alphabets, Numbers, Exact articles and not exact Articles **UNITII:** Prepositions**,** Present Tense **UNIT III:** Past Tense and about family **UNIT – IV:** Future Tenses
Text books and Reference books	**Text Book:** [1] Studio d A1Cornelsen Goyalaas Publications New Delhi.
E-resources and other digital material	

17HS2406/K – Psychology

Course Category:	**Humanities elective**	**Credits:**	1
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1- 0 - 0
Prerequisites:	Introduction to Philosophy PSYCHOLOGICAL PROCESSES	**Continuous Evaluation:**	**100M**

Course outcomes		**Upon successful completion of the course, the student will be able to:**													
	CO1	Relate biological and socio-cultural factors in understanding human Behaviour.													
	CO2	Understand the nature of sensory processes, types of attentions.													
	CO3	Explain different types of learning and the procedures, distinguishes between different types of memory,													
	CO4	Demonstrate an understanding of some cognitive processes involved in Problem solving and decision-making.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSPO 1**	**PSPO 2**
	CO1						**M**								
	CO2						**M**								
	CO3						**M**								
	CO4						**M**								
Course Content	**UNIT I:** Introduction: Psychology as a scientific study of behaviour. Biological and sociocultural bases of behaviour, fields of psychology **UNIT II:** Sensory and perceptual processes: Sensation, attention and perception **UNIT III:** Cognition and Affect: Learning and memory. Emotion and motivation **UNIT – IV** Thinking, problem solving and decision making**,** Personality and intelligence														

Text books and Reference books	**Text Book:** 1 Zimbardo, P. G. (2013). Psychology and Life (20th Ed.). New York: Pearson Education **Reference Books:** 1. Baron, R. A. (2006). Psychology (5th Ed.). New Delhi: Pearson Education. 2. Coon, D., & Mitterer, J. O. (2007). Introduction to Psychology: Gateway to mind and behaviour. New Delhi: Cengage. 3. Feldman, R. S. (2013). Psychology and your life (2nd Ed.). New York: McGraw Hill.
E-resources and other digital material	

17CE3451
FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0 - 0 - 2
		Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	**Upon successful completion of the course, the student will be able to:**														
	CO1	Determine the total energy at various sections of pipe flow and Classify different types of flows.													
	CO2	Determine the discharge through tanks and pipes													
	CO3	Determine the discharge through Open channel.													
	CO4	Determine the performance of various Hydraulic machines													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**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				**H**										**H**
	CO2				**H**										**H**
	CO3				**H**										**H**
	CO4				**H**										**H**
Course Content	1. Verification of Bernoulli's theorem. **Practical Application:** To find the total energy in a pipe line by verifying the Bernoulli's theorem 2. Determination of Coefficient of discharge of a Venturimeter. **Practical Application:** To find the discharge in pipe line 3. Determination of Coefficient of discharge of an Orifice meter. **Practical Application:** To find the discharge in pipe line. 4. Orifice: Determination of Coefficient of discharge by steady and unsteady flow methods water. **Field Application:** To find the discharge in village water tanks and agricultural tanks in agricultural fields. 5. Mouthpiece: Determination of Coefficient of discharge by steady and unsteady flow methods. **Field Application:** To find the discharge in village water tanks and agricultural tanks in agricultural fields. 6. Determination of friction factor of Pipes. **Field Application:** To find the loss of head in pipe lines due to friction.														

	7. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion. **Field Application**: To find the losses of head in pipe line fittings such as bends, Elbows, sudden contraction and sudden enlargements, etc. 8. Determination of Coefficient of discharge for a Rectangular Notch / Triangular / Trapezoidal Notch. **Field Application:** Determination ofdischarge in canals and village water tanks and agricultural tanks in agricultural fields. 9. Characterization of laminar and turbulent flows by Reynolds's apparatus. **Practical Application: 1.** Flow through blood vessels, increase in viscosity increases blood pressure. **2.** Flow through aquifers. 10. Measurement of force due to impact of jets on vanes of different types. **Practical Application:** Power generation through hydro power houses. 11. Performance studies on single stage centrifugal pump. **Practical Application:** Design the pump from model to prototype by using characteristic curves. 12. Performance studies on Pelton turbine/Francis turbine. **Practical Application:** Efficiency studies. **Demonstration Experiments:** 1. Determination of Manning's and Chezy's coefficients in open channel. 2. Performance studies on Reciprocating pump. 3. Demo on Francis/Kaplan Turbine. 4. Performance studies on Gear Pump.

Text books and Reference books	1. Fluid Mechanics and Hydraulic machinery laboratory manual by Dr. N.KumaraSwamy, Charrotar Publishing House Pvt. Ltd. 2. Experiments in fluid mechanics by Dr. BaljeetKapoor, Khanna Publications. 3. Hydraulics and fluid mechanics including hydraulic machines by Dr. P.N.Modi and Dr. SM Seth, Standard book house, New Delhi
E-resources and other digital material	[1] Prof. Arup Kumar Sharma, IIT/ Guwahati – Hydraulics – "www.nptel.ac.in/courses/105103096/" [2] Prof. B.S. Murthy and Dr. B.S. Thandaveswara, IIT/Madras–Hydraulics - "www.nptel.ac.in/courses/105106114/"

17CE3452
BUILDING PLANNING AND DESIGN LABORATORY

Course Category:	Programme Core	**Credits:**	1
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0 - 2
Prerequisites:	Engineering graphics 17ME1105	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Acquire the knowledge of Various measurements and dimensions of a building components
	CO2	Understand principles of planning, principles of architecture and building bye-laws.
	CO3	Draw the line diagrams as per National Building Code
	CO 4	Draw the plan, elevation, sectional view of the building as per principles of planning

Contribution of course out comes towards achievemen		**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO1 0**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
	CO1	**L**		**M**											

t of program out comes L-Low, M-Medium, H-High	**CO2**	**L**		**M**											
	CO3	**L**		**M**											
	CO4	**L**		**M**											

Course Content

PART A

Introduction and Theory Explanation of the Following

- Principles of planning & architecture
- Building bye-laws & National Building Code
- Conventional signs and Symbols & Line diagrams
- Plan, Elevation, Section of Buildings
- Standard dimensions of Doors, windows and measurements of different rooms

(Manual Drawing)

Draw Plan, Elevation & Section of the following Building Line diagrams

1. Residential building – Single Bedroom and Hall (Load bearing wall structure)
2. Residential building- Single bedroom, Living room, Kitchen with open verandah(Load bearing wall structure)
3. Dog legged Stair case
4. RCC Two storied framed structure building with staircase.

PART B

(Auto CAD Drawing)

Explanation of Auto CAD Commands

Draw Plan, Elevation & Section of the following Building Line diagrams

5. Single bedroom and hall residential building
6. Double bed room building with Balcony
7. Rural hospital building
8. Open well stair case
9. RCC Two storied framed structure building with staircase
10. Elevations of different buildings.

Text books and Reference books	**Text Books:** 1. Building planning, designing and scheduling by Gurucharan Singh and Jagdish Singh. – Standard Publishers-Delhi. 2. Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki; Tata McGrawHill Publishing Co. Ltd., New Delhi. **Reference Books:** 1. National Building Code, Bureau of Indian Standards, New Delhi, 2005. 2. Planning & Designing Buildings by Yashwant S. Sane; Allies Book Stall, Pune 3. Residential Interior Design: A Guide To Planning Spaces 3rd Edition by Maureen Mitton (Author), Courtney Nystuen (Author)
E-resources and other digital material	**NPTEL :** NPTEL, www.floorplanner.com

17HS1453

COMMUNICATION SKILLS LABORATORY

Course Category:	soft skills	Credits:	1
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-2
Prerequisites:	Technical English & Communication skills 17HS1205	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Execute rational pronunciation of speech sounds including accentuation.
	CO2	Apply elements of listening comprehension in professional environments.
	CO3	Develop the abilities of rational argumentation and skills of public speaking.
	CO4	Demonstrate proficiency in the elements of professional communication including the competitive examination

Contribution of Course Outcomes towards achievement of Program Outcomes (H- Highly Mapped, M- Moderately Mapped, L- Low)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1										**H**				
CO2						**H**		**L**	**H**	**H**	**M**	**H**		
CO3				**M**	**M**	**H**	**H**	**M**	**H**	**H**	**M**	**H**		
CO4	**M**	**L**	**L**	**M**	**L**	**H**	**M**	**H**	**H**	**H**	**H**	**M**		

Course Content

UNIT:I :Elements of Spoken Expression and processes of Listening comprehension:

- Speech Mechanism
- Articulation of vowels and consonants
- Patterns of Accentuation

Types and processes of Listening comprehension

UNIT II: Patterns of Substantiation and Refutation in Public Speaking:

- Group Discussion(Open and Monitored)
- Pyramid Discussion
- PNI

Seminar Talk and Power Point Presentation

	UNIT III: Professional Communication: ➢ Self Affirmation ➢ Textual Patterns ➢ Advanced Composition including Memo and e-mail ➢ Résumé Preparation Corporate ethic of Non-Verbal Communication
	UNIT IV: Life Skills and Vocabulary for Competitive Examinations: ➢ Select Life Skills(50) ➢ Select Logies, Isms, Phobias and Manias (25 each) ➢ Sentence Completion and Double Unit Verbal Analogies (50 items) Fundamentals of Syllogisms(Descriptive and Pictorial)
Text books and Reference books	Text Book(s): 1. Martin Cutts, Oxford Guide to Plain English, 7th Impression, OUP, 2011 2. Exercises in Spoken English, Prepared by Department of Phonetics and Spoken English, CIEFL, OUP, 21st Impression, 2003 Reference Books: 1. Stephen R Covey, The 7 Habits of Highly Effective people, II edition, (Pocket Books) Simon & Schuster UK Ltd, 2004 Eclectic Learning Materials offered by the Department
E-resources and other digital material	1. ODll Language Learner's Software, 27-6-2012 Orell Techno Systems 2. Visionet Spears Digital Language Lab software Advance Pro, 28-01-2015 3. www.natcorp.ox.ac.uk, *British National Corpus accessed on 28-11-2017*
E-resources and other digital material	1. ODll Language Learner's Software, 27-6-2012 Orell Techno Systems 2. Visionet Spears Digital Language Lab software Advance Pro, 28-01-2015 3. www.natcorp.ox.ac.uk, *British National Corpus accessed on 28-11-2017*

17MC1407A
ENVIRONMENTAL STUDIES

Course Category:	Institutional Core	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0 – 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the various natural resources, analyze and explore degradation management
	CO2	Understand the Ecosystems and need of Biodiversity
	CO3	Realize and Explore the Problems related to Environmental pollution and its management
	CO4	Apply the Role of Information Technology and analyze social issues, Acts associated with Environment.

Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
	CO1	**L**							**H**						
	CO2					**L**			**H**						
	CO3				**L**		**H**								
	CO4				**L**				**H**	**H**					

Course Content

UNIT -I

The Multidisciplinary Nature of Environmental Studies

Definition, scope and importance
Need for public awareness.

Natural Resources

Renewable and Non-renewable Resources:

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought,

conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

UNIT II

Ecosystems

Concept of an ecosystem.

Structure and function 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 ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation

Introduction, 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.

Endangered and endemic species of India.

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution

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.

Diaster management: Floods, earthquake, cyclone and landslides.

	UNIT IV **Social Issues and the Environment** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. **Environment Protection Act**. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. **Human Population and the Environment** Population growth, variation among nations. Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health. **Field Work/Case Studies:** Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.
Text books and Reference books	**Text Book:** 1.Text book for **ENVIRONMENTAL STUDIES** for under graduate courses of all branches of higher education – ErachBharucha -- For University Grants Commission. First edition 2004. **Reference Book:** 1.Anjaneyulu Y. Introduction to Environmental sciences, B S Publications PVT Ltd, Hyderabad 2004
E-resources and other digital material	collegesat.du.ac.in/UG/Envinromental%20**Studies**_ebook.**pdf**

17CE3501	WATER RESOURCES ENGINEERING

Course Category	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	--	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes

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

CO1	understand various irrigation methods and Irrigation management practices in the field.
CO2	evaluate the Run-off and evaluate the ground water yield.
CO3	evaluate and Design of various Channel sections.
CO4	evaluate reservoir capacity and summarize various types of hydraulic structures

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	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	H						M			L				
CO2	H		M	M									M	
CO3	H		M	M									H	
CO4	H		H		M		M			L			H	

Course Content

UNIT – I

1. **IRRIGATION:WATER APPLICATION METHODS**
   Definition; Necessity; Scope of irrigation science; Benefits of irrigation; Ill-effects of irrigation; Types of irrigation and methods of applying water to crops; Uncontrolled or wild flooding; Free flooding; Contour laterals; Border strip method; Check flooding; Basin flooding; Zig zag method; Furrow method; Contour Farming; Sub-surface irrigation; Sprinkler Irrigation; Drip irrigation.

2. **WATER REQUIREMENT OF CROPS:**
   Saturation capacity; Field capacity; Wilting point; Available moisture and readily available moisture; Duty and Delta; Base period; Relation between Duty and Delta; Factors affecting duty; Methods of improving duty; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; Standards of irrigation water; Assessment of irrigation water.

UNIT – II

3. **HYDROLOGY:**
   Introduction to Engineering Hydrology and its applications; Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over a basin; Run off;

Factors affecting run off; Computation of run-off. Hydrograph; definition of Unit hydrograph; Limitations and applications of unit hydrograph, construction of a flood hydrograph resulting from rainfall of unit duration; Application of unit hydrograph to construction of a flood hydrograph resulting from two or more periods of rainfall; Construction of unit hydrograph of different unit duration from a unit hydrograph of some given unit duration. S-hydrograph

4. **WELL IRRIGATION:**
   Introduction; Aquifer; Aquicludes; Aquifuge; Specific yield; Specific retention; Divisions of sub–surface water; Water table; types of aquifers; Dupit's theory for confined and unconfined aquifers; Constant level pumping test, Recuperation test.

UNIT-III

5. **IRRIGATION CHANNELS – SILT THEORIES & DESIGN PROCEDURE:**
   Classification; Canal alignment; Silt theories–Kennedy's theory, Lacey's regime theory; Kennedy's method of channel design; Silt supporting capacity according to Kennedy's theory; Use of Garret's diagram in channel design; Lacey's theory applied to channel design; Use of Lacey's regime diagrams; Drawbacks in Kennedy's theory; Defects in Lacey's theory; Comparison of Kennedy's theory and Lacey's theory

6. **WATERLOGGING, CANAL LINING**
   Waterlogging, causes, effects and remedial measures. Lining of Irrigation canals, Types of lining; Design of lined canal

UNIT-IV

7. **DAMS IN GENERAL:**
   Classification; Gravity dams, Arch dams, Buttress dams, Steel dams, Timber dams, Earth dams and rock fill dams; factors governing selection of site for a dam.

8. **RESERVOIR PLANNING:**
   Selection of site for a reservoir; Zones of storage in a reservoir; Storage capacity and yield; Mass inflow curve and demand curve; Calculation of reservoir capacity for a specified yield from the mass inflow curve; Determination of safe yield from a reservoir of a given capacity; Life of reservoir;

Text books and Reference books	**Learning Resources:** **Text Books:** 1. Irrigation and water power Engineering by Dr. B.C. Punmia & Dr. Pande B.B.Lal; Laxmi Publications Pvt. Ltd., New Delhi., 2006. 2. Irrigation Engineering and Hydraulic structures by S. K. Garg; Khanna publishers New Delhi, 2006. 3. Irrigation Engineering and Hydraulic structures by SR Sahasrabudhe, Katson Publishing house.2005 **Reference Books:** 1. Irrigation, Water Resources & Water Power Engineering by Dr. P.N. Modi; standard Book House, New Delhi.,2006 2. Irrigation water power and water resources engineering by K R ARORA, Standard published distributors, New Delhi.,2006. 3. A text book of hydrology by Dr.P.Jayarami Reddy, published by Laxmi Publications. 4. Journals in Water resources
E-resources and other digital material	www.nptel.ac.in/couses/105104103

17CE3502	**ENVIRONMENTAL ENGINEERING**

Course Category:	Programme core	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	17CH1102 - Engineering chemistry 17MC1407A -Environmental studies	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes		Upon successful completion of the course, the student will have an ability to
	CO1	understand source of water for water supply scheme with reference to quantity and quality of water
	CO2	understand and apply the methods of treatment for purification of water
	CO3	analyse the distribution of water
	CO4	understand the concepts of collection & conveyance, Quality and quantity of sewerage
	CO5	apply appropriate treatment and disposal methods of sewage and septage

Contribution of Course	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

Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)	CO1										L	L			
	CO2				H									L	L
	CO3	H	H	M				M			M			H	
	CO4	M	M	H										M	
	CO5	H	M	H	H		H	M						H	H

Course Content

UNIT – I

1.INTRODUCTION, QUANTITY AND COLLECTION & CONVEYANCE OF WATER

Objectives of water supply systems, Per capita consumption; Design period; Types of demands; Fluctuations in demand; Prediction of population.

Types of intakes; Capacity and design of pipes; Materials for pipes; Types of pumps.

2. QUALITY OF WATER

Impurities in water; Routine water analysis - physical, chemical and bacteriological tests; Standards for drinking water; Water borne diseases.

UNIT – II

3. PURIFICATION OF WATER

Purification of water; Plain sedimentation; coagulation and types of Coagulants; Sedimentation and coagulation tanks; Design aspects; Theory of filtration; Slow sand and rapid sand filters; Construction and Operation; Disinfection methods-chlorination; Removal of hardness, Methods of removal; De-fluoridation.

4. DISTRIBUTION SYSTEMS

Methods of supply; Layouts; Distribution reservoirs; Capacity of balancing tank; Methods of analysis of distribution systems; valves. Plumbing-pipes and fittings; Traps; One pipe and Two pipe systems.

UNIT – III

5. INTRODUCTION TO SANITARY ENGINEERING AND SEWERS AND SEWER APPURTENANCES

Sanitation; Conservancy and water carriage system; Sewerage systems; Relative merits, Sanitary and storm water sewage; Estimation of their quantities.

Sewers-types, design, construction and maintenance; sewer appurtenances-types.

6.QUALITY OF SEWAGE AND PRIMARY TREATMENT OF SEWAGE

Characteristics of sewage-physical, chemical and biological; decomposition cycles; BOD and COD

	Primary treatment- theoretical concepts of Screens; Grit chamber; Skimming tanks; design aspects of Sedimentation tanks.
	UNIT – IV **7.SECONDARY TREATMENT OF SEWAGE** Trickling filters; high rate trickling filters at primary level, Principles of action; Recirculation; Operational problems and remedies; Activated sludge process; Principle of action; Methods of aeration; Sludge bulking; Sludge volume index. **8. SEWAGE DISPOSAL; SEPTIC TANKS & FEACAL WASTE AND SEPTAGE MANAGEMENT** Methods; Disposal by dilution; Self purification process; Oxygen sag; Zones of pollution of river; Disposal by irrigation. Septic tank-Design; effluent disposal; Septage Management, government policies and programs, value chain, environmental aspects, on site contaminant system, waste characterisation and treatment options.
Text books and Reference books	**Text Books**: 1. Elements of public health engineering by K. N. Duggal; S. Chand & Company Ltd., New Delhi, 2014. 2. Environmental Engineering Vol. I& II - Water supply engineering by S. K. Garg; Khanna Publishers, New Delhi, 2017. **Reference Books**: 1.Water Supply and Sanitary Engineering Vol. 1 by Gurucharan Singh; Standard Publishers Distributors, Delhi, 2009 2.Water Supply and Sanitary Engineering by G.S. Birde; Dhanpatrai and sons,Delhi, 1998. 3. Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi,2005
E-resources and other digital material	NPTEL:http://nptel.ac.in/courses/105104102/ http://nptel.ac.in/courses/105106119/

17CE3503	STRUCTURAL ANALYSIS

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory Mandatory course	**Lecture: Tutorial :Practice:**	3-0-0
Prerequisites:	17CE3403 Mechanics of Materials	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

COURSE OUT COMES	Upon successful completion of the course, the student will be able to	
	CO1	draw and interpret influence line diagrams
	CO2	apply energy methods for analysis of indeterminate beams and frames
	CO3	analyze statically indeterminate structures using force and displacement methods
	CO4	analyze multistory frames for vertical and horizontal loads by approximate methods

Contribution of Course Outcomes Towards achievement of Program Outcomes (L – Low, M-Medium, H–High)		PO 1	PO 2	PO 3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO l1	PO l2	PSO1	PSO2
	CO1	H				M				L	L		M	M	
	CO2	H	L			M				L	L		M	M	
	CO3	H	L			M				L	L		M	M	
	CO4	H	L			M				L	L		M	M	

Content

UNIT – I

INFLUENCE LINES FOR STATICALLY DETERMINATE STRUCTURES:

1. EQUILIBRIUM PRINCIPLES AND ITS APPLICATION:

Influence line for beam reaction, Shearing forces, Bending moment, Calculation of maximum and absolute maximum bending moment for rolling loads.

2. MULLER BRESLAU PRINCIPLE AND ITS APPLICATION:

Influence line for beam reaction, Shearing forces, Bending moment.

UNIT – II

ANALYSIS OF INDETERMINATE STRUCTURES USING ENERGY METHODS;

3.BEAMS:
Strain Energy Method for analysis of continuous beams.

4.FRAMES:
Analysis of rigid & pin jointed frames up to second degree of redundancy. Lack of fit and

	Temperature variation.
	UNIT III **ANALYSIS OF INDETERMINATE STRUCTURES:** **5.FORCE METHOD** Propped cantilever by consistent deformation method. Fixed beams for different loadings, Effect of sinking and rotation of support. Clapeyron's theorem of three moments. **6. DISPLACEMENT METHODS:** Slope deflection method for continuous beam and portal frames. Moment distribution method for continuous and portal frames.
	UNIT IV **APPROXIMATE METHODS OF ANALYSIS FOR MULTISTORY FRAMES:** **7.KANI'S METHOD:** Introduction and principles of the kani's method, Application of the method to continuous beams, Application of method to the analysis of portal frames without side sway, **8.ANALYSIS OF GRAVITY & LATERAL LOADS** Substitute frame method with various examples, Portal method and cantilever method .

Text books and Reference Books	**Text Books:** 1.Analysis of structures by Volume I –17th Edition by Vazirani & Ratwani; & Volume –II 16th Edition by Vazirani & Ratwani, Khanna Publications; Delhi, 2015. 2. Structural Analysis by S.S. Bhavikatti, Volume-I and II, 4th Edition, Vikas Publishing house PVT Ltd, 2014. **Reference Books:** 1. Structural analysis by Hibbeler, 6th Edition, Pearson India Education Services Pvt Ltd.2015 2. Structural Analysis by R.Vaidyanathan Volume-I and II, 3rd Edition, Laxmi Publications (P) Ltd, 2012. 3. Theory of structures by S. Ramamrutham, 9th Edition, Dhanapat Rai Publications, 2014. 4. Basic Structural Engineering by C.S Reddy, Tata McGraw Hill, Third Edition. 5. Theory of structures Vol – I by G.S. Pandit and S.P Gupta and R. Gupta by Tata McGraw Hill Ltd., New Delhi.
3.E-resources and other digital material:	http:// nptel.ac.in/courses/105101085 http://nptel.ac.in/courses/105105166 http://nptel.ac.in/courses/105101086

OPEN ELECTIVES

17CE2504 A	GEOSPATIAL TECHNOLOGIES

Course Category:	Open Elective -I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	NIL	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes		Upon successful completion of the course, the student will be able to
	CO1	Apply the recent advances GIS technology in various fields of engineering
	CO2	Evaluate the opportunities and available methods for integrating GIS in various engineering applications
	CO3	Understand large scale maps using GIS.

Contribution of Course Outcomes towards achievement of		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					H				L	M		L		M

Program Outcomes (L – Low, M - Medium, H – High)	CO2					H	H			L	M		L		M
	CO3					H				L	M		L		M

Course Content	**UNIT I** **1.INTRODUCTION TO GIS** Introduction to GIS, History of GIS, Early developments in GIS, Applications of GIS **2.MAP AND MAP SCALES** Introduction to Maps, History of Maps, Map Scales, Types of Maps, Map and Globe **UNIT II** **3.GEOREFERENCING AND PROJECTION** Understanding Earth ,Coordinate System, Map Projection, Transformation, Georeferencing **4.SPATIAL DATABASE MANAGEMENT SYSTEMS** Introduction, Data Storage, Database Structure Models, Database Management system, Entity Relationship, Model Normalization. **UNIT III** **5.DATA MODELS AND DATA STRUCTURES** Introduction, GIS Data Model, Vector Data Structure, Raster Data structure ,Geo database and metadata. **6.SPATIAL DATA INPUT AND EDITING** Primary Data, Secondary Data, Data Editing, Data types – Spatial and Non Spatial (attribute) data. **UNIT IV** **7.MODELLING IN GIS:** Introduction to Web GIS, Digital Terrain Modelling, Digital Elevation Modelling, Triangular Irregular Network. **8.APPLICATIONS OF GIS:**

	Multidisciplinary applications of GIS.
Text books and Reference books	Text books 1. Remote Sensing & Geographical Information Systems by M.Anji Reddy, BPS Publications-Hyderabad,4th edition 2011. 2. Remote Sensing & GIS by Basudeb Bhatta, Oxford University Press, New Delhi 2011 Reference books 1.Remote sensing and Image interpretation by TM Lillesand and RWKiefer; John Willey and sons.7th edition, 2015 2. Remote sensing and Geographical information System by AM Chandra & SK Ghosh;Narosa Publishing House, Second Edition New Delhi,2015
E-resources and other digital material	**NPTEL : http://nptel.ac.in/courses/105102015**

17CE2504 B	**QUALITY CONTROL AND QUALITY ASSURANCE**

Course Category:	Open Elective -I	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	----------	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes		Upon successful completion of the course, the student will be able to
	CO1	understand meaning of quality, quality standards
	CO2	apply provisions of IS codes
	CO3	apply QC techniques
	CO4	analyze methods to improve quality

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	**H**					**M**	M		**H**	**M**				**H**
	CO2						**M**	**M**	**M**	**H**	**M**				**H**
	CO3	**H**	**H**			**H**	**M**	**M**		**H**	**M**		**M**		**H**
	CO4	**H**	**H**				**M**	**M**		**H**	**M**		**M**		**H**

Course Content	**UNIT – I** **1.QUALITY MANAGEMENT** Introduction – Definitions and objectives – Factors influencing construction quality – Responsibilities and authority – Quality Management Guidelines. TQM Guidelines **2.QUALITY SYSTEMS** Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification. Quality circles.
	UNIT – II **3.QUALITY PLANNING** Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion, IS code on sampling, sampling plans, acceptance criteria, Inspection procedures - Total QA / QC programme. **4.QUALITY PROCEDURES:** Develop, schedule and implement procedures for tracking control phase meetings for definable features of work in the QC Plan. Notify appropriate personnel of time, date and agenda.
	UNIT – III **5.QUALITY CONTROL:** Definition, Objectives, Regulatory agencies, statically tolerances, Taguchi concept, Statistical methods: Mean, variance, standard deviation, coefficient correlation, coefficient regression, control charts, methods to evaluate deviation, Contractor Quality Control, Quality Control Personnel, The Three-Phase Control System: Preparatory Phase, Initial Phase and Follow-up Phase. Conduct Meetings (preparatory and initial). Safety considerations and Activity Hazard Analyses (AHAs). **6.QUALITY ASSURANCE:** Checklists for - Quality of Materials and processes, factors influencing construction quality , Quality Assurance Personnel and their role, Document actual discussions and provide minutes to attendees. Monitor work in place through follow-up phase. Conduct additional control phase meetings, as needed. Quality Management Record Keeping, The Contractor Quality Control Report,
	UNIT – IV **7.QUALITY IMPROVEMENT TECHNIQUES** Definition, objectives, quality appraisal, techniques of quality assurance, Quality manual ,specification for few items. **8.FORENSIC ANALYSIS FOR BAD QUALITY** Deficiency Tracking System/Rework Items List, Pareto analysis, cause effect diagram.

Text books and Reference books	**Text Books:** 1. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", McGraw Hill,2001 2. Thoms Pyzdec; Rozeer W. Berger, '"Quality Engineering Hand Book", TATA MC GRAW- HILL, New Delhi, 1995. 3. Statistical Quality Control 7th Edition , Eugene L Grant, McGraw-Hill Series, 1980.		
Course Category:	Open Elective, II	Credits:	3
	Reference Books: 1. Dale Besterfield, Carl Besterfield-Michner, Glan Besterfield, mary Besterfield-Sacre, 2nd edition,Total Quality Management, printice Hall, 1999. 2. Shridhara Bhat, " Total Quality Management- Cases", Himalaya Publihing House, Mumbai, 2009.		
E-resources and other digital material	NPTEL:http://nptel.ac.in/courses/		

17CE2505 A	**AIR AND NOISE POLLUTION**

Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:		Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes		Upon successful completion of the course, the student will have an ability to
	CO1	understand various types of air pollutants and their effects
	CO2	understand the dispersion phenomenon of air pollutants with regard to meteorological parameters
	CO3	analyse the samples, pollutants from chimney stacks and ambient atmosphere
	CO4	understand the various types of air pollution controlling equipment
	CO5	understand the sources and controlling measures of noise pollution

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO 10	PO 11	PO1 2	PSO 1	PSO 2
	CO1						**H**	**M**							
	CO2	**H**	**H**					**M**							**H**
	CO3	**H**		**H**										**L**	**H**
	CO4	**M**				**H**	**M**	**L**						**H**	
	CO5	**M**		**M**		**H**	**M**	**L**						**M**	**H**

Course Content

UNIT – I

1.INTRODUCTION TO AIR POLLUTION

Composition of air, Air pollution-definition, Prominent air pollution disasters / episodes, Sources of air pollution - Stationary and mobile sources;

2.CLASSIFICATION OF AIR POLLUTANTS AND ITS EFFECTS

Classification- Natural Contaminants; Particulate Matter Aerosols and Gaseous pollutants; Primary and secondary pollutants.

Effects of air pollutants on human health; Effects on plants and economic effects.

UNIT – II

3.METEOROLOGY AND AIR POLLUTION

Meteorological factors influencing dispersion of air pollutants- Wind direction and wind speed, Atmospheric stability, temperature inversions, Mixing height, precipitation and humidity-measurement- Wind Rose; Plume behavior.

4.SAMPLING OF AIR POLLUTION

	Stack sampler; Sampling Procedure-Sampling point – size - Isokinetic Conditions- sampling of Particulate matter and Gases. Sampling methods. – Indian standard methods of analysis of SO2 and NOx gases- Air Quality and Emission standards
	UNIT – III **5. METHODS OF CONTROLLING AIR POLLUTION** Different means of control of effluent discharges into the atmosphere. Control of Particulate matter by equipment -Settling chamber, inertial separators-fabric filters- wet scrubbers-Electrostatic Precipitators **6. CONTROL OF GASEOUS POLLUTANTS** Controlling methods of Gaseous Emissions- combustion, adsorption, absorption, closed collections and recovery systems- Control of SO2 and NOx gases
	UNIT – IV **7.SOURCES AND EFFECTS OF NOISE POLLUTION** Sources Of Noise – Units And Measurements Of Noise – Characterization Of Noise From Construction, Mining, Transportation And Industrial Activities, Airport Noise – General Control Measures – Effects Of Noise Pollution – Auditory Effects, Non-Auditory Effects **8. CONTROL OF NOISE POLLUTION** Prevention And Control Of Noise Pollution – Control Of Noise At Source, Control Of Transmission, Protection Of Exposed Person – Control Of Other Types Of Noise Sound Absorbent-standards
Text books and Reference books	**Text Books**: 1.Air Pollution and Control by Rao, M.N and Rao, H.N., Tata McGraw Hill, New Delhi, 2007 2. Environmental Engineering and Management, (2nd Edition) by Suresh, l.S.K.Kartarai & Sons, 2005. 3.Environmental Engineering vol. II – Sewage disposal and air pollution engineering by S. K. Garg; Khanna Publishers, Delhi. **Reference Books**: 1. An Introduction to Air pollution by Trivedi, R.K., B.S.Publications, 2005. 2. Air pollution by Wark and Warner, Addison-Wesley Publications, 1998.
E-resources and other digital material	**NPTEL:http://nptel.ac.in/courses/webcourse-contents/IIT-delhi/Environmental%20Air%20Pollution/**

17CE2505 B	ENVIRONMENTAL IMPACT STUDIES

Course Category:	Open Elective - II	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	17MC1407A-Environmental Studies	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will have an ability to	
	CO1	understand impacts of the project on individual, society and environment
	CO2	analyse the various indicators to assess the state of health, economy and standard of life either prospering or deteriorating
	CO3	apply the methodologies of EIA for projects under suitable conditions
	CO4	assess the impacts on environment-case studies

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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					L									M
	CO2	L			M							H		L	
	CO3				M							L		L	H
	CO4	L												M	L

Course Content	**UNIT – I** **1.INTRODUCTION TO EIA** Environment and its interaction with human activities-Environment Imbalances- Attributes, impacts, Indicators, and measurements **2.SCOPE AND OBJECTIVES OF EIA** Concept of Environmental Impact assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and limitations of EIA.

	UNIT – II **3.ENVIRONMENTAL INDICATORS FOR CLIMATE** Indicators for climate-Indicators for terrestrial subsystems-Indicators for aquatic subsystems-Selection of indicators- **4.SOCIO-ECONOMIC INDICATORS** Socio-economic indicators-Basic information-Indicators for economy-Social indicators-indicators for health and nutrition-Cultural indicators-Selection of indicators
	UNIT – III **5.METHODOLOGIES OF EIA** Overview of methodologies, Adhoc, Checklist, Matrix, Network, Overlays, Benefit cost analysis choosing a methodology, review criteria. **6.PREDICTION AND ASSESSMENT** Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna-Mathematical models- Public participation
	UNIT – IV **7.ENVIRONMENTAL MANAGEMENT PLAN** Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora & fauna **8.CASE STUDIES** Case studies -water quality impact assessment – attributes, water quality impact assessment of water resources projects-data requirements of water quality impact assessment for dams impacts of dams on environment-case studies-On site and off site impacts during various stages of industrial development, long term climatic changes, greenhouse effect, industrial effluents and their impact cycle, Environment Impact of high ways, mining and energy development.
Text books and Reference books	**Text Books**: 1. Anjaneyulu, VallManickam, "Environmental Impact Assessment Methodologies", 2nd Edition ,B.S.Publications, 2007. 2. CANTER L.W, "Environmental Impact Assessment", Mcgraw Hill Pub.Co. New York, 1996. **Reference Books**: 1. Join, R.K. Urban L.V.Stracy, G.S. "Environmental Impact Analysis", 2nd Edition, VauNostrand Reinhold Co, 2004. 2. Ran, J.G. & Wooten, D.C., "Environmental Impact Assessment", 2nd Edition,

	McGraw Hill Pub. Co. Ltd, 2008.
E-resources and other digital material	**https://nptel.ac.in/courses/120108004/5**

17CE2506 A	GREEN BUILDINGS AND SUSTAINABILITY

Course Category:	Open Elective - III	Credits:	2
Course Type:	Theory	Lecture - Tutorial - Practice:	0 - 0 - 0
Prerequisites:	Nil	Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes		Upon successful completion of the course, the student will be able to													
	CO1	understand green building and green building materials.													
	CO2	apply different rating agencies and features of green buildings.													
	CO3	understand sources of carbon emissions and its impact on climate.													
	CO4	apply Zonal regulation while preparing land use plans.													
Contribution of Course Outcomes towards achievement		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						M	H					M		M
	CO2			H			M	H			H	M	M	L	

of Program Outcomes (L – Low, M - Medium, H – High)	CO3						M	H					M		M
	CO4			M		L	M	H			H	M	M	L	

Course Content

UNIT I

1.INTRODUCTION

Green Building, Why to go for Green Building, Benefits of Green Buildings.

2.GREEN BUILDING MATERIALS

Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building

UNIT II

3.GREEN BUILDING CONCEPTS

Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building,

4.GREEN BUILDING PRACTICES

Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings and Energy Efficiency,

UNIT III

5.SUSTAINABILITY

Introduction, Human development index, Sustainable development and social ethics, definitions of sustainability, populations and consumptions.

6.THE CARBON CYCLE AND ENERGY BALANCES

Introduction, Climate science history, carbon sources and emissions, The carbon cycle, carbon flow pathways, and repositories, Global energy balance, Global energy balance and temperature model, Greenhouse gases and Effects, Climate change projections and impacts

UNIT IV

7.SUSTAINABILITY IN PLANNING

Introduction, Land use and land; cover change, Land use planning and its role in sustainable development-Zoning and land use planning, smart growth.

8.SUSTAINABILITY IN BUILT ENVIRONMENT

Environmentally sensitive design- low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings

Course Category:	Open Elective - III	Credits:	2
Course Type:	Theory	Lecture - Tutorial - Practice:	0-0-0
Prerequisites:	----------	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

17CE2506 B	ADVANCED CONSTRUCTION MATERIALS

Text books and Reference books	**Text Books:** 1) International Green Construction Code Powered by Standard 189.1-2017. 2) Engineering Applications in Sustainable Design and Development By Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis. First edition, 2016, CENGAGE Learning. **Reference Books:** 1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers,2009. 2.Green Building Hand Book by Tomwoolley and Samkimings,2009.
E-resources and other digital material	https://igbc.in/igbc/ http://www.grihaindia.org/

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

	CO1	understand different types of modern materials , Paints, Enamels and Varnishes that are used in construction.
	CO2	understand the importance of special concretes and glass materials used in Building Construction.
	CO3	understand the classification and usage of materials like plastics, tar and sound absorbent materials
	CO4	understand building material like gypsum and various adhesives.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	L	L				M				L				M
	CO2	L	L				M				L				M
	CO3	L	L				M				L				M
	CO4	L	L				M				L				M

Course Content

UNIT – I

1.MODERN MATERIALS:

Ceramics, Sealants for joints, fibre glass reinforced plastic, refractories- composite materials, Geosynthetics.

2. PAINTS, ENAMELS AND VARNISHES:

Introduction, rubber paints, plastic emulsion paints, plastic paints, enamel paints, texture paints, varnish, wax polish.

UNIT – II

3.SPECIAL CONCRETES:

Light Weight concrete, High density concrete, Fiber reinforced concrete, polymer concrete.

4.GLASS

Composition, classification, properties and types of glass.

UNIT – III

5. PLASTICS, BITUMEN:

Composition, polymerization, Classification of plastics, biodegradable plastic, Grades of Bitumen.

	6. SOUND ABSORBENT MATERIALS: Porous materials, porous-cum-elastic materials, perforated materials, Baffle materials.
	UNIT – IV **7. Gypsum:** Introduction, plaster of Paris, gypsum wall plasters, gypsum plaster boards, Non-load bearing Gypsum partition blocks. **8. Miscellaneous materials:** Adhesives- advantages and disadvantages, properties, types of Adhesives; Different types of Building faced cladding materials; heat insulating materials; water proofing materials.
Text books and Reference books	**Text Books:** 1. Engineering Materials by S. C. Rangwala; Charotar Publishing House, 33 Edn 2017. 2. Building materials by S.K Duggal; New Age International publishers, 3rd Edn, 2009. **Reference books:** 1. Building materials by P.C Varghese; PHI Learning, 2nd Edn 2005.
E-resources and other digital material	**www:http://nptel.ac.in/courses/105102088/**

17TP1507	**PERSONALITY DEVELOPMENT AND CAMPUS**

	RECRUITMENT

Course Category:	**HS**	**Credits:**	1
Course Type:	**PRACTICE**	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Internal Assessment:** **Total Marks:**	100 100

Course Outcomes	Upon successful completion of the course, the student will be able to	
	CO1	understand the corporate etiquette.
	CO2	make presentations effectively with appropriate body language
	CO3	be composed with positive attitude
	CO4	understand the core competencies to succeed in professional and personal life

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
	CO1								M		H				
	CO2									M	H				
	CO3										H				
	CO4									M	H				

Course Content	**UNIT I** **ANALYTICAL THINKING &COMMUNICATION SKILLS** 1. Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception. 2. Verbal Communication; Non Verbal Communication (Body Language)
	UNIT II **SELF-MANAGEMENT SKILLS & ETIQUETTE** 3. Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities 4. Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette
	UNIT III

	STANDARD OPERATION METHODS & VERBAL ABILITY 5. Note Making, Note Taking, Minutes Preparation, Email & Letter Writing 6. Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work
	UNIT – IV **CAREER-ORIENTED SKILLS** 7. Group Discussion, Mock Group Discussions 8. Resume Preparation, Interview Skills, Mock Interviews
Reference books	[1] Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. [2] S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010. [3] R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018. [4] Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.
E Sources & Other Digital Material:	www. Indiabix.com www.freshersworld.com

17CE3508	**GEOTECHNICAL ENGINEERING**

Course Category:	Programme Core	Credits:	3
Course Type:	Theory with practical	Lecture - Tutorial - Practice:	2-0-2
Prerequisites:		Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able	
	CO1	to understand the origins of soil and basic inter-relationships of soil components
	CO2	to determine the index properties of soil and classify the soil based on the index properties
	CO3	to understand the Soil-Water Interaction
	CO4	to understand compressibility and shear characteristics of soil
	CO5	to determine the basic engineering properties of soil

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	H													
	CO2	H	H											H	H
	CO3	H				H								H	H
	CO4	H	H			H								H	H
	CO5	H	H												H

Course Content	**UNIT – I** **1.INTRODUCTION, BASIC DEFINITIONS AND RELATIONS:** Scope of Geotechnical Engineering; Origin of Soils; Formation of soils; Types of soils; Transportation of soils; Major soil deposits of India. Phase diagrams; Volumetric relationships; Weight relationship; Volume-weight relationships; Specific gravity of soils; Three phase diagram in terms of void ratio; Inter–relationships; **2.INDEX PROPERTIES AND SOIL CLASSIFICATION:** Index Properties – Introduction, Particle Size Distribution Curve and its uses, Relative Density, Plasticity of soils, Consistency Limits and uses, Plastic, consistency and liquidity indices; Flow index & toughness index; Sensitivity; Thixotropy; Activity of soils. Unified soil classification system; Indian standard soil classification system **Experiments:** 1. Determination of water content by oven drying method 2. Determination of specific gravity by Density bottle & Pycnometer 3. Grain Size analysis – Mechanical analysis – wet and dry soil 4. Hydrometer analysis 5. Determination of liquid limit and plastic limit 6. Determination of field unit weight by Core cutter method 7. Determination of field unit weight by sand replacement method
	UNIT – II **3.SOIL MOISTURE AND PERMEABILITY:** Flow of water in soils; Darcy's law; Validity of Darcy's law by Reynolds number; Determination of coefficient of permeability* by constant head and variable head methods & Indirect methods; Seepage velocity; General expression for laminar flow; Laminar flow through porous media; Factors affecting permeability; Permeability of stratified soil deposits. **4.EFFECTIVE STRESS PRINCIPLE:** Effective stress principle; Effective stress in a soil mass under different loading conditions – effect of depth of water table, surcharge loading, capillary water **Experiments:** 8. Determination of permeability by Constant head and Variable head methods
	UNIT – III **5.SEEPAGE THROUGH SOILS** Seepage pressure; Quick sand conditions; Laplace equations*; Stream and potential functions*; Characteristics of flow net; Uses of flow nets; Seepage through earth dams with horizontal filter*; Uplift pressure; Flow net for anisotropic soils. **6.COMPACTION OF SOILS:** Introduction; Standard proctor test and modified proctor test; Compaction of clayey soil and sand; Factors affecting compaction; Effect of compaction on properties of soils; Field compaction of soils and field compaction control. **Experiments:** 9. Standard proctor compaction test- Determination of OMC, MOD
	UNIT – IV **7.CONSOLIDATION OF SOILS:** Introduction; Initial and secondary consolidation; Spring analogy for primary consolidation; Terazaghi's theory of consolidation; Solution of basic differential equation;

	Consolidation test; Determination of void ratio at various load increments-height of solids and change in voids ratio methods; Consolidation test results; Determination of coefficient of consolidation-square root of time and logarithmic time fitting methods 8.**SHEAR STRENGTH OF SOILS:** Introduction; Mohr – coulomb theory; Different types laboratory of shear strength tests*(Triaxial test Direct shear test; Unconfined compressive strength test; Vane shear test*); Different drainage conditions and their field applicability; Mohr - coulomb failure criterion; Shear characteristic of cohesive and cohesion less soils **Experiments:** 10. Determination of C and φ by direct shear test 11. Determination of Shear strength by Vane shear test 12. Unconfined compression test- Determination of C and φ **Note:** 1. In Laboratory tests only test procedures need be studied - no need of derivations of the formulae used in the tests 2. Only test procedures according to relevant IS codes need be studied. 3.*methods and / or formulae only - no derivation of formulae needed.
Text books and Reference books	**Text Books:** 1. Soil Mechanics and Foundation Engineering by K.R. Arora; Standard Publishers & Distributors, Naisarak, New Delhi. 2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R.Rao. published by New Age International Ltd., **Reference Books:** 1. Geotechnical Engineering by B. J. Kasmalkar; Pune Vidyarthi Griha Prakashan, Pune. 2. Modern Geotechnical Engineering by Alam Singh; CBS Publishers & distributors Pvt. Ltd., Delhi. 3. Soil Mechanics and Foundation Engineering Vol. 1 by V. N. S. Murthy; Saikripa Technical Consultants, Bangalore. 4. Soil Mechanics and Foundation Engineering by B. C. Punmia; Laxmi Publications, Delhi. 5. Soil Mechanics Laboratory Manual by B.M. Das, Oxford University Press, 2002 6. Relevant Indian Standard Code Books – IS 2720
E-resources and other digital material	**Introduction to Soil Mechanics - http://nptel.ac.in/courses/105103097/** **Soil Mechanics - http://nptel.ac.in/courses/105101084/** **Geotechnical Engineering Laboratory - https://nptel.ac.in/courses/105101160/**

17CE3509	DESIGN OF CONCRETE STRUCTURES

Course Category:	Programme Core	Credits:	2
Course Type:	Theory	Lecture - Tutorial - Practice:	2-0-0
Prerequisites:	17CE3402 Concrete Technology	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes		Upon successful completion of the course, the student will have an ability to
	CO1	design of R.C. beams
	CO2	design of R.C slabs
	CO3	design of R.C columns
	CO4	design Footings

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	M		H		H								H	
	CO2	M		H		H								H	
	CO3	M		H		H								H	
	CO4	M		H		H								H	

Course Content	
	UNIT – I **1.GENERAL**: Loading standards as per IS 875, Grades of steel and cement, Stress- Strain characteristics of concrete and steel, Introduction to working stress method and Limit State Method (L.S.D.) of design. Characteristic load and strengths, Design values, Partial safety factors, Factored loads. **ALL DESIGNS IN LIMIT STATE METHOD** **2. DESIGN OF BEAMS** (IS456-2000). Design of singly reinforced rectangular section, Doubly reinforced rectangular section and singly reinforced flanged sections. Shear in R. C. beams; Diagonal tension and diagonal compression; Development length; Anchorage bond; Flexural bond; Check for development length. Deflection and cracking

	UNIT – II **3. DESIGN OF ONE WAY SLAB** (IS456-2000). One way and Two-way action of slabs, Choosing slab thickness. Design of one way slab. **4. DESIGN OF TWO WAY SLAB** (IS456-2000). Design of restrained and unrestrained Two way slabs as per I.S. code provision (IS456-2000).
	UNIT – III **5. DESIGN OF COLUMNS FOR AXIAL COMPRESSION (IS456-2000).** Define short and long columns, estimation of effective length of a column. Code requirements on slenderness limits, minimum eccentricity and reinforcement. Design of short column under axial compression with lateral ties and helical reinforcement. **6. DESIGN OF COLUMNS FOR COMBINED ACTION (IS456-2000).** Design of short columns subjected to combined axial load and uniaxial moment
	UNIT – IV **7. DESIGN OF ISOLATED FOOTING (IS456-2000).** General aspects of footings and types of footings. Design and detailing of Isolated Column footings. **8. DESIGN OF COMBINED FOOTING (IS456-2000).** Design and detailing of combined footings.
Text books and Reference books	**Text Books**: 1. Reinforced Concrete Vol-1,8th Edition by H.J.Shah, by Charotar Publication House. 2. Reinforced Concrete (Limit State Design), 7th Edition by Ashok K.Jain, Nem Chand & Bros., Roorkee **Reference Books**: 1. Limit state designed of reinforced concrete – P.C.Varghese, Printice Hall of India, New Delhi 2. Design of concrete structures by ArtherH.Nilson, Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
E-resources and other digital material	**http://nptel.ac.in/courses/105105105/** **http://nptel.ac.in/courses/105105104/**

17CE3551	ENVIRONMENTAL ENGINEERING LAB

Course Category:	Programme core	Credits:	1
Course Type:	Lab	Lecture - Tutorial - Practice:	0-0-2
Prerequisites:		Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	test the various parameters and understand their significance and application.
	CO2	recommend the suitability of water for various applications by knowing water quality standards.
Course Content	1. Determination of total suspended and dissolved solids in water / sewage sample. 2. Determination of fixed and volatile solids in water / sewage sample. 3. Determination of turbidity of water / sewage sample. 4. Determination of alkalinity of water sample. 5. Determination of acidity of water sample. 6. Determination of temporary and permanent hardness of water sample. 7. Determination of chloride concentration of water / sewage sample. 8. Determination of PH value of water / sewage sample. 9. Determination of optimum dose of coagulant. 10. Determination of dissolved oxygen of water / sewage sample. 11. Determination of fluorides in water sample. 12. Determination of biochemical oxygen demand (BOD) of waste water. 13. Determination of Chemical oxygen demand (COD) of waste water. 14. Determination of chlorine demand and residual chlorine. 15.Determination of nitrogen in water sample.	

Text books and Reference books	**Text Books**: Environmental Engineering Vol. I - Water supply engineering by S. K. Garg; KhannaPublishers, Delhi. 18th Edn, 2004. **Reference Books**: 1. Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi. 2. Is 3025 (part 2): 2004 iso 11885:1996 Indian standard methods of sampling and test (physical and chemical) for water and waste water ,* part 2 determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
E-resources and other digital material	http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php

17CE3601	DESIGN OF STEEL STRUCTURES

Course Category:	Programme Core	Credits:	2
Course Type:	Theory	Lecture - Tutorial - Practice:	2-0-0
Prerequisites:		Continuous Evaluation:	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes		Upon successful completion of the course, the student will have an ability to													
		CO1	design of steel connections												
		CO2	design of steel members in tension and compression with simple connections												
		CO3	design of laterally supported and unsupported steel beams												
		CO4	design of steel column bases												
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	M		H		H								H	
	CO2	M		H		H								H	
	CO3	M		H		H								H	
	CO4	M		H		H								H	
Course Content		**UNIT – I** **1.GENERAL:** Fundamental Concepts of limit state design of structures, Different types of rolled steel sections available to be used in steel structures. Stress – Strain relationship for mild steel. **2. SIMPLE CONNECTIONS (IS800-2007).** Bolted connections: Types of joints, Behaviour of bolted joints, Design strength of ordinary black bolts, Simple connections. Design of bolted joints subjected to axial load. Welded Connections: Advantages of welding, Types and properties of welds, Types of joints, weld specifications, Design of welded joints subjected to axial load.													
		UNIT – II **3. TENSION MEMBERS (IS800-2007).** Types of tension members, slenderness ratio, displacement of tension members, behaviour of tension members, modes of failure, factors affecting													

	strength of tension members, design of tension members and Lug angles with bolted and welded connections. **4.COMPRESSION MEMBERS (IS800-2007)** Possible failure modes, behaviour of compression members, Effective length, radius of gyration and slenderness of compression members, Allowable stresses in compression, Design of axially loaded compression members, built up compression members with Laced and Battened columns with bolted and welded connections.
	UNIT – III **5. BEAMS- LATERALLY SUPPORTED (IS800-2007).** Introduction; classification of sections; Lateral stability of beams; web buckling; Web crippling. Design of laterally supported beams. **6. BEAMS- LATERALLY UNSUPPORTED (IS800-2007).** Design of laterally unsupported beams.
	UNIT – IV **7. COLUMN BASE - SLAB BASE (IS800-2007).** Introduction to column bases and types of column bases. Allowable stress in bearing, Design of Slab base with bolted and welded connections. **8.COLUMN BASE - GUSSET BASE** Design of Gusset base with bolted and welded connections.
Text books and Reference books	**Text Books**: 1. Design of Steel structures by N. Subramanian, Oxford University Press. 2. Limit State Design of steel structures by S.K.Duggal, McGraw Hill Education Private Ltd. 3. Limit State Design of steel structures – Ramchandra and VirendraGehlot, Scientific Publishers (India) **Reference Books**: 1. Design of steel structures by K.S.Sai Ram, Pearson Education India. 2. Design of steel structures by Limit State Method as per IS: 800-2007 – S.S. Bhavikatti, IK International Publishing House, Bangalore – 560 001.
E-resources and other digital material	**http://nptel.ac.in/courses/105103094/** **http://nptel.ac.in/courses/105106112/**

17 CE 3602	**TRANSPORTATION ENGINEERING**

Course Category:	Program Core	Credits:	4
Course Type:	Theory	Lecture - Tutorial - Practice:	3 - 0 - 2
Prerequisites:		Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

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

outcomes	CO1	analyze the best alternative route for highways.
	CO2	identify suitable Pavement materials in Highway Construction by performing various tests.
	CO3	design geometrics, traffic control devices and pavement crust
	CO4	understand the Construction and Maintenance of Highways

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	H		H											
	CO2				H										H
	CO3	H	H	H										H	
	CO4			M		M									

Course Content

UNIT – I

1. HIGHWAY NETWORK PLANNING AND ALIGNMENT

Different Modes of Transportation, Road Classification, Road Patterns, 20 Year Road Development plans. Highway Alignment: Requirements, factors controlling, Engineering Surveys

2. HIGHWAY GEOMETRIC DESIGN

Geometric Design: Highway Cross Section Elements- Friction, Unevenness. Camber, Carriageway Width, Kerbs, road margins, formation width, right of way, Sight Distance- Stopping Sight Distance, Overtaking Sight Distance, Intermediate Sight Distance, Design of Horizontal Alignment- Super elevation, transition curves, extra widening, Design of Vertical Alignment-Grades and Grade Compensation, Types of Vertical curves.

UNIT-II

3. TRAFFIC STUDIES

Introduction, Road User Characteristics, Vehicle Characteristics, Traffic Volume Studies- objectives, methods, presentation of data(no numerical), Speed Studies- spot speed, average speed, running speed, travel speed, objectives of spot speed study, methods and presentation of data, various methods of speed and delay studies, various methods of Origin and Destination Studies, types of parking system, various methods of Parking Studies(no numerical), Traffic Flow Characteristics, Traffic Capacity and concept of Level of Service.

4. DESIGN OF TRAFFIC CONTROL DEVICES

	Traffic Operations-Traffic Regulation, Traffic Control Devices- types of Signs, Signals- advantages, disadvantages, types of traffic signals, types of traffic signal system, design of traffic signal by Webster's method. **UNIT-III** **5. DESIGN OF PAVEMENTS** Types of Pavement Structures, Design Factors, Design of Flexible Pavements- IRC Method, Design of Rigid Pavement- Wheel Load stresses, Temperature Stresses, Frictional Stresses. 6. **HIGHWAY CONSTRUCTION AND MAINTENANCE** Construction Steps of Embankment, earth roads, Granular Sub Base (GSB), Wet Mix Macadam (WMM), Dense Bituminous Macadam (DBM), Bituminous Concrete (BC) as per MORTH. Pavement failures, causes, failures in flexible pavement, failures in rigid pavements, maintenance of Bituminous pavements and concrete pavements. **7. HIGHWAY DRAINAGE** Importance of Highway Drainage, Requirements, Surface Drainage and Sub Surface Drainage **UNIT-IV** **8. PAVEMENT MATERIALS** Sub grade Soil Properties, CBR Test, Plate Bearing Test (demo), Stone Aggregates-Desirable Properties, tests- Aggregate Crushing Value Test, Aggregate Impact Value Test, Aggregate Abrasion Value Test, Shape Tests, Specific gravity, Bitumen-Desirable Properties, Penetration test, ductility test, softening point test, viscosity test, flash and fire point test, Marshal Method of Bituminous Mix Design (theory only), Job mix formula for GSB, WMM.
Text books and Reference books	**Learning Resources:** **Text Books** 1. Khanna, S. K., C. E. G. Justo, A.Veeraragavan" Highway Engineering Revised 10th Edition Nem Chand Bros . Roorkee 2017. 2. L R Kadyali, "Principles and Practices of Highway Engineering", Khanna Publishers,New Delhi, 2004. **Reference Books** 1. Principles of Transportation Engineering by Partha Chakraborthy & Animesh Das; PHI Learning Pvt. Ltd.; New Delhi, Second edition 2017 2. Ministry of Road Transport and Highways- Specifications for Roads and Bridge Works, Fifth Revision, IRC, New Delhi, India-2013 3. IRC 37:2012- Guidelines for the design of flexible pavements (Third Revision) 4. IRC58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways

E-resources and other digital material	https://nptel.ac.in/downloads/105101087/ https://nptel.ac.in/courses/105105107/

PROGRAM ELECTIVES

17CE4603 A	ADVANCED STRUCTURAL ANALYSIS

Course Category:	Programme Elective - I	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	17CE3503:Structural Analysis	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	analyze arches and cables.
	CO2	evaluate statically indeterminate beams, rigid jointed plane frames using Flexibility method
	CO3	evaluate statically indeterminate beams, rigid jointed & pin jointed plane frames using Stiffness method
	CO4	apply plastic analysis principles to determinate , indeterminate beams and portal frames

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO1 2	PSO 1	PSO 2
	CO1	H	H	L							L	L		H	
	CO2	H	H	L							L	L		H	
	CO3	H	H	L							L	L		H	
	CO4	M	M	L							L	L		H	

Course Content

UNIT – I

1. ARCHES:

Eddy's Theorem; Analysis of three hinged and two hinged Parabolic and Circular arches for Static loads

2. CABLES:

Analysis of cables under uniformly distributed and concentrated loads; Shape of the cable under self-weight; Effect of temperature changes in suspension cables; Anchor cables.

	UNIT – II **3. FLEXIBILITY AND STIFFNESS MATRICES:** Flexibility and stiffness; Flexibility matrix; Stiffness matrix; Relationship between flexibility matrix and stiffness matrix **4. FLEXIBILITY METHOD (MATRIX APPROACH):** Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility method with matrix approach.
	UNIT – III **5. STIFFNESS METHOD (MATRIX APPROACH):** Analysis of continuous beams, rigid jointed plane frames (Single bay, single storey with vertical legs only) by stiffness method with matrix approach **6. DESCRIPTION OF MATRIX METHOD :** Application to plane truss (Limited to two degree of freedom)
	UNIT – IV **7. PLASTIC ANALYSIS OF STRUCTURES:** Idealized stress - strain curve for mild steel; Ultimate load carrying capacity of members carrying axial forces; Moment - Curvature relationship for flexural members; Evaluation of fully plastic moment; Shape factor; Collapse load factor; Upper and lower bound theorems; Collapse load analysis of indeterminate beams and single bay, single storied portal frames. **8. FRAMES WITH INCLINED MEMBERS:** Plastic analysis of a gable frame, effect of axial forces on plastic moment capacity, effect of shear on plastic moment capacity.
Text books and Reference books	**Text Books**: 1) Structural Analysis – A matrix approach by G. S. Pandit& S.P. Gupta, 2008, Tata Mc. Graw – Hill Publishing Co. Ltd., New Delhi 2) Basic Structural Analysis by C.S.Reddy, McGraw Hill Education; 3rd Edition, 2010 3) Limit state Design of steel structures by S.K.Duggal, **2** edition, 2017, McGraw Hill Education, New Delhi. **Reference Books**: 1) Analysis of structures Vol.2 by Prof V.N.Vazirani, Dr.M.M.Ratwani, Dr.Sk.Duggal, 16th Edition,2016, Khanna Publishers, New Delhi. 2) Indeterminate Structural Analysis by C.K.Wang, 5th Edn 2014, McGraw Hill Education, New Delhi.
E-resources and other digital material	http://onlinecourses.nptel.ac.in/courses/105106050

17CE 4603 B	ADVANCED ENVIRONMENTAL ENGINEERING

Course Category:	Programme Elective-1	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	17CE3502 - Environmental Engg	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes		
	At the end of the course, the students are able to develop ability to….	
	CO1	Interpret contamination of water bodies on disposal of waste water.
	CO2	Understand the new concepts in Biological Waste Treatment
	CO3	Design low cost treatment units and to choose suitable treatment for selected industrial effluents.
	CO4	Identify the types of air pollutants, their effects and understand the working of controlling devices to control particulate matter.
	CO5	Understand the basics of noise, sources, effects and controlling measures.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	H		M		L			L						L
	CO2	H							L						L
	CO3	H		M					L					L	L
	CO4	H	L						L						L
	CO5	H	L						L						L

Course Content

UNIT – I

1. STREAM SANITATION

Introduction; Tolerance limits for the sewage effluents discharged in to inland surface water WRT BOD and TSS in particular; Self purification in a stream- De-oxygenation & Re-aeration;

Self purification and Oxygen sag curve with critical concentration, deficit and time; Dissolved oxygen model or Mathematical Equation for Oxygen sag curve - derivation.

Impact of following pollutants on water bodies and usage with reference to flora and fauna.

Temperature, Suspended matter and Turbidity, Foam, Acidic and Alkaline pollutants, Dissolved Inorganic substances.

2. NEW CONCEPTS IN BIOLOGICAL WASTE TREATMENT

(At preliminary level)

Introduction; Nitrogen removal by biological nitrification and de-nitrification; Modified Activated Sludge Process; Phosphate removal; Rotating disc biological

	contactor (RBC); An–aerobic filters; U-tube aeration system.
	UNIT – II **3. INDUSTRIAL WASTE WATER TREATMENT AND SUGAR PLANT WASTE WATER TREATMENT** Introduction; General Characteristics of Industrial wastes; Routine Treatment methods of Industrial wastes. Quantity of liquid waste; Manufacturing process flow diagram and sources of waste; Characteristics of liquid waste; Methods of treatment and treatment flow diagram and disposal. **4. DAIRY AND PULP AND PAPER INDUSTRY WASTE WATER TREATMENT** Quantity of liquid waste; Manufacturing process with flow diagram and sources of waste; Characteristics of liquid waste; Methods of its treatment and treatment flow diagram and disposal.
	UNIT – III **5. LOW COST WASTE WATER TREATMENT SYSTEMS AND THEIR DESIGN** Introduction; Biological kinetics of waste water; Algal-Bacterial Symbiosis; Aerobic and Facultative Stabilization ponds-Principle and working. Design w.r.t latitude of the locality and dispersion factor; Aerated lagoons- working and design; Oxidation ditch-working and design; Extended aeration process at preliminary level. **6. SOURCES, CLASSIFICATION OF AIR POLLUTANTS AND EFFECTS OF AIR POLLUTION** Stationary and mobile sources; Primary and secondary pollutants; Natural contaminants; Particulate matter- dust, SPM, smoke, Mist, Fumes, etc ; Aerosols; Gases. Effects of air pollutants on human health; Effects on plants and Economic effects.
	UNIT-IV **7. METEOROLOGY AND AIR POLLUTION** Atmospheric stability – variation of temperature w.r.t to altitude. Temperature inversions – Radiation Inversion, Subsidence Inversion, Advective Inversion and combined Inversion. Wind Rose and Mixing height; Measurement of following meteorological parameters Wind direction recorder; Wind speed recorder; Humidity measurement; Temperature measurement; Plume behaviour- types-looping, Coning, Fanning, Fumigation, lofting, trapping **8. CONTROL OF AIR POLLUTION BY EQUIPMENT** Objectives; Types of collection equipment (particulate matter only); Settling chambers; Inertialseparators; Cyclones-principle, working; Filters- principle, working; Electrostatic precipitators- principle, working; Types of Electrostatic precipitators – Pipe type and Plate type; Scrubbers- principle, working; Types of Scrubbers – Spray tower, Venturi scrubber, Cyclone scrubber, Packed Scrubber. Noise Pollution - Introduction; Sources of noise and their levels; Acceptance levels of various noise; Noise rating systems; Measures of noise; Effects of noise; Control of noise.

Text books and Reference books	**Text Books:** 1. Waste water treatment by M. N. Rao and A. K. Datta, 2008, Oxford &IBHpublishing Co. Pvt. Ltd., New Delhi. 2. Waste Water Engineering, Treatment, Disposal and Reuse by Metcalf &Eddy, 2005, Tata McGraw – Hill publishing Co. Ltd., New Delhi. 3. Air pollution by M. N. Rao and H. V. N. Rao, 2004, Tata McGraw – Hill Publishing Co. Ltd., New Delhi. **Reference Books:** 1. Environmental pollution control Engineering by C. S. Rao, 2008, Wiley Eastern Ltd., New Delhi. 2. Water Supply and waste water disposal by G. M. Fair et al. 1958, John Wiley &Sons. 3. Sewage and Sewage treatment by S. K. Kshirasagar, 1998, Roorkee Publishing House, Roorkee. 4. Sewage Disposal and Air pollution Engineering by S. K. Garg, 2010, KhannaPublications; Delhi.
E-resources and other digital material Web References:	https://onlinecourses.nptel.ac.in/noc18_ce29 https://onlinecourses.nptel.ac.in/noc18_bt19 https://onlinecourses.nptel.ac.in/noc18_me63 https://onlinecourses.nptel.ac.in/noc18_ce26 NPTEL

17CE4603 C	AIRPORT PLANNING AND DESIGN

Course Category:	Program Elective-1	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	-	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	understand airport and aircraft characteristics.
	CO2	understand various obstructions at airport.
	CO3	evaluate airport runway pavement.
	CO4	understand traffic control aids

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2
	CO1		H												M
	CO2	H		M											M
	CO3	H	H	M							L		L	H	
	CO4					H					L		L		M

Course Content	**UNIT – I** **1.AIR TRANSPORT** Different modes of transportation, Introduction to NAA, IAAI, AAI and ICAO **2.AIRPORT PLANNING AND CHARACTERISTICS** Airport classification based on ICAO, airport components, Aero plane components; Air–craft characteristics; Selection of site for airport; Surveys for site selection
	UNIT – II **3.AIRPORT OBSTRUCTIONS** Zoning laws, Imaginary surfaces, Approach zone, turning zone **4.RUNWAY DESIGN** Runway orientation- cross wind component, wind rose diagram, types of wind rose; Basic runway length; Corrections for elevation, Temperature and gradient; Runway geometric design. Runway configurations, geometric design standards of taxiway design
	UNIT – III **5.STRUCTURAL DESIGN OF AIRFIELD PAVEMENT** **FLEXIBLE PAVEMENT** Various design factors, Design methods for flexible airfield Pavement- CBR Method, Mcleod Method and Burmister's Method **6.RIGID PAVEMENT** rigid pavement Design- PCA Method; LCN Method of pavement design.
	UNIT – IV **7.VISUAL AIDS** Necessity of visual aids, airport markings-runway markings, taxiway

	markings, runway and taxiway shoulder markings, apron markings. Wind direction indicator, landing direction indicator, airport lighting **8.AIR TRAFFIC CONTROL** Need of air traffic control, air traffic control aids- airway aids, landing aids
Text books and Reference books	**Text Books:** 1. Airport Planning and Design by S. K. Khanna ,M. G. Arora& SS Jain; Nemchand& Bros,Roorkee- 2012 2. **Airport Engineering: Planning and Design, Subhash C Saxena, CBS Publisher, 2012** **Reference Books:** 1. Airport Engineering – Rangwala, Charotar Publishing House Pvt. Ltd., 2012 2.Virender Kumar and Satish Chandra, "Airport Planning and Design"- Galgotia Publication Pvt Ltd 2012
E-resources and other digital material	**https://nptel.ac.in/courses/105107123/**

17CE4603 D	IRRIGATION STRUCTURES

Course Category:	Programme Elective - I	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	17CE3501 – Water Resources Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	understand the basics of diversion head works and canal regulation
	CO2	apply the design principles of various cross drainage works
	CO3	evaluate various types of dams and principles of Aurthur cotton technology

	CO4	understand various types of spill ways.													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO 2**
	CO1													**M**	
	CO2	**H**	**H**	**H**		**M**								**M**	
	CO3	**H**	**H**	**H**		**M**					**M**			**H**	**H**
	CO4										**M**				**M**

Course Content

UNIT – I

1. DIVERSION HEAD WORKS:

Component parts of a Diversion Head works. Types of weirs, causes of failures of weirs and their remedies. – Bligh's Creep Theory, & Khosla's Theory. Outlets, Types:-Non modular Outlets, Semi modular Outlets, Rigid Module, Canal falls; Necessity and locations of falls, Development of falls and classification of falls. Silt control at head works.

2. CANAL REGULATION WORKS:

Canal regulators; Off-take alignment; Head regulators and cross-regulators; Canal escape.

UNIT – II

3.CROSS DRAINAGE WORKS:

Introduction; Types of cross - drainage works; Selection of suitable type of cross - drainage work; Classification of Aqueducts and Syphon Aqueducts; Selection of a suitable type.

4.COTTONS TECHNOLOGIES

Introduction to aurthur cotton technologies for present day needs, modern substitutes for aurthur cottons materials, introduction to design of Krishna anicut, introduction to design of Godavari anicut

UNIT – III

5.STABILITY ANALYSIS OF GRAVITY DAMS:

Introduction; Forces acting on a gravity dam; modes of failure and stability analysis of gravity dams:

6.DESIGN OF GRAVITY DAMS:

Elementary profile of a gravity dam; Practical profile of a gravity dam; Limiting height of a gravity dam; High and low gravity dams; Design of gravity dams–single step method; Galleries; Joints; Keys and water seals.

UNIT – IV

7. EARTH DAMS:

Introduction; Types of earth dams; Causes of failure of earth dams; Criteria for safe design of earth dams; Section of an earth dam; Seepage control measures; Slope protection.

	8. SPILLWAYS: Introduction; Types of spillways; Profile of ogee spillway; Energy dissipation below spillways for relative positions of jump height curve and tail water curve; Stilling basins; Types and description only.
Text books and Reference books	**Text Books:** 1. Irrigation and Water Power Engineering by Dr. B.C.Punmia & Dr. Pande B.B. Lal; Laxmi Publications pvt. Ltd., New Delhi. 2006. 2. Water Power Engineering by M.M. Dandekar and K. K. Sharma; Vikas Publishing House Pvt. Ltd., New Delhi.,2006. 3. Irrigation Engineering and Hydraulic Structures by S.R. Sahasra Budhe; Katson Publishing House, Ludhiana. 2000. 4. Sir Srthur Cottons Technologies for todays anicuts, dams, aqueducts, bridges, barrages, kissing reservoirs., by Dr Gutta Lakshmana Rao, Dr KSR Prasad. **Reference Books:** 1. Irrigation Engineering and Hydraulic Structure by S. K. Garg; Khanna Publishers, Delhi.,2006 2. Irrigation, Water Resources and Waterpower Engineering by Dr. P.N. Modi; Standard Book House, New Delhi. 2006. 3. Journals in Water Resources Methods of Numerical Analysis, S. S. Sastry, PHI , 2005.
E-resources and other digital material	www.nptel.ac.in/courses/105105110

17CE4603 E	**REMOTE SENSING AND GIS**

Course Category:	Programme Elective - 1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	apply the recent advances satellite based remote sensing and GIS technology in variou fields of Civil engineering
	CO2	evaluate the opportunities and available methods for integrating remote sensing and GIS in various civil engineering applications
	CO3	understand large scale maps using satellite imageries.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)

	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					**H**				**L**	**M**		**L**		**M**
CO2					**H**	**H**			**L**	**M**		**L**		**M**
CO3					**H**				**L**	**M**		**L**		**M**

Course Content

UNIT-I

1.INTRODUCTION TO REMOTE SENSING

Necessity and importance; Radiant energy from the sun; The electromagnetic spectrum Atmospheric effects on radiation; Absorption, transmission and reflection; Atmospheric windows Black body radiation; Specular and diffuse surfaces: Multi concept of Remote Sensing: Sensor an Platforms: Satellites: Types of data products – Types of image interpretation

2.IMAGE INTERPRETATION – Basic Elements, visual interpretation keys - Digital Imag Processing – Pre-Processing – image enhancement techniques – multispectral image classification.

UNIT-II

3.REMOTE SENSING APPLICATIONS

Introduction, Land use and land cover mapping: urban growth studies: Agriculture:
Forestry: Ground water mapping: Flood plain mapping: Hydro morphological studies: Type extent and distribution of wastelands in India; Development of wastelands;

4.REMOTE SENSING APPLICATIONS IN CIVIL ENGINEERING

District level planning : Disaster management: Application of Remote Sensing in Civil Engineering

UNIT-III

	5.INTRODUCTION TO GIS Introduction – Maps – Definitions – Map projections – types of map projections –Maps analysis GIS definition and terminology – basic components of GIS –standard GIS software's **6.DATABASE MANAGEMENT SYSTEMS** Data types – Spatial and Non Spatial (attribute) data –measurement scales – Data Base Managemer system (DBMS): definition - DTM ,DEM ,TIN
	UNIT-IV **7.APPLICATIONS OF GIS** Introduction, Problem Identification; GIS for Site Suitability in Urban Planning – Roa Accident Analysis – Irrigation water management – Tourism Information System – **8.ADVANCED APPLICATION OF GIS IN CIVIL ENGINEERING** Worldwide Earth quake Information System- Drainage problem in Tea Plantation Area- Knowledge Based System for Military Use. GIS-T; Application of GIS in Civil Engineering.
Text books and Reference books	**Text Books:** **1.** Remote Sensing & Geographical Information Systems by M.Anji Reddy, BPS Publications-Hyderabad. 2012 **2.** Remote Sensing & GIS by Basudeb Bhatta, Oxford University Press. New Delhi 2011 **Reference Books:** **1.** Remote sensing and Image interpretation by TM Lillesand and RWKiefer; John Willey and sons.7th edition 2015 **2.** Remote sensing and Geographical information System by AM Chandra & SK Ghosh;Narosa Publishing House. Second edition, 2015
E-resources and other digital material	E1]www.sciencedirect.com/science/article/pii/S1878029612003957 [E2] transportgeography.org /page_id6741 [E3] https://www.gislounge.com/military-applications-of-gis/ [E4] https://grindgis.com/blog/gis-applications-uses/attachment/gismap-45 [E5] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5557132/ [E6] https://shodhganga.inflibnet.ac.in/bitstream/10603/174401/13/13_chapter%207.pdf [E7] www.researchgate.net/publication/323411930Applications_of_Remote_Sensing_and_GIS_in_Wasteland_mapping

17HS1604	ENGINEERING ECONOMICS AND FINANCE

Course Category:	Core	**Credits:**	2

Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0 - 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to														
	CO1	Understand various forms of organizations and principles of management													
	CO2	Understand the various aspects of business economics													
	CO3	Acquire knowledge on Human resources and Marketing functions													
	CO 4	Understand different methods used in calculating depreciation and evaluating alternatives economicaly													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
	CO1	M											M		M
	CO2	M				H							M		M
	CO3	M											M		M
	CO4	M				H							M		M
Course Content	**UNIT-I** **Forms of Business Organization:** Salient Features of Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Society and Public Sector. **Management:** Introduction to Management, Functions of Management, Principles of Scientific Management, Modern Principles of Management.														

	UNIT-II **Introduction to Economics:** Introduction to Basic Economic Concepts, Utility Analysis: Marginal Utility and Total Utility, Law of Diminishing Marginal Utility, Law of Equi Marginal Utility. **Demand Analysis:** Theory of Demand: Demand Function, Factors Influencing Demand, Demand Schedule and Demand Curve, Shift in Demand, Elasticity of Demand: Elastic and Inelastic Demand, Types of Elasticity. **Supply Analysis:** Supply Schedule and Supply Curve, Factors Influencing Supply, Supply Function.
	UNIT-III **Human Resource Management:** Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management. **Marketing Management:** Concept of Selling And Marketing – Differences, Functions of Marketing, Product Life Cycle, Concept of Advertising, Sales Promotion, Types of Distribution Channels, Marketing Research, Break-Even Analysis.
	UNIT-IV **Financial Management:** Functions of Financial Management, Time value of money with cash flow diagrams, Concept of Simple and Compound Interest. **Depreciation:** Causes of depreciation, Factors influencing depreciation, common methods of Depreciation: Straight Line Method, Declining Balance Method, Sum of Year's Digits Method –Problems. **Economic Alternatives:** Methods of Evaluating Alternatives under Present worth method, Future worth method, Annual Equivalent method - Problems.
Text books and Reference books	**Text Books** [1] M. Mahajan *Industrial Engineering and Production Management* Dhanpat Rai Publications 2nd Edition. [2] Martand Telsang" Industrial & Business Management" S.Chand publications **Reference books** [1] R.Paneer selvam "Production and Operations Management" PHI [2] Philip Kotler & Gary Armstrong "Principles of Marketing" ,pearson prentice Hall,New Delhi,2012 Edition. [3] IM Pandey, "*Financial Management*" Vikas Publications 11th Edition [4] B.B Mahapatro, ***"Human Resource Management".***,New Age International ,2011
E-resources and other digital material	[1]https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/ [2]https://keydifferences.com/difference-between-personnel-management-and-human-resource-management.html [3] http://productlifecyclestages.com/ [4] https://speechfoodie.com/cash-flow-diagrams/

OPEN ELECTIVE-IV

17CE2605 A	TRAFFIC SAFETY

Course Category:	Open Elective - IV	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	NIL	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	understand the road accidents and road safety improvement strategies
	CO2	analyse the crash data using statistical methods & conduct road safety audits
	CO3	understand the mechanism needed for crash reconstruction based on case

		studies	
	CO4	apply accident mitigation measures in view of safety of user on a highway.	

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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				L										
	CO2		H	H	M	L									L
	CO3			M		L									L
	CO4		M	M	H							M			

Course Content

UNIT I

1.INTRODUCTION TO SAFETY:

Road accidents, Trends, causes, Collision and Condition diagrams, Highway safety, human factors.

2.**SAFETY MANAGEMENT SYSTEMS AND STRATEGIES:**

Vehicle factors Road Safety Management System, road safety improvement strategies, elements of a road safety plan, Safety Data Needs.

UNIT II

3.STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH DATA:

Before-after methods in crash analysis, Discussion on Advanced statistical methods, Black Spot Identification & Investigations, Case Studies.

4.ROAD SAFETY AUDITS:

Key elements of a road safety audit, Road Safety Audits & Investigations, Crash investigation and analysis, Describe methods for identifying hazardous road locations, Case Studies.

UNIT-III

5.CRASH RECONSTRUCTION:

Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction.

6.CASE STUDIES FOR CRASHES AND ACCIDENTS:

Speed for various skid, friction, drag, and acceleration scenarios, crash vs accident, Case Studies.

UNIT-IV

7.MITIGATION MEASURES:

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Traffic calming.

8.TRAFIC MANAGEMENT EDUCATION AND ENFORCEMENT:

	Traffic management measures and their influence in accident prevention, legislation, enforcement, education and propaganda,
Text books & Reference Books	**Text books :** 1.Trafffic Engineering and Transport Planning , Dr.L.R.Kadiyali, 9th Edition, 2017, Khanna Publications , New Delhi. 2. S K Khanna C E G Justo, A. Veeraragavan. Highway Engineering. Nem Chand and Bros, Roorkee, 2001 **Reference books:** [R1] Black Spot Manual, Traffic safety project- General Directorate of Highways, Swedish Transport Administration, December 2001. [R2] Guidelines for road safety audit, directorate of urban land transport, Urban development department, Govt. of Karnataka. [R3] Stewart, A.E. and Lord, J.H., 2002. Motor vehicle crash versus accident: a change in terminology is necessary. Journal of traumatic stress, 15(4), pp.333-335.
E-resources and other digital material	[E1] https://nptel.ac.in/courses/105101008/downloads/cete_42.pdf [E2] https://roadsafety.piarc.org/en/road-safety-management [E3] http://erso.swov.nl/knowledge/content/10_rsm/the_road_safety_management_system.htm [E4] http://www.nimhans.ac.in/sites/default/files/UL_BR_b007_Summery%20rprt.pdf [E5] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2700566/ [E6] https://safety.fhwa.dot.gov/provencountermeasures/

17CE2605 B	BUILDING SERVICES ENGINEERING

Course Category:	Open Elective - IV	Credits:	3
Course Type:	Theory	Lecture - Tutorial - Practice:	3-0-0
Prerequisites:	--	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	understand the types, basic planning and specifications of buildings.
	CO2	understand ventilation and thermal insulation in structures
	CO3	understand the plumbing and electrical fixtures in structures
	CO4	understand the considerations for fire prevention and fighting and termite prevention in buildings.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	**H**						**M**							**M**
	CO2	**L**						**M**			**M**				**M**
	CO3	**L**				**L**	**L**	**M**			**M**				**M**
	CO4	**L**				**L**	**L**	**M**			**M**				**M**

Course Content	**UNIT – I** **1. BASICS OF BUILDINGS** Types of structures: Load bearing walled structures & Framed structures – Different types of buildings: Residential, Public, Assembly, Hospitals, Institutional etc - Zoning regulations; Regulations regarding layouts or sub-divisions; Building height regulations; Calculation of plinth, floor and carpet area; Floor space index. **2. BASIC BUILDING PLANNING AND ELEMENTS** Site planning; Space requirement–Establishing areas for different units - Grouping, Circulation, Orientation, Aspect and prospect, Privacy, Elegance and economy; Climatic considerations – Basic building elements: Stair cases, doors and windows - Guidelines for staircase planning; Guidelines for selecting doors and windows; Terms used in the construction of stair case, doors and window
	UNIT – II **3. VENTILATION AND AIRCONDITIONING,** Ventilation – Necessity of Ventilation – Functional Requirements – Types: Natural Ventilation – Artificial Ventilation – Air Conditioning – Systems of Air Conditioning – Essentials of Air Conditioning systems – Protection against fire to be caused by Air Conditioning systems **4. THERMAL INSULATION:** Heat transfer – Thermal Insulating Materials – Thermal Insulation Methods – Economics of Thermal Insulation – Insulation of Walls – Roofs – Doors & Windows.
	UNIT – III **5. PLUMBING SERVICES** Types of plumbing – Fixing pipes in buildings – Plumbing fittings and accessories – Water Supply System: guidelines for mains, communication and consumer pipes – Water Meters; Drainage – Sanitary Fittings: Bathtubs, wash basins, sinks, flushing cisterns, water closets – Principles governing design of building drainage – Guidelines for laying of Gas supply systems. **6. ELECTRICAL INSTALLATION IN BUILDINGS** Considerations for Office Buildings, School Buildings & Residential Buildings; Lighting– Fannage – Electrical Installation for Air Conditioning/Heating – Reception and distribution of main supply – Electrical Fittings and accessories- Method of internal wiring – Earthing – Planning of electrical Installations – Lightening arrestors

	UNIT – IV **7. FIRE SAFETY:** Causes of fire in buildings – Planning considerations for fire resistance - Non-combustible materials in construction, staircases and lift lobbies, fire escapes - Special features required for physically handicapped and elderly people – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire fighting pump and water storage – Dry and wet risers – Automatic sprinklers **8. ANTI- TERMITE TREATMENT** Pre construction treatment – Post construction treatment – Construction of anti termite groove in buildings for termite prevention.
Text books and Reference books	**Text Books**: 1.Building Construction by B.C. Punmia; Ashok Kumar Jain; Arun Kumar Jain, 2005; Laxmi Publications, New Delhi 2. Building Construction by Janardhan Jha; S.K. Sinha; 2007; Jain Book Agency, New Delhi. **Reference Books**: 1. National Building Code, 2015 2. Building Construction by P.C.Varghese, 2005, PHI Publications, New Delhi 3. Building Services Engineering by David V. Chatterton, Sixth Edition, 2013, Routledge Publications.
E-resources and other digital material	https://nptel.ac.in/courses/105102176/

17TP1606	QUANTITATIVE APTITUDE

Course Category:	Institutional Core	Credits:	1
Course Type:	Learning by Doing	Lecture - Tutorial - Practice:	0 – 0 – 2
Prerequisites:		Continuous Evaluation: Semester end Evaluation: Total Marks:	100 0

			100

Course outcomes		Upon successful completion of the course, the student will be able to													
		CO1	solve various Basic Mathematics problems by following different methods												
		CO2	follow strategies in minimizing time consumption in problem solving Apply shortcut methods to solve problems												
		CO3	confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.												
		CO4	analyze, summarize and present information in quantitative forms including table, graphs and formulas												
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	M													
	CO2		M												
	CO3	M													
	CO4				M										
Course Content		**UNIT I:** **1.Numerical ability l:** Number system, HCF & LCM, Average, Simplification, Problems on numbers **2.Numerical ability II:** Ratio & Proportion, Partnership, Percentages, Profit & Loss													
		UNIT II: **3. Arithmetical ability l** Problems on ages, Time & Work, Pipes & Cistern, Chain Rule. **4.Arithmetical ability ll:** Time & Distance, Problems on boats &Steams, Problems on Trains													

	UNIT III: **5.Arithmetical ability lll:** Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock, **6.Logical ability**: Permutations and Combination and Probability.
	UNIT IV: **7.Mensuration:** Geometry, Areas, Volumes, **8.Data interpretation:** Tabulation, Bar graphs, Pie charts, line graphs
Text books and Reference books	R. S. Aggarwal "Quantitative Aptitude", Reviseded., S Chand publication, 2017 ISBN:8121924987
E-resources and other digital material	

17MC1607	**BIOLOGY FOR ENGINEERS**

Course Category:	Mandatory Learning	**Credits:**	---
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2-0-0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes		Upon successful completion of the course, the student will be able to													
		CO1	Describe the fundamental principles and methods of engineering												
		CO2	Identify the functions of different types in bio-molecules												
		CO3	Describe mechanisms underlying the working of molecular biological process including enzyme catalysis, metabolic pathways, gene expression												
		CO4	Use Excel, MATLAB and other computational tools to quantitatively analyze biological processes												
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	M	H												
	CO2		H												
	CO3		M		H										
	CO4		L		M	H									

Course Content	**UNIT – I** **Introduction and Classification of Living organisms** **Introduction:** Fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Biology as an independent scientific discipline. Discuss how biological observations of 18^{th} century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. **Classification:** Classification of living organisms based on (a) Cellularity- Unicellular or multicellular (b) Ultrastructure- prokaryotes or eukaryotes. (c) Energy and Carbon utilization –Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitat-acquatic, terrestrial (e) Molecular taxonomy- three major kingdoms of life.

	UNIT – II **Biomolecules and Enzymes** **Biomolecules:** Biomolecules: Structures of sugars (Glucose and Fructose), starch and cellulose. Nucleotides and DNA/RNA. Amino acids and lipids. Proteins- structure and functions- as enzymes, transporters, receptors and structural elements. **Enzymes:** Enzyme classification. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters
	UNIT – III **Genetics and Gene information Transfer** **Genetics:** "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Concepts of recessiveness and dominance. Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. **Information Transfer:** DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.
	UNIT – IV **Metabolism and Microbiology** **Metabolism:** Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. ATP as an energy currency. Breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (photosynthesis). Energy yielding and energy consuming reactions. **Microbiology:** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Growth kinetics. Ecological aspects of single celled organisms. Microscopy.
Text books and Reference books	**Text Books** 1) Biology: A global approach: Campbell, N.A.;Reece, J.B.;Urry, Lisa;Cain,M,L.;Wasserman,S.A.; Minorsky,P.V.;Jackson, R.B.Pearason Education Ltd 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons **Reference Books** 3) Principles of Biochemistry (V Edition), By Nelson, D.L.; and Cox, M.M.W.H. Freeman and Company 4) Molecular Genetics (Second Edition), Stent, G.S.; and Calender, R.W.H. Freeman and Company, Distributed by Satish Kumar Jain for CBS publisher 5) Microbiology, Prescott, L.M J.P. Harley and C.A.Klein 1995. 2nd edition Wm, C.Brown publishers

E-resources and other digital material	International Standard Book Number-13: 978-1-4398-9402-6 (eBook - PDF)

17CE3608	**FOUNDATION ENGINEERING**

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	17CE3508— Geotechnical Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes		**Upon successful completion of the course, the student will be able to**
	CO1	understand the principle of earth pressure, analyze and design of earth retaining structures
	CO2	understand, analyze and design of soil slopes.
	CO3	analyze the various parameters in soil investigation program and analyze the soil profile and its properties.
	CO4	analyze various types of loads applied to the soil and its distribution in soil.
	CO5	analyze and design of various types of shallow foundation including settlements.
	CO6	analyze and design of various types of deep foundations.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		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	H	H	M									M	M	
	CO2	H	H	M									M	M	
	CO3	M	M	M									M	L	
	CO4	H	H	M									M	L	
	CO5	H	H	M									M	H	
	CO6	H	H	M									M	H	

Course Content	**UNIT – I** **1.SUB–SOIL INVESTIGATION AND SAMPLING** Introduction; Planning of sub-surface exploration Program; Stages in sub-surface exploration; Methods of exploration; Soil sampling and samplers; Water table location; Depth and number of borings; Bore hole logging; In-situ tests – Standard penetration test, Static cone penetration test, Dynamic cone penetration test and Vane shear tests. **2.STRESSES DUE TO APPLIED LOADS** Stress-strain parameters; Vertical and horizontal stresses due to concentrated loads; Boussinesq and Westergard solutions; Isobars; Influence diagram; Newmark's influence charts; Contact pressure distribution.
	UNIT – II **3.LATERAL EARTH PRESSURE & RETAINING WALLS** Different types of lateral earth pressure; Rankine's and Coulomb's earth pressure theories; Graphical methods; Types of retaining walls; Proportioning of retaining walls. **4.STABILITY OF SLOPES** Definition of slope; Types of slopes; Types of slope failures; Different factors of safety; Factors affecting the stability of slopes; Assumptions in the stability analysis; Analysis of finite slopes by Culman's method; Method of slices; Friction Circle method and Taylor's stability charts; Methods of improving stability of slopes.
	UNIT – III **5.BEARING CAPACITY OF SHALLOW FOUNDATION** Different bearing capacity equations; Types of shear failures; Effect of inclined load, eccentric load and water table on bearing capacity; Bearing capacity from in-situ tests; Methods of improving bearing capacity; Plate load test. **6.SETTLEMENT ANALYSIS** Settlement of foundations; Immediate and consolidation settlements; Allowable settlement; Proportioning of a foundation for a given settlement.
	UNIT – IV **7.PILE FOUNDATIONS** Necessity of pile foundation; Classification of piles; Construction of piles; Load carrying capacity of single pile from static, dynamic and in-situ test methods; Pile load tests; Pile group and its efficiency; Settlement of pile foundation; Negative skin friction; Under-reamed pile foundation in swelling soils. **8.WELL FOUNDATION** Forces acting on well foundation; Types, different shapes of wells; Analysis of well foundation; Individual components of well; Sinking of wells; Measures for rectification of tilts and shifts.

Text books and Reference books	**Text Books** 1. Basic and Applied Soil Mechanics, Gopal Ranjan and A.S.R. Rao, 8th Edition, 2018, New Age International (P) Limited Publishers, Chennai. **2.** Soil Mechanics and Foundation Engineering K.R. Arora, 2011, Standard Publishers and Distributors, New Delhi. **Reference Books** 1. Advanced Foundation Engineering, V.N.S.Murthy, 2018, CBS Publishers and Distributors, New Delhi. 2. Foundation Analysis and Design, Joseph E. Bowles, 4th Edition, 1996, McGraw – Hill International Editions, 3. Relevant Indian Standard Code Books.
E-resources and other digital material	**nptel**.ac.in/courses/105107120 **nptel**.ac.in/courses/105101083

17CE3651	**COMPUTER APPLICATIONS IN CIVIL ENGG LAB-1**

Course Category:	**Programme Core**	Credits:	1
Course Type:	**Practical**	Lecture - Tutorial - Practice:	**0-0-2**
Prerequisites:		Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	**design and prepare structural drawings themselves for various structural elements by using AUTOCAD**
	CO2	**write and execute the program using Microsoft Excel/Mat Lab**

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2
	CO1	M	L			M						H		M	L
	CO2	M	M			M						H		M	L

Course Content	**PART-A: AUTOCAD** Design and Drawing the reinforcement details of the following RCC Structural elements / steel structural elements. 1. Roof/Floor System (Continuous) with flanged beams 2. Doglegged staircase 3. Two way slabs (Simply supported slabs corners held down / corners not held down) 4. R.C.C Beam - Column joint 5. Isolated and Combined footing 6. Steel Roof Truss **PART - B: PROGRAMMING** Students are required to write & execute the programs using Microsoft Excel language 1. Design of singly reinforced beam for flexure by LSM. 2. Design of doubly reinforced beam for flexure by LSM. 3. Design of R.C.C column of rectangular section for axial load by LSM.
Text books and Reference books	**TEXT BOOKS:** **1. Structural Design and Drawing - Dr. N. Krishnaraju** **2. Engineering Graphics using AUTOCAD, T.Jeyapoovan, Vikas Publishing House Pvt. Ltd., 2000.** **3. Engineering Drawing and Graphics and AUTOCAD, K.Venugopal, New Age International Publishers, 2001.** **4. Computer Applications in Civil Engineering, New Chand & Bros., Roorkee, India,1979.**
E-resources and other digital material	

17CE3652	ADVANCED SURVEYING LAB

Course Category:	Programme Core.	Credits:	1
Course Type:	Practical	Lecture - Tutorial - Practice:	0-0-2
Prerequisites:	17CE3304: Surveying & Geomatics, 17CE3351:Surveying Laboratory	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to	
	CO1	calculate linear and angular measurements using Total station
	CO2	calculate area of a given building/field using Total station
	CO3	set out curves
	CO4	transfer points from plan to field

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2
	CO1	M				H		H				H			
	CO2	M				M		H				M			
	CO3	M				H		H				H			
	CO4					M						H			

Course Content	**PART-A** 1. Setting of Boundaries and computation of area of a field by using Total Station. 2. Calculation of Height of object by using Total station. 3. Setting of simple curve using chain and tape. 4. Setting of simple curve using chain, tape and Theodolite 5. Setting of simple curve using Total Station. 6. Setting out for a Building using chain and tape. 7. Setting out for a Building using Total Station. 8. Computation of area of building by using Total station. 9. Contour Map (Levelling) using Total station 10. Demonstration of DGPS- area measurement **PART-B** Survey Camp is to be conducted for a minimum period of one week Using Total Station to train in one of the following areas: 1. Preparation of a contour Plan/ Map. 2. Earth work Computations for a high way / canal projects 3. Marking of a Sewer line/ Water supply line. 4. Any type of Execution works.
Text books and Reference books	**Text Books**: 1. Surveying Vol I & II by K R Arora, 15th Edn , 2016, Standard Book house New Delhi. 2. Higher Surveying by Dr.A.M.Chandra, 2006, New Age International Publishers, Chennai. **Reference Books**: 1. Surveying Vol I & II by B.C. Punmia, 6th Edn 2016, Laxmi Publications, New Delhi.
E-resources and other digital material	NPTEL: http://www.nptelvideos.in/2012/11/surveying.html

17CE 5653	ENGINEERING PROJECTS IN COMMUNITY SERVICE

Course Category:	Programme Core	**Credits:**	2
Course Type:	Project Work	**Lecture - Tutorial - Practice:**	0 - 1- 2
Prerequisites:		**Continuous Evaluation:**	30

		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to													
	CO1	analyzing the societal problem and survey the literature for a feasible solution.												
	CO2	applying modern Research Tools and Material available.												
	CO3	evaluating knowledge of contemporary issues.												
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
	CO1		H			M	H				M	H		M	H
	CO2		H			M	H				M	H		M	H
	CO3		H			M	H				M	H		M	H
Course Content	The Engineering Projects in Community Service (EPICS) is a service-learning design program in which teams of students partner with local and global community organizations to design, build and deploy real systems to solve engineering-based problems for local community service and education organizations. The EPICS is designed to inspire and prepare students for the future while improving their communities today. EPICS will be carried out during summer vacation after IV Semester and the report shall be submitted in VI Semester. Students will go to the society to identify the problem and survey the literature for a feasible solution. Students are encouraged to choose and solve real life problems through this course. Further, this may be considered as precursor to the project work to be done in the 2nd semester of the final year B.Tech., Programme. It trains the students to make use of Research Tools and Material available for civil engineering practice. The topic of Engineering Projects in Community Service (EPICS) is chosen from the B.Tech curriculum so as to identify, formulate and solve the contemporary issues and societal problems of civil engineering. Based on the topic a hypothesis is to be made by the student. The students are then required to collect literature and support information for their chosen topics of work from Standard Reference Books, Journals, and Magazines – both printed and online. The students submit the work in the form of a report of 8-10 (A4 size) in length and follow the standard IEEE/Technical Journal Format and present their work with the help of Power Point slides at the time of Semester end Evaluation. The Engineering Projects in Community Service contains: • The Aim and Objectives of the study • The need for Rationale behind the study • Identify the work already done in the field • Hypothesis and Discussion • Conclusion													

	• Appendix with support data (Illustrations, Tables, Graphs, etc.,) Last date of submission of the Draft : One week after the 1st Mid Term Examinations Last date of submitting the Project Report : One week before commencement of 2nd Mid Term Examinations Date of Seminar : During the Lab. Internal Examinations **Method of Evaluation:** Day-to-Day work (Evaluated by the Guide) : 10 M Seminar - 1 : 10 M Seminar – 2 with report submission : 10 M Semester End Evaluation : 70 M --- **Total** **: 100** M ---

Text books and Reference books	**Text Books:** Standard Reference Books, Journals and Magazines – both printed and online.
E-resources and other digital material	https:// www.purdue.edu http://unnatbharatabhiyan.gov.in

17CE3701 CONSTRUCTION ENGINEERING AND MANAGEMENT

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3401- Building Materials and Construction	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand knowledge on planning and scheduling of various construction projects.
	CO2	Apply PERT and CPM networking methods.
	CO3	Apply resource optimization techniques in construction
	CO4	Apply knowledge on the concepts of quality control and safety management

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	M		M	M		M						H		M
	CO2	M		M		M						M	H		M
	CO3	M			M		M						H		M
	CO4			M	M	M	M		M				H		M

Course Content

UNIT-I

INTRODUCTION

Classification of construction works; Stages of construction; Main causes of project failure; Objectives of construction management; Functions of construction management

PLANNING AND SCHEDULING

Steps involved in planning; Objectives; Principles; Advantages; Limitations; Stages of planning; Scheduling, Preparation of construction schedules; Methods of scheduling; Bar charts; Mile stone charts; Controlling; Job layout; Factors affecting job layout; Project work break down.

UNIT-II

PROJECT MANAGEMENT THROUGH NETWORKS - PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT)

Objectives of network techniques; Fundamentals of network analysis; Events; Activities; Dummies; Types of networks; Choice of network type; Advantages of network techniques over conventional techniques. – PERT :Introduction; Time estimates; Earliest expected time; Latest allowable occurrence time; Slack; Critical path; Probability of completion time for a project.

	CRITICAL PATH METHOD (CPM) & COST CONTROL Introduction; Difference between CPM and PERT; Earliest event time; Latest event time; Activity time; Float; Critical activities and critical path. Cost Control: Direct cost; Indirect cost; Total project cost; Optimization of cost through networks; Steps involved in optimization of cost. **UNIT-III** **RESOURCE MANAGEMENT (MANPOWER & MACHINERY)** Introduction; Resource smoothing; Resource leveling; Establishing workers productivity. Advantages and disadvantages of using equipment; Selection of equipment– Task consideration, Cost consideration; Factors affecting the selection; Factors affecting cost of owning and operating the equipment; Equipment maintenance. **CONSTRUCTION EQUIPMENT** Classification of construction equipment; Earth moving equipment; Excavation equipment; Hauling equipment, Earth compaction equipment; Hoisting equipment; Concreting plant and equipment; Pile driving equipment; Tunneling and rock drilling equipment; Paving equipment **UNIT-IV** **RESOURCE MANAGEMENT (MATERIALS)** Objectives of material management; Costs; Functions of material management department; ABC classification of materials; Inventory of materials; Material procurement; Stores management. **QUALITY CONTROL:** Importance of quality; Elements of quality; Organization for quality control; Quality assurance techniques; Documentation; Quality control circles; Total quality management; ISO – 9000.
Text books and Reference books	**Text Books:** [T1] Seetharaman. S, Construction Engineering and Management, Umesh, NDLS, 2006 [T2] Peurifoy R Construction Planning, Equipment & Methods; McGraw Hill, LN, UK, 2010. **Reference Books:** [R1] Sengupta. B and Guha. H, Construction Management & Planning, Tata McGraw Hill, NDLS, 2004. [R2] Bhattacharjee, S.K. Fundamentals of PERT/CPM and Project Management, Khanna, NDLS, 1996.
E-resources and other digital material	nptel.ac.in/courses/105103093

17CE4702/A ADVANCED DESIGN OF CONCRETE STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3509 - Design of Concrete Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Evaluate sectional details for staircase and flat slab.
	CO2	Evaluate safe section for foundation and retaining wall.
	CO3	Evaluate safe section for water tanks.
	CO4	Evaluate safe composite structures.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	H		M		L								H	
CO2	H		M		L								H	
CO3	H		M		L								H	
CO4	H		M		L								H	

Course Content

UNIT I

DESIGN OF STAIRCASE

Types; Design and detailing of reinforced concrete doglegged staircase.

DESIGN OF FLAT SLABS

Design of Flat Slab: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two-way shears, Limitations of Direct design method, Introduction to Equivalent frame method.

UNIT II

DESIGN OF FOUNDATIONS

Structural Design of Pile Foundations: Types of piles, Load carrying capacity of piles, Group action in piles, Structural design of RC piles, Design of pile cap for 2 or 3 piles, Reinforcement detailing and bar bending schedule.

DESIGN OF RETAINING WALLS

Introduction – Types of retaining walls –Active and passive earth pressure- Design principles of cantilever retaining walls with horizontal back fill –With sloping back

	fill. Design principles of Counter fort retaining walls with horizontal back fill. Reinforcement detailing and bar bending schedule. **UNIT III** **DESIGN OF RECTANGULAR WATER TANKS** Rectangular Water Tanks**:** Introduction – General design requirements according to Indian standard code of practice – Design of on ground and underground water tanks- Design of overhead water tanks- Reinforcement detailing and bar bending schedule. **DESIGN OF CIRCULAR WATER TANKS:** Introduction – General design requirements according to Indian standard code of practice – Joints in water tanks – Circular tank with flexible joint between floor and wall – Circular tank with rigid joint between floor and wall – Design of Overhead tanks - IS code method for design of circular tanks- Reinforcement detailing and bar bending schedule need to be prepared. **UNIT – IV** **DESIGN OF COMPOSITE STRUCURES** Introduction – Design principles – Composite action of components- Equivalent section – prefabricated steel and in-situ concrete – composite members **DESIGN OF SHEAR CONNECTORS:** Shear connectors – channel connectors - Spiral connectors - Composite beams and bridge deck
Text books and Reference books	**Text Books:** [T1] Ramamrutham. S and Narayanan. P, *Design of Reinforced concrete structures*, Dhanapat Rai Publishing Co. (P) Ltd., NDLS, 2010 [T2] Punmia, B.C, *Limit state design of Reinforced concrete*, Laxmi Publications, NDLS, 2007 [T3] Punmia, B.C, *Reinforced concrete structure design*, Laxmi Publications, NDLS, 2010 **Reference Books:** [R1] Shah, V.L. and Karve, S.R., *Limit State theory & Design of reinforced concrete* Structures, Pune, 2003. [R2] Elliot. K, *Precast Concrete Structures*, Elsevier, CH, 2002. [R3] Multi-Storey Precast Concrete Framed Structures, Kim S. Elliott, Colin Jolly, Wiley-Blackwell publications, second edition-2013, Wiley-Blackwell **Codes of Practice:** 1. IS 456:2000- Code of Practice for Plain and Reinforced Concrete 2. SP16 – Design aids of IS 456:2000 3. IS 13920 (1993) Ductile Designing of Reinforced Concrete Structures subjected to Seismic Forces.
E-resources and other digital material	https://onlinecourses.nptel.ac.in/noc18_ce24/preview https://nptel.ac.in/downloads/105105104/ (Phase - 1) https://nptel.ac.in/syllabus/105105105/ (Phase - 2) http://engineeringvideolectures.com/course/294

17CE4702/B SOIL DYNAMICS AND MACHINE FOUNDATIONS

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3608— Foundation Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply theory of vibrations to solve dynamic soil problems
	CO2	Evaluate the dynamic properties of soils using laboratory and field tests
	CO3	Analyze and design behavior of a machine foundation resting on the surface, embedded foundation.
	CO4	Analysis and design of vibration isolation systems

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	H	H	M									M	M	
CO2	H	H	M									M	M	
CO3	M	M	M									M	L	
CO4	H	H	M									M	L	

Course Content

UNIT – I

NTRODUCTION

Nature and types of dynamic loading, Importance of soil dynamics. Fundamentals of vibration: Vibration of elementary systems, Dynamics of elastic systems, Degrees of freedom, Free and forced vibration.

WAVES & WAVE PROPAGATION

Types of waves, Waves in unbound media, Waves in semi-infinite media, Waves in layered media.

UNIT – II

DYNAMIC PROPERTIES OF SOILS

Dynamic soil properties: Laboratory tests, Field tests, Correlation of different parameters.

	DYNAMIC EARTH PRESSURE: Active and Passive Pressures, Retaining wall problems under Dynamic loads. Dynamic slope stability Analysis. **UNIT – III** **DESIGN OF MACHINE FOUNDATIONS-I** General requirements of machine foundations – Design criteria – principles of & simple procedures of design of foundations for machineries of reciprocating type. **DESIGN OF MACHINE FOUNDATIONS-II:** Impact & Rotary type (treated as single degree freedom only) – dynamic loads, simple design procedures for foundations under **UNIT – IV** **VIBRATION ISOLATION** General, Force isolation, Motion isolation **VIBRATION SCREENING** Screening of vibration by use of open trenches, Passive screening by use of pile barriers, Illustrative Examples
Text books and Reference books	**Text Books:** [T1] Saran, S., *Soil Dynamics and Machine Foundations*, Galgotia, NDLS, 1999, [T2] Prakash S. and Pun V.K, *Soil Dynamics & Design foundation*, McGraw, LN, UK, 1998 **Reference Books:** [R1] Srinivasulu P. and Vaidanathan. C, *Handbook on machine Foundations*, McGraw Hill, NDLS, 1976, [R2] I.S.2974, Part I to IV, *Indian Standard Code Practice of Design and Construction of Machine Foundations*, 1987.
E-resources and other digital material	https://nptel.ac.in/courses/105/101/105101005/

17CE4702/C SOLID WASTE MANAGEMENT

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3502 - Environmental Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Analyze the sources and composition of Municipal Solid Waste.
	CO2	Analyze collection, transport and disposal of Municipal Solid Waste.
	CO3	Apply methods of separation and recycling of Municipal Solid Waste.
	CO4	Understand handling of Bio-medical, plastic and e-waste.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	H		L		L			H						**M**
CO2	H		H		H			H						**M**
CO3	H		L		L			H						**M**
CO4	H		L		L			H						**M**

Course Content

UNIT I

SOURCES, TYPES AND COMPOSITION OF MUNCIPAL SOLID WASTE

Sources, Types, Composition of Solid Waste, Effects of improper disposal of solid waste, public health effects, Types of materials recovered from MSW.

WASTE HANDLING, SEPARATION AND STORAGE

On - site handling and separation at solid waste, on - site storage of solid waste, options under Indian conditions.

UNIT II

COLLECTION OF MUNCIPAL SOLID WASTE

Methods of collection, equipment, types of vehicles, man power requirement.

TRANSFER AND TRANSPORT OF MUNCIPAL SOLID WASTE

Need for Transfer operations, Transfer Stations, Selection of Location of Transfer

	Stations, Transport means and methods. **UNIT III** **OFF-SITE PROCESSING,SEPARATION,TRANSFORMATION:** Size Reduction, Separation, Density separation, Magnetic Separation, Pyrolysis, Composting, Incineration. **DISPOSAL OF SOLID WASTE** Disposal of Solid Waste – Sanitary land Fills, Site selection, Planning, Design and operation of Sanitary land fills, Leachate collection. **UNIT – IV** **BIO-MEDICAL WASTE MANAGEMENT** Sources & generation of Bio-medical Waste, Biomedical Waste Management. **PLASTIC AND E-WASTE MANAGEMENT** Dangers of Plastics, Recycling of Plastic waste, Disposal of plastic waste. Health Hazards of E- waste, E- waste Management
Text books and Reference books	**Text Books:** [T1] Goerge,T. Hilary,T. & Samuel, A.V. *Integrated Solid waste management,* McGraw Hill Indian Edition, 2014. [T2] Amalendu,B. *Design of Land Fills and Integrated Solid waste management* , John Wiley & Sons 3RD Edition, 2004 **Reference Books:** [R1] *CPCB Manual on solid waste Management*, NDLS, 2016. [R2] Sasikumar,K. Sanoop,G. *Solid waste management*, PHI, NDLS, 2009 [R3] Urvashi,D. Solid waste management in India, NDLS, 2014
E-resources and other digital material	[1] www.nptel.ac.in/courses/120108005 [2] nptel.ac.in/courses/10510605 [3] https://www.coursera.org/learn/solid-waste-management

17CE4702/D RAILWAY ENGINEERING, DOCKS AND HARBOR ENGINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**													
	CO1	Understand the components of the Railway Track.												
	CO2	Analyze and prepare a section for Railway Track.												
	CO3	Apply Signaling System for a Railway Track.												
	CO4	Understand components of docks and harbors.												
Contribution of Course Outcomes towards achievement of Program Outcomes		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
	CO1	H	H			H									
	CO2	H		H								H		H	
	CO3		H			H									
(L – Low, M - Medium, H – High)	**CO4**	H		H								H			

Course Content

UNIT - I

INTRODUCTION TO RAILWAYS

Introduction to Railways, Comparison of railway and highways transportation; Classification of Indian, Railways, Gauges in Railway Track, Permanent way, Rails-Types.

COMPONENTS OF RAILWAY TRACK

Coning of Wheels, Rail failures, Creep of Rails, Rail Joints-Types of Joints, Sleepers-Types, stresses in track , Comparison of Sleepers Types of Ballast materials-Specifications of Indian Railways, Ballast Profile, Blanket or Sub Ballast, Specification for Blanket Material, Formation; Specifications of Formation, Compaction of Formation

UNIT - II

GEOMETRIC DESIGN OF RAILWAY TRACK

Geometric Design Necessity; Gradients & Gradient Compensation; Elements of

	horizontal alignment; Speeds on track, Super elevation; Cant deficiency and cant excess; Negative Super elevation. **GEOMETRIC DESIGN AT CURVES** Types of Transition Curve, Length of Transition Curve, Vertical curve and gradients, Length of vertical curve. **UNIT - III** **POINTS AND CROSSINGS & SIGNALLING** Switches, Components and types of crossing, Turnouts components, Types and its working principle , Classification of signals-types , Interlocking **STATION & STATION YARDS** Classification , Applications Brief on RDSO Rules and Recommendations. **UNIT - IV** **DOCKS** Dry Docks , Wet Docks and Slipways **HARBOR** Harbor Layout: types of harbors, port terms, site selection, Break Waters, Piers and wharves
Text books and Reference books	**Text Books:** [T1] Saxena, S.C. and Arora. S, *Railway Engineering*, Dhanpat Rai, NDLS, 2009. [T2] Hasmukh P. Oza, Gautam H. Oza , *Dock And Harbour Engineering*, Charotar, Anand, GJ, 2016. **Reference Books:** [R1] Agarwal, M M, *Railway Engineering*, Prabha , NDLS, 2018.
E-resources and other digital material	https://nptel.ac.in/courses/105/107/105107123/

17CE4702/E TOWN PLANNING AND ARCHITECTURE

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 1 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply knowledge of architectural history and theory.
	CO2	Understand basics of Landscape Design and Housing scenarios.
	CO3	Apply the Concepts and theories of urban design and basic principles of town planning
	CO4	Apply significant techniques used in drafting development plans and planning for different urban infrastructure systems.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	M			M			M				M			
CO2	M		H	H					M		H	H		
CO3	M	M	H					H			H			
CO4	M	M		H							H			

Course Content

UNIT - I

HISTORY OF ARCHITECTURE

Indian – Indus valley, Vedic, Buddhist, Indo-Aryan, Dravidian and
Mughal periods: European – Egyptian, Greek, Roman, medieval and renaissance periods construction and Architectural styles; vernacular and traditional architecture.Principles of Architecture.

ENVIRONMENTAL STUDIES IN BUILDING SCIENCE

Components of Ecosystem; ecological principles concerning environment; energy efficient building design; thermal comfort; solar architecture; principles of lighting and styles for illumination; basic principles of architectural acoustics.

UNIT – II

LANDSCAPE DESIGN

Principles of landscape design and site planning; history of landscape styles; landscape elements and materials.

	HOUSING: Concept of housing; neighborhood concept; site planning principles; housing 193 typology; housing infrastructure; housing policies, finance and management; housing programs in India; **UNIT – III** **URBAN DESIGN** Concepts and theories of urban design; Urban design interventions for sustainable development and transportation; Historical and modern examples of urban design; Public spaces, spatial qualities and Sense of Place; Elements of urban built environment – urban form, spaces, structure, pattern, etc; Urban renewal and conservation; Site planning; Landscape design; **CITY PLANNING:** Evolution of cities; principles of city planning; planning regulations, Development controls – FAR, densities and building byelaws; sustainable development. **UNIT – IV** **TECHNIQUES OF PLANNING** Planning survey techniques; preparation of development plans; site planning - principles and design; application of G.I.S and remote sensing techniques in urban and regional planning; **Urban Infrastructure, Services and Amenities:** Basic understanding of sustainable Development, green infrastructure; urban rainwater harvesting; power supply and communication systems - guidelines
Text books and Reference books	**Text Books:** [T1] Brown, P. *Indian Architecture (Buddhist and Hindu period)*, Taraporevala, CSTM, 2015. [T2] Bandopadhyay, A. *Text book of Town Planning*, Books and Allied, HRH, 2000. **Reference Books:** [R1] Evans.M, *Housing, Climate & Comfort*, Architectural , LN, UK, 1980. [R2] Grover,S. *The Architecture of India (Buddhist and Hindu period*), Vikas, NDLS, 2017.
E-resources and other digital material	nptel.ac.in/courses/105107067 www.pipsc.ca/portal/page/portal/website/memberservices/representation/.../ar.en.pdf

17CE4703/A ADVANCED DESIGN OF STEEL STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3601 - Design of Steel Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Analyze the loads on the roof trusses
	CO2	Evaluate safe section for Plate girders
	CO3	Evaluate safe section gantry girders
	CO4	Evaluate eccentric connections

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	M		M		H									
CO2	M		M		H									
CO3	M		M		H									
CO4	M		M		H									

Course Content

UNIT - I

ROOF TRUSSES

Introduction, Types of trusses, Various types of loads, Calculation of Wind loads, Load combinations and calculation of joint loads, Problems on evaluation of joint loads

PURLINS

Design of Purlin, Problems on Purlin Design

UNIT - II

INTRODUCTION TO GANTRY GIRDER

Introduction, Various loads, Load effects, explanation of how to calculate loads, Calculation of Maximum SF and Maximum BM using influence lines, Deflections

	DESIGN OF GANTRY GIRDER Design of Gantry Girder, Problems on design of gantry girder. **UNIT - III** **INTRODUCTION TO PLATE GIRDERS** Introduction to plate girder, Elements eccentric depth, Design of web and flanges, Design of plate girders without stiffeners, Problems **DESIGN OF PLATE GIRDERS** Design of plate girders with stiffeners, Design of plate girders with intermediate stiffeners, Problems on plate girders with intermediate stiffeners **UNIT - IV** **SEATED CONNECTIONS** Introduction to Connections, Unstiffened seated connections-bolted and welded, Stiffened seated connection-bolted and welded **BRACKET CONNECTIONS** Bracket Connections, type1-bolted and welded, Bracket connection type 2 - bolted and welded.
Text books and Reference books	**Text Books:** [T1] Duggal, S.K., *Limit State Design of Steel Structures*, McGraw-Hill, NDLS, 2019. [T2] Bhavikatti, S.S., *Design of Steel Structures-By Limit State Method as per IS:800-2007,* I. K. International Publishing House Pvt. Ltd., NDLS, 2019. **Reference Books:** [R1]Subramanian, N., *Design of Steel Structures-Limit State Method* Oxford University press, HYB, 2018. [R2] Ram, K.S.S., *Design of Steel Structures*, Pearson Education India, NDLS, 2015. [R3] Chandra, R. and Gehlot, V., Limit State Design of Steel Structures, Scientific Publishers, NDLS, 2010.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105/106/105106113/ [2] https://nptel.ac.in/courses/105/105/105105162/

17CE4703/B INDUSTRIAL EFFLUENT TREATMENT

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3502 Environmental Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the properties of industrial wastes
	CO2	Apply suitable treatment process for industrial waste
	CO3	Understand new concepts of waste water treatment
	CO4	Analyze the characteristics and treatment of different industrial wastes

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	H													M
CO2			H											M
CO3						H								M
CO4	H													M

Course Content

UNIT - I

SOURCES OF POLLUTION –
Physical, Chemical, Organic & Biological properties of Industrial Wastes - Difference between industrial & municipal waste waters.

EFFECTS OF INDUSTRIAL EFFLUENTS
Effects of industrial effluents on sewers and Natural water Bodies.

UNIT - II

PRE-TREATMENT-
Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste

PRIMARY TREATMENT –
Reduction-Volume Reduction-Strength Reduction.

	UNIT - III **WASTE TREATMENT METHODS** – Nitrification and De-nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process **SPECIAL TREATMENT AND DISPOSAL**- Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water. **UNIT - IV** **MANUFACTURING PROCESS -** Manufacturing Processes of Industries like Textile Mill Waste, Steel Plant Waste, Petrochemical Waste. **CHARACTERISTICS AND TREATMENT -** Composition of Industries like Textile Mill, Steel Plant, Petrochemical Waste.
Text books and Reference books	**Text Books:** [T1] Metcalf & Eddy, *Wastewater engineering Treatment disposal reuse*, Tata McGraw Hill. [T2] Eckenfelder, W.W., *Industrial Water Pollution Control*, McGraw-Hill **Reference Books:** [R1] Rao, M.N and Dutta – *Industrial Waste*. [R2] Mark J. Hammer, Mark J. Hammer, Jr., *Water & Wastewater Technology*, PHI, NDLS, [R3] Nemerrow, N.L., *Theories and practices of Industrial Waste Engineering.* [R4] C.G. Gurnham – Principles o Industrial Waste Engineering
E-resources and other digital material	https://nptel.ac.in/courses/105105178/ https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105106119/lec36.pdf

17CE4703/C INSTRUMENTATION AND SENSOR TECHNOLOGY IN CIVIL ENGINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand measurement units, types of measurement and errors in measurement
	CO2	Evaluate electrical variables, converse various measurements
	CO3	Understand various types of sensors and understand sensors used for temperature measurement
	CO4	Apply various sensors used in flow, pressure, level measurement

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	M				M								L	
CO2	M				M								L	
CO3	M				M								L	
CO4	M				M								L	

Course Content

UNIT - I

INTRODUCTION TO MEASUREMENT, INSTRUMENT TYPES

Introduction, Measurement units, Review of instrument types, Static characteristics of instruments, dynamic characteristics of instruments

MEASUREMENT ERRORS

Introduction, Gross and systematic errors, absolute errors and relative errors, accuracy precision, resolution and significant figures, measurement error combinations

UNIT - II

ELECTRICAL INDICATING AND TEST INSTRUMENTS

Introduction, Digital Meters, Analog Meters, Cathode ray oscilloscope, Digital storage oscilloscope

	VARIABLE CONVERSION ELEMENTS Introduction, Bridge circuits, Resistance Measurement, Inductance measurement, capacitance measurement, current measurement, frequency measurement, phase measurement **UNIT - III** **SENSOR TECHNOLOGIES** Introduction, Types of Sensors, Piezo electric Transducers, Ultrasonic Transducers **TEMPERATURE MEASUREMENT** Introduction, Principles of Temperature measurement, Thermoelectric effect sensors, Varying resistance devices, semiconductor devices, Radiation thermometers, thermography, Thermal expansion methods, Intelligent temperature measuring instruments **UNIT - IV** **PRESSURE MEASUREMENT** Introduction, Diaphragms, Capacitive Pressure sensor, Fibre-Optic Pressure sensor, Bellows, Bourbon tube, Manometers, Resonant Wide devices, Dead-weight gauge, Special measurement devices for low pressures, high-pressure measurement, Intelligent pressure transducers **FLOW MEASUREMENT & LEVEL MEASUREMENT** Introduction, Mass flow rate, Volume flow rate, Intelligent flow meters, Introduction to level measurement, Dipsticks, float systems, ultrasonic level gauge, radar methods, radiation methods, intelligent level measuring systems
Text books and Reference books	**Text Books:** [T1] Bell D. A., *Electronic Instrumentation and Measurements*, Oxford, LN, UK, 2007. [T2] Morris A. S. *Measurement and Instrumentation Principles*, Butterworth Hienemann,LN, UK, 2001. **Reference Books:** [R1] Tumanski S. *Principle of Electrical Measurement*, Taylor & Francis, LN, UK, 2006. [R2] Gertsbakh I. *Measurement Theory for Engineers*, Springer, BL, Germany, 2010.
E-resources and other digital material	[1] https://www.sensy.com/en/blog/instrumentation-for-civil-engineering-applications-b38 [2] https://www.iitk.ac.in/nicee/wcee/article/13_1791.pdf

17CE4703/D PAVEMENT DESIGN AND CONSTRUCTION

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the concept of layer system and factors affecting pavement design
	CO2	Evaluate the thickness of flexible pavement and rigid pavement
	CO3	Understand and fully conversant on construction of different types of pavements
	CO4	Evaluate and compute pavement overlays

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M		M											M
CO2	H		H										H	
CO3					H		L							M
CO4	H		H										H	

Course Content

UNIT - I

FLEXIBLE PAVEMENT

Requirements of highway pavement, Types of pavement structures, Flexible pavement components and functions, factors affecting design and performance of flexible pavements, stresses in flexible pavement- single layer system, two layer system

DESIGN OF FLEXIBLE PAVEMENT

CBR method, Flexible pavements design as per IRC guidelines IRC 37:2001, AASHTO Method- basis for AASHTO method, performance criteria, traffic and material inputs, pavement design as per AASTHO criteria.

UNIT - II

RIGID PAVEMENT

Rigid pavement components and functions, Types of joints, factors affecting design and

	performance of CC pavement, stresses in rigid pavement (numerical) **DESIGN OF RIGID PAVEMENTS** Design of rigid pavement as per IRC guidelines, design of joints, design of dowel bars, design of tie bars **UNIT - III** **CONSTRUCTION OF FLEXIBLE PAVEMENTS** Construction of highway embankment – material, construction steps, QC checks, Construction of subgrade - material, construction steps, QC checks, Equipment for compaction of soils, Equipment for excavation of earth, Construction of GSB – material, construction, QC checks, Construction of Base course- WMM material, construction steps, QC checks, Preparations before constructing bituminous layer over GSB, Preparations before laying bituminous pavement layer over existing bituminous layer, Prime coat, tack coat, Construction of bituminous macadam – materials, construction steps, QC checks, Dense graded bituminous mixes – materials, construction steps, QC checks, **CONSTRUCTION OF RIGID PAVEMENTS** Construction of CC pavement- construction of supporting layers, construction of cc pavement slab, construction of joints, QC checks, Interlocking concrete block pavements, **UNIT - IV** **PAVEMENT EVALUATION** Pavement deterioration, objectives of maintenance, classification of maintenance, structural evaluation of flexible pavement- principle of FWD method, Evaluation by Benkelman beam method (no numerical), **PAVEMENT OVERLAYS** Design of flexible pavement overlay using BBD data, strengthening existing flexible pavement by overlays, strengthening of cc pavements by overlays.
Text books and Reference books	**Text Books:** [T1] Khanna, S.K., Justo, C.E.G., Veeraragavan, A. *Highway Engineering*, Nem Chand RK, 2018. [T2] *AASHTO Guide for Design of Pavement Structures*, American Association of State Highway and Transportation Officials (AASHTO), 1993 **Reference Books:** [R1] Yang, H.H. *Pavement Analysis and Design*, Pearson, NJ, 2004 [R2] Chakraborthy, P., Das, A. *Principles of Transportation Engineering*, PHI, NDLS, 2017.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105/105/105105107/ [2] https://nptel.ac.in/courses/105/101/105101087/

17CE4703/E FORENSICS IN CIVIL ENGINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3509: Design of concrete structures 17CE3608: Foundation engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply forensic engineering to demonstrate structural and geotechnical failures
	CO2	Understand reinforced concrete Structures and steel structure failures through case studies
	CO3	Evaluate different geotechnical failures through case studies
	CO4	Analyze reasons for geo-environmental and fluid and hydraulic failures

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	M	L	M								H			M
CO2	M	L	M								H			M
CO3	M	L	M								H			M
CO4	M	L	M											M

Course Content

UNIT - I

INTRODUCTION

Definition of a Forensic Engineer, Typical Clients, Types of Damage, Civil litigation, Important legal terms, Causes of failure, Preliminary information about failure, Data collection, Hierarchy of forensic investigation.

FORENSIC STRUCTURAL INVESTIGATION

Load tests, Instrumentation, Dimensional measurements, concrete and masonry tests, Metal tests, Wood tests, Weld tests, water and air penetration tests, Heat loss tests.

UNIT - II

FORENSIC GEOTECHNICAL INVESTIGATION

Bore hole logs, Penetration tests (SPT, CPT), Test Pits, In-place strength tests, Instrumentation, Dimensional Measurements, Seismic tests.

REINFORCED CONCRETE STRUCTURES CASE STUDIES

Skyline Plaza in Bailey's Crossroads, Bombing of the Oklahoma City Murrah Federal Building, The Pentagon Attack, Harbour Cay Condominium

	UNIT - III **STEEL STRUCTURES CASE STUDIES** The World Trade Center Attacks, Pittsburgh Convention Center Expansion Joint Failure, Minneapolis I-35W Bridge Collapse, Hartford Civic Center Stadium Collapse **GEOTECHNICAL CASE STUDIES** Leaning tower of Pisa, Teton Dam, Vaiont Dam Reservoir Slope Stability Failure, Excavation failure, Reclamation bund failure, High way failure **UNIT - IV** **GEO-ENVIRONMENTAL CASE STUDIES** Love Canal, Valley of the Drums, Stringfellow Acid Pits, Kettleman Hills Waste Landfill, North Battleford, Saskatchewan Water Treatment Failure **FLUID MECHANICS AND HYDRAULICS CASE STUDIES:** Johnstown Flood, Malpasset Dam, Schoharie Creek Bridge, New Orleans Hurricane Katrina Levee Failures
Text books and Reference books	**Text Books:** [T1] Robert, W. D., *Forensic Geotechnical and Foundation Engineering*, Second Edition, McGraw-Hill, NY, US, 2011. [T2] Delatte, N. J., *Beyond Failure –Forensic case studies for Civil Engineers,* ASCE, US, 2009. **Reference Books:** [R1] Kenneth, L. C., *Forensic Engineering*, CRC Press, 2nd Edition, NY, US, 2000 [R2] Rao, V.V.S. and Babu, G. L. S., *Forensic Geotechnical Engineering*, Developments in Geotechnical Engineering series, Springer, SG, 2016. [R3] Paul, A.B., Pamalee, A. B., Norbert, J. D. and Kevin, M. P., *Failure case studies in civil Engineering-Structures, Foundations and Geoenvironment,* 2nd Edition, ASCE, Virginia, US, 2013
E-resources and other digital material	[1] NIL

17CE4704/A DESIGN OF PRESTRESSED CONCRETE

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3509 - Design of RC Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the concept of prestressing and systems of prestressing
	CO2	Evaluate losses of pre-stressing
	CO3	Analyze the section for safety of a pre-stressed beam.
	CO4	Analyze end anchorages for prestressing beams.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	L		L											
CO2			H		H									
CO3	L		H		H								H	
CO4	L		H		H								H	

Course Content

UNIT – I

INTRODUCTION AND SYSTEMS

Basic concepts of pre stressing; Historical development; Need for High strength steel and High strength concrete; Advantages of prestressed concrete. Tensioning devices; Hoyer's long line system of pre tensioning; Post tensioning systems; Detailed study of Freyssinet system and Gifford – Udall system; Thermo – electric prestressing; Chemical prestressing.

LOSSES OF PRESTRESS

Types of losses in pre and post tensioning ;Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

UNIT – II

ANALYSIS OF PRESTRESS AND BENDING STRESSES

Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure

	(Thrust) line and internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment. **DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS** Importance of control of deflections; Factors influencing deflections; Short term and long term deflections of un cracked members. **UNIT – III** **ELASTIC DESIGN OF PRESTRESSED CONCRETE SECTIONS FOR FLEXURE** Permissible compressive stresses in concrete as per IS 1343; Elastic design of rectangular and I – sections of TYPE 1, TYPE 2 members, LINs approach. **ULTIMATE FLEXURAL STRENGTH OF PRE-STRESSED CONCRETE MEMBERS:** Modes of failure, Ultimate flexural strength of pre-stressed concrete members of rectangular , flanged sections **UNIT – IV** **SHEAR RESISTANCE** Shear and Principal stresses; Ultimate shear resistance of prestressed concrete members; Design of shear reinforcement **TRANSFER OF PRESTRESS IN PRE–TENSIONED MEMBERS** **& ANCHORAGE ZONE STRESSES IN POST-TENSIONED MEMBERS** Transmission of prestressing force by bond; Transmission length; Bond stresses; Transverse tensile stresses; End zone reinforcement; Stress distribution in end block; Investigations on anchorage zone stresses by IS code method; Anchorage zone reinforcements; Design of anchorage and end block.
Text books and Reference books	**Text Books:** [T1] KrishnaRaju, N. *Pre-stressed Concrete*. Tata Mc Graw - Hill, NDLS, 2012. [T2] Lin, T.Y. and Burns, N.E.D.H. *Design of Prestressed Concrete Structures*, John Wiley, LN,UK, 2010 **Reference Books:** [R1] RajaGopalan, N. *Prestressed Concrete*, Narosa, NDLS, 2005 [R2] Ramamrutham, S. *Prestressed Concrete Structures*, Dhanpat Rai, NDLS, 2009. [R3] IS1343-2012: Prestressed Concrete Code.
E-resources and other digital material	www.nptel.ac.in/courses/105106117 nptel.ac.in/courses/105106118 www.nptelvidoes.in/2012/11prestressedconcrete-structures/html

17CE4704/B CONSTRUCTION EQUIPMENT AND AUTOMATION

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3401 - Building Materials and Construction	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply the working procedures of Equipments for earthwork & other construction Activities
	CO2	Understand working procedures of material handling and production equipments.
	CO3	Apply the concept & procedure of automation systems and Identify Fire safety Equipment
	CO4	Analyze the various processes of HVAC & Security

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	**L**				**H**	**M**	**L**	**H**	**M**	**H**				**L**
	CO2	**L**				**H**	**M**	**L**	**H**	**M**	**H**				**M**
	CO3	**M**	**M**			**H**	**H**	**L**	**H**	**M**	**H**			**L**	**M**
	CO4	**M**	**M**			**H**	**H**	**L**	**H**	**M**	**H**			**L**	**M**

Course Content

UNIT – I

EQUIPMENT FOR EARTHWORK:

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers.

OTHER CONSTRUCTION EQUIPMENTS:

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment – Equipment for Demolition, Road making Equipments

UNIT – II

MATERIALS HANDLING EQUIPMENT:

Cranes, Hoists, Forklifts and related equipment - Portable Material Bins – Conveyors – Hauling Equipment.

	EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING Crushers and crushing Plants, Compressor, Feeders, Screening Equipment, Handling Equipment, Batching and Mixing Equipment, Hauling, Pouring and Pumping Equipment , Transporters. **UNIT – III** **INTRODUCTION BUILDING AUTOMATION SYSTEMS** Concept and application of Building Automation System, requirements and design considerations and its effect on functional efficiency, architecture and components of BAS. **FIRE ALARM SYSTEM DETAILS STANDARDS** Fundamentals: Fire modes, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. FAS Architectures, loop, Examples. Fire Standards: IS Concept of fire & alarm system. **UNIT - IV** **ACCESS-CONTROLSECURITY-SYSTEMS** Access Control System: Components, Design. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, Network design, Storage design. Components. Security Systems, Concepts, Components, Technology, Advanced Applications, Security system design. **HVAC – HEATING, VENTILATION & AIR CONDITIONING SYSTEM** HVAC basic processes, Air Properties, Psychometric Chart, Heat Transfer-mechanisms, Human comfort zones, Effect of Heat, Humidity, Heat loss. Heating Process & Applications, Cooling Process & Applications, Ventilation Process & Applications. Instrumentation Basics, Field components & use. Air conditioning Components.
Text books and Reference books	**Text Books:** [T1] Sharma S.C. *Construction Equipment and Management*, Khanna, NDLS, 1988. [T2] Deodhar, S.V. *Construction Equipment and Job Planning*, Khanna, NDLS, 1988. **Reference Books:** [R1] Varma, M., *Construction Equipment and its planning and Application*, Metropolitan, NDLS. 1983. [R2] Gagnon. R. *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar, NY, US, 2007. [R3] Levenhagen, Spethmann. J.I, Donald . *HVAC Controls and Systems* , McGraw-Hill, SG, 1994.
E-resources and other digital material	[1] http://nptel.ac.in/video.php [2]https://buildingsolutions.honeywell.com/en-US/Pages/default.aspx [3]http://www.isa.org

17CE4704/C OPEN CHANNEL FLOW AND RIVER ENEINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3404– Hydraulics & Hydraulic Machines	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply energy principles and analyze Uniform flow.
	CO2	Evaluate Gradually varied flow and Rapidly varied flow profiles.
	CO3	Understand the behavior of flow through non-prismatic channels.
	CO4	Understand the concept of analysis of river flow hydraulics.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	H	M	H											H
CO2	H	M	H											H
CO3	H	M	H										M	H
CO4	H	M	H										M	H

Course Content

UNIT I

OPEN CHANNEL FLOW

Basic concepts of free surface flow; Velocity and Pressure distribution; Differential form of continuity and momentum equations; Energy principles and applications; Energy equation; energy and momentum correction coefficients.

STEADY UNIFORM FLOW

Shear stress on the boundary; chezy's equation amdn Mannings formula; Resistance formulae for practical use; Equivalent roughness; Uniform flow computations; Computation of Normal depth; Compound Sections

UNIT II

GRADUALLY VARIED FLOW

Gradually varied flow; Governing equations; Classification of surface profiles; Computation of gradually varied flow in Prismatic and Non-Prismatic channels – Graphical and Direct integration methods.

	RAPIDLY VARIED FLOW Application of Momentum equation; Hydraulic Jump in horizontal and sloping rectangular channels, Basic characteristics of the Jump; location and length of jump; Jump as energy dissipater; Control of Jump by Sills. **UNIT – III** **FLOW THROUGH NON-PRISMATIC CHANNELS** Sudden Transitions; Subcritical flow through sudden Transitions; Contractions and Expansions in Supercritical flow; constrictions; Subcritical flow through Constrictions; Backwater effect due to Constriction. **RAPIDLY VARIED UNSTEADY FLOW** Waves and classification; Celerity of waves; Moving Hydraulic Jump; Surges; Equations of motion; Method of Characteristics. **UNIT IV** **FLUVIAL HYDRAULICS** Basic characteristics of river beds and sediments, Initiation of motion; regimes of flow; Resistance to flow in alluvial streams; Theories of Bed Load, Suspended Load and Total Load. **RIVER ENGINEERING** Classification of Rivers; Meandering - Causes; Features of Meandering – Factors controlling process of Meandering; Cutoffs; Guide Banks; Groynes; River training and its objectives; Classification of river training works; Methods river training works.
Text books and Reference books	**Text Books:** [1] Subramanya, K. "Flow in Open Channels", 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2008. [2] Punmia, B.C. and Pande B.B. Lal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 2010. **Reference Books:** [1 Chow, V.T. "Open Channel Hydraulics", Mc Graw Hill Book Company, Inc. London, Reprint, Blackburn Press, 2009. [2] Garde and Ranga Raju, K.G., "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern, New Delhi, 1979.
E-resources and other digital material	[1] IIT/Kharagpur – "www.nptel.ac.in / courses/105105110/" [2] IIT/Roorkee – "www.nptel.ac.in/courses/105107059/"

17CE4704/D ENVIRONMENTAL GEOTECHNOLOGY

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand concepts and principles of environmental geotechnology
	CO2	Apply the concepts in evolving various components of waste containment facility
	CO3	Evaluate and remediate contaminated sites
	CO4	Understand geotechnical re-use of waste

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	H						H							H
CO2	H		H			H								H
CO3	H			H	L									
CO4	H				L		L							H

Course Content

UNIT - I

FUNDAMENTALS OF ENVIRONMENTAL GEOTECHNOLOGY
Introduction; Scope of Environmental Geotechnology; Sources of contamination; Types of contaminants; Impact of subsurface contamination

SOURCES AND CHARACTERISTICS OF WASTES;
Waste characterization; Environmental concerns with wastes; Waste management strategies; Engineered waste disposal facilities

UNIT - II

SOIL - WATER INTERACTION;
Soil mineralogy characterization and its significance in determining soil behavior; Soil-water interaction and concepts of double layer; Forces of interaction between soil particles.

	CONTAMINANT TRANSPORT Soil-water-contaminant interactions and its implications; Factors effecting retention and transport of contaminants **UNIT - III** **CONTAINMENT FACILITY;** Concept and principles of waste containment; Site selection criteria for containment facility; Different components of waste containment system; Design of waste containment facilities **CONTAMINATED SITE ASSESSMENT** Need for contaminated site characterization, Characterization methods – Electromagnetic resistivity; Ground penetrating radar; Electrochemical and electro-optical sensing methods **UNIT - IV** **CONTAMINATED SITE REMEDIATION:** Remediation methods for subsurface contamination; Selection and planning of remediation methods, bio – remediation, incineration, soil washing, electro kinetics, soil heating, **RECYCLING AND REUSE** Geotechnical reuse of waste materials; Waste characteristics for soil replacement; Waste materials suitable for geotechnical construction
Text books and Reference books	**Text Books:** [T1] Sharma, H.D. and Reddy, K.R., *Geoenvironmental Engineering,* John Wiley.NY,USA, 2004. [T2] Gulhati, S.K. and Datta M., *Geotechnical Engineering,* McGraw Hill India, NDLS, 2005.. **Reference Books:** [R1] Rowe, R. K. - *Geotechnical and Geoenvironmental Engineering Handbook*, Kluwer Academic,AM, Netherland, 2001. [R2] Reddy, L.N. and Inyang, H.I. - *Geoenvironmental Engineering: Principles and Applications*, CRC Press,FL,USA 2000. [R3] Mohamed, A.M.O. and Antia, H.E., *Geoenvironmental Engineering*, Elsevier, AM, Netherlands, 1998.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105102160/ [2] https://nptel.ac.in/courses/105103025/

17CE4704/E TRAFFIC ENGINEERING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**														
	CO1	Analyze the traffic flow and conduct necessary studies.													
	CO2	Evaluate traffic stream characteristics.													
	CO3	Analyze highway capacity.													
	CO4	Analyze traffic signal systems.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	H	H			H									
	CO2	H	H			H									
	CO3	H	H			H									
	CO4	H		H		H									

Course Content

UNIT-I

TRAFFIC CHARACTERISTICS MEASUREMENT

Basic traffic Characteristics - Speed, Volume and density. Relationship between Flow, Speed and density, Traffic stream models, moving observer method. Traffic Measurement and Analysis - Volume Studies - Objectives, Methods; Speed studies – Objectives, Definition of Spot Speed, time mean speed and space mean speed; Methods of conducting speed studies. Intrusive and non-intrusive technologies, travel time data collection.

ANALYSIS OF TRAFFIC DATA

Presentation of speed study data: cumulative frequency graphs, fitting normal distribution, percentile speeds; Head ways and Gaps; Critical Gap; Gap acceptance studies; headway distribution models.

	UNIT-II **HIGHWAY CAPACITY AND LEVEL OF SERVICE** Basic definitions related to capacity; Level of service concept; Factors affecting capacity and level of service; Computation of capacity and level of service for two lane highways, Urban streets, Multilane highways and freeways. **PARKING ANALYSIS** Types of parking facilities – On-street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume. **UNIT-III** **TRAFFIC SAFETY** Traffic Safety -Accident studies and analysis; Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents. **TRAFFIC SIGNALS** Traffic Signals –Types of Signals; design principles of a traffic signal, capacity and level of service of a signalized intersection, Principles of Phasing; Timing Diagram; Design of Isolated Traffic Signal by Webster method, Warrants for signalization. Signal Coordination - Signal Coordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems. **UNIT-IV** **TRAFFIC AND ENVIRONMENT** Detrimental effects of Traffic on Environment, Air pollution; Noise Pollution; Measures to curtail environmental degradation due to traffic. **SUSTAINABLE TRANSPORTATION AND THE ROLE OF TECHNOLOGY** Sustainable Transportation: Sustainable modes, Transit Oriented Development, ITS based benefits for Environment.
Text books and Reference books	**Text Books:** [T1] Kadiyali, L.R., "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 2006. [T2] Principles of Highway Engineering and Traffic Analysis- Fred L. Mannering, Scott S.Washburn and Walter P.Kilareski. Wiley India.

	Reference Books: [R1] Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication, 2003. [R2] Principles of Transportation Engineering- P.Chakraoborthy and Animesh Das, Prentic Hall India. [R3] Indian Highway Capacity Manual (2017), Central road research institute, New Delhi
E-resources and other digital material	http://nptel.ac.in/syllabus/syllabus.php?subjectId=105101008 http://nptel.ac.in/syllabus/syllabus.php?subjectId=105102019

17CE4705/A FINITE ELEMENT ANALYSIS

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17MA1101- Matrix Algebra & Basic Mathematics courses 17CE3503 - Structural Analysis	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Apply elasticity principles to finite element analysis
	CO2	Apply finite element formulation techniques
	CO3	Apply stiffness matrix formulation using different element configurations
	CO4	Analyze trusses and beams using finite element analysis

Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	L		M		L								L	
	CO2	L												L	
	CO3	M		L		L								M	
	CO4	M		M		L								M	

Course Content

UNIT - I

INTRODUCTION TO FINITE ELEMENT ANALYSIS

Introduction, Basic Concepts of Finite Element Analysis, Introduction to Elasticity; Steps in Finite Element Analysis

FINITE ELEMENT FORMULATION TECHNIQUES

Virtual Work and Variational Principle, Galerkin Method, Finite Element Method: Displacement Approach ,Stiffness Matrix and Boundary Conditions

UNIT - II

ELEMENT PROPERTIES

Natural Coordinates, Triangular Elements, Rectangular, Lagrange and Serendipity Elements, Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoperimetric Elements

	NUMERICAL INTEGRATION One Dimensional, Numerical Integration: Two and Three Dimensional **UNIT – III** **ANALYSIS OF TRUSSES** Stiffness of Truss Members, Analysis of Truss **ANALYSIS OF BEAMS** Stiffness of Beam Members, Finite Element Analysis of Continuous Beam **UNIT – IV** **FEM FOR TWO DIMENSIONAL PROBLEMS** Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of Element Stiffness **FEM FOR THREE DIMENSIONAL SOLIDS** Finite Element Formulation for 3 Dimensional Elements
Text books and Reference books	**Text Books:** [T1] Cook, R.D. Malkus, D.S and Plesha. *Concepts in Finite Element Analysis*, John Wiley, NY, US, 2004. [T2] Rao, S.S. *Finite Elemen Analysis*, Elsevier Butterworth-Heinemann, NY, US, 2017 **Reference Books:** [R1] Logan, D. L. *AFirst Course in the Finite Element Method*, Thomson Engineering, CAN, 2001. [R2] Jalaudeen, M. D. *Finite Element Analysis in Engineering,* Anuradha, MAS, 2013.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105/105/105105041/

17CE4705/B REPAIR AND REHABILITATION OF STRUCTURES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the causes for deterioration of structures
	CO2	Analyze damage to structures
	CO3	Apply the methods of reinforcement protection and repair materials
	CO4	Apply the techniques for repair and methods of strengthening

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1		H												H
CO2				H										H
CO3			H											H
CO4			H										H	

Course Content

UNIT – I

INTRODUCTION

Introduction; Definition - Repair, Maintenance and Rehabilitation; Maintenance; Importance of Maintenance; Facets of Maintenance

CAUSES OF DAMAGE TO STRUCTURES

Causes of Distress in Structures - Extrinsic and Intrinsic causes for damage of structures; Effect of Chemical and Marine Environment on structures

UNIT - II

SEMI DESTRUCTIVE TESTS FOR DAMAGE ASSESSMENT

Core Test, LOK test, CAPO test, Penetration Tests

NON DESTRUCTIVE TESTS FOR DAMAGE ASSESSMENT

Rebound Hammer Test, Ultrasonic Pulse Velocity test,Resistivity Test, Carbonation Test

	UNIT - III **REINFORCEMENT PROTECTION** Methods of corrosion prevention - corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection **REPAIR MATERIALS** Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete **UNIT - IV** **TECHNIQUES FOR REPAIR** Crack repair techniques – Crack Stitching, Mortar and dry pack, vacuum concrete, Shotcreting, Epoxy injection, Mortar repair for cracks, **METHODS OF STRENGTHENING** Repairs to overcome low member strength – Jacketing, blanketing
Text books and Reference books	**Text Books:** [T1] CPWD Hand book on Repair and Rehabilitation of RCC Buildings, NDLS 2008 [T2] Santha kumar A.R. *Concrete Technology*, Oxford, LN, U.K, 2006 **Reference Books:** [R1] Edwards, S.C., Shaw, J.D.N. and Allen, R.T. *Repair of Concrete Structures*, Span Press, GW, UK, 1993 [R2] Jacob Feld and Kenneth L Carper, *Structural Failures*, John Wiley & Sons, NY. US,1997
E-resources and other digital material	[1] http://nptel.ac.in/courses/114106035/38

17CE4705/C DISASTER PREPAREDNESS AND PLANNING MANAGEMENT

Course Category:	Programme Elective	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial -Practice:**	2 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**													
	CO1	**Understand the vulnerability and risk for a given society**												
	CO2	**Evaluate the damage & life loss during disasters**												
	CO3	**Analyze the requirement of rehabilitation or retrofitting post disaster**												
	CO4	**Evaluate disaster mitigation programme.**												
Contribution of Course Outcomes towards achievement of Program Outcomes		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	L	M			L									M
	CO2	L	M			L									M
	CO3	L	M			H									M
(L – Low, M - Medium, H – High)	**CO4**	L	M			L									M

Course Content

UNIT – I

INTRODUCTION TO HAZARDS

Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

DISASTERS

Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT – II

TROPICAL IMPACT OFDISASTER

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs);

	GLOBAL IMPACT OF DISASTERS Hazard locations; global and national disaster trends; climate change and urban disasters. **UNIT-III** **DISASTER MITIGATION & POST DISASTER ISSUES** **DISASTER MITIGATION** Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, **POST DISASTER ISSUES** Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority. **Unit - IV:** **DISASTERS, ENVIRONMENT AND DEVELOPMENT** Disasters due to Developmental activities, factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.) **SUSTAINABLE DEVELPMENT** Sustainable and environmental friendly recovery; reconstruction and development methods.
Text books and Reference books	**Text Books:** [T1] Subramanian, R., *Disaster Management*, Vikash Publishing House Pvt. Ltd., Noida, 2018 [T2] Sahni, P. and Ariyabandu, M. M., *Disaster Risk Reduction in South Asia*, Prentice Hall, NDLS, 2004 **Reference Books:** [R1] Carter, W.N., *Disaster Management: A Disaster Manager's Handbook*, Manila, ADB, 2006. [R2] Andrew, C. and Spence, R., *Earthquake Protection*, John-Wiley & Sons, NY, 2002. [R3] Sinvhal, A., *Understanding Earthquake Disaster*, McGraw Hill, NDLS, 2011.
E-resources and other digital material	Open web

17CE4705/D HIGHWAY SAFETY

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the road accidents and road safety improvement strategies
	CO2	Analyze the crash data using statistical methods & conduct road safety audits
	CO3	Understand the mechanism needed for crash reconstruction based on case studies
	CO4	Apply accident mitigation measures in view of safety of user on a highway

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1				L										
	CO2		H	H	M	L									L
	CO3			M		L									L
	CO4		M	M	H							M			

Course Content

UNIT I

INTRODUCTION TO TRAFFIC SAFETY

Road accidents, trends, causes, collision and condition diagrams, highway safety, human factors, vehicle factors.

SAFETY MANAGEMENT SYSTEMS AND STRATEGIES

Road safety management system, road safety improvement strategies, elements of a road safety plan, safety data needs.

UNIT II

STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH DATA

Before-after methods in crash analysis, statistical methods for traffic safety analysis: Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons., Black Spot Identification & Investigations, Case Studies.

	ROAD SAFETY AUDITS Key elements of a road safety audit, Road Safety Audits and Investigations, Crash investigation and analysis, Describe methods for identifying hazardous road locations, Case Studies. **UNIT-III** **CRASH RECONSTRUCTION** Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction. **CASE STUDIES FOR CRASHES AND ACCIDENTS** Speed for various skid, friction, and drag, and acceleration scenarios, crash vs accident, Case Studies. **UNIT-IV** **ACCIDENT MITIGATION MEASURES** Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Traffic calming. **TRAFIC MANAGEMENT EDUCATION AND ENFORCEMENT** Traffic management measures and their influence in accident prevention, legislation, enforcement, education and propaganda. Salient features of Motor vehicle act, 2019: registration and licensing authorities in India: Their powers and duties, legal requirements to be met for driving various classes of vehicles. classification of traffic offences. Penalties and appeals.
Text books and Reference books	**Text Books:** [T1] Kadiyali,L.R. *Trafffic Engineering and Transport Planning*, Khanna , NDLS, 2017. [T2] Khanna, S.K. and Justo, C E G. , *Highway Engineering*. Nem Chand, RR, 2001 **Reference Books:** [R1] Hauer, E. , *Observational Before-After Studies in Road Safety*, Pergamon, Turkey, 1997 [R2] Stannard Baker. J, *Traffic Accident Investigation Manual*, The traffic Institute Northwestern University, IL, US, 2019. [R3] Shinar, D., *Traffic safety and human behavior*, Emerald, WY, UK, 2017.
E-resources and other digital material	[E1] https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_42.pdf [E2] https://nptel.ac.in/courses/105101008/downloads/cete_42.pdf [E3] https://roadsafety.piarc.org/en/road-safety-management [E4] http://erso.swov.nl/knowledge/content/10_rsm/the_road_safety_management_system.html [E5] http://www.nimhans.ac.in/sites/default/files/UL_BR_b007_Summery%20rprt.pdf [E6] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2700566/ [E7] https://safety.fhwa.dot.gov/provencountermeasures/

17CE4705/E ENVIRONMENTAL IMPACT ASSESSMENT

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17MC1407A - Environmental Studies	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the Concept of EIA, EIA methodologies.
	CO2	Analyze the effect on different sources on developmental activities.
	CO3	Analyze the effect of development on flora and fauna.
	CO4	Understand the different acts and case studies.

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	H													M
	CO2	H						H							M
	CO3	H						H							M
	CO4										H				M

Course Content

UNIT – I

INTRODUCTION

Salient Features of EIA, EIA Procedure – Analytical functions of EIA – classification and prediction of impacts -Elements of EIA - Factors affecting EIA - Impact evaluation and analysis - Preparation of environmental base map - Classification of environmental parameters.

EIA METHODOLOGIES

Criteria for the selection of EIA Methodology – EIA methods - Adhoc methods, matrix methods, network method - Environmental medium quality index method, overlay methods and cost/benefit analysis.

UNIT – II

ENVIRONMENTAL IMPACT ASSESSMENT ON SOIL AND GROUND WATER

Introduction, Prediction and assessment - Soil quality -Methodology for the

	assessment of soil and groundwater - Delineation of study area - Identification of activities. **ENVIRONMENTAL IMPACT ASSESSMENT OF SURFACE WATER AND AIR** Impact prediction - Assessment of impact significance - Identification and incorporationof mitigation measures - EIA in surface water, air and biological environment:Methodology for the assessment of impacts on surface water environment. Air pollutionsources, Air pollution effect - Generalized approach for assessment of air pollution Impact **UNIT - III** **ASSEMENT OF IMPACT ON VEGETATION AND WILDLIFE** Assessment of impact of developmental activities on vegetation and wildlife - Environmental impact of deforestation – Causes and effects of deforestation. **ENVIRONMENTAL AUDIT** Environmental audit and environmental legislation - Objectives of environmental audit - Types of environmental audit - Audit protocol - Stages of environmental audit - Onsite activities - Evaluation of audit data and preparation of audit report. **UNIT - IV** **ENVIRONMENTAL ACTS:** Post audit activities - The Environmental protection act - The water act - The air act - Wild life act. **CASE STUDIES** Case studies and preparation of environmental impact assessment statement for various industries.
Text books and Reference books	**Text Books:** [T1] Anjaneyulu, Y., *Environmental Impact Assessment Methodologies*, B.S. Publications, HYB, 2010. [T2] Glynn. J, and Gary W. Heinke, *Environmental Science and Engineering*, PHI, NDLS, 1996. **Reference Books:** [R1] Dhameja,S.K., *Environmental Engineering and Management*, Kataria, NDLS, 2010. [R2] Bhatia,H.S., *A Text Book of Environmental Pollution and Control*, Galgotia NDLS, 2003.
E-resources and other digital material	https://nptel.ac.in/courses/120/108/120108004/

17CE3706 ESTIMATION, COSTING AND VALUATION

Course Category:	Programme Core	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial -Practice:**	2 - 0 – 0
Prerequisites:	**Building planning and Design lab- 17CE3452**	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand the Drawings, Procedures and different Estimating methods of Buildings.
	CO2	Apply suitableprocedures to estimate R.C.C works, Road and Canal works.
	CO3	Evaluate the rates for different civil engineering works and apply Specifications
	CO4	Evaluate valuation of buildings based on rent and understand PWD procedures

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**L**		**H**											
CO2	**L**		**H**											
CO3	**L**		**H**										**M**	
CO4	**L**		**H**							**M**				

Course Content

UNIT - I

PROCEDURE AND METHODS OF BUILDING ESTIMATES

Introduction, Main items of work, Deduction for openings Degree of accuracy; Units of measurement. Individual wall method; Centre line method ;comparison

ESTIMATE OF BUILDINGS:
Estimate of RCC framed residential building with footings,

UNIT - II

ESTIMATE OF RCC WORKS AND ROAD ESTIMATE
Standard hooks and cranks; RCC beam; Estimate of earthwork; Estimate of earthwork of road from longitudinal sections

	CANAL ESTIMATE Earthwork in canals, Estimate of earthwork in irrigation channel both in banking and cutting.. **UNIT - III** **SPECIFICATIONS** Purpose and method of writing specifications; Detailed Specifications for Brick work; R.C.C work; Plastering; **ANALYSIS OF RATES** Task or out - turn work; Labour and materials required for different works; Rates of materials and Labour; Preparing analysis of rates for the following items of work: RCC slab Works ,Brick work in super structure . **UNIT – IV** **PWD ACCOUNTS AND PROCEDURE OF WORKS** Organization of Engineering department; Contract; Tender; Tender notice; Earnest money; Security money; Measurement book; Revised Estimate; Supplementary estimate. **VALUATION OF BUILDINGS** Introduction, Methods of valuation; Out goings; Depreciation; Gross income; Net income; Scrap value; Salvage value; Obsolescence; sinking fund, Capitalized value; Years purchase; :Methods of depreciation; Valuation of building based on rents
Text books and Reference books	**Text Books:** [T1] Dutta, B.N , *Estimating & Costing in Civil Engineering,* U. B. S. ,NDLS, 2016. [T2] Rangwala. *Estimating, Costing & Valuation,* Universal , NDLS, 2017. **Reference Books:** [R1] D. D. Kohli and R. C. Kohli., Estimating and Costing, S. Chand Publications-New Delhi-2013 [R2] Chakrborthy, M. *Estimating & costing, Variuos, NDLS,2012.*
E-resources and other digital material	http://nptel.ac.in/courses/105103093/15

17CE4751 COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB-II

Course Category:	Programme Core	**Credits:**	1
Course Type:	Practical	**Lecture - Tutorial -Practice:**	0 - 0 – 2
Prerequisites:	17CE3509 Design of Concrete Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes

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

CO1	Evaluate cross sectional and reinforcement requirements of various structural elements by using STAAD.Pro
CO2	Evaluate quantities and prepare rate analysis for various works in construction of a building using Spread Sheets.

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**M**		**M**		**H**								**H**	**L**
CO2	**H**		**L**		**L**								**L**	**H**

Course Content

PART-A

Analysis of the following concrete & steel structural elements using STAAD. Pro Software.

1. Design of continuous beam.
2. Design of plane frame
3. Design of space frame.
4. Design of G+4 Residential building: Creating model from the given drawing, Assigning Loads and Load Combinations
5. Design of G+4 Residential building: Preparation of detail drawing
6. Design of G+4 Residential building: Preparation of Design Documents
7. Design of Roof Truss

PART – B

1. Estimate & Working out rates using spread sheets for the different items in a single story building.
2. Demonstration of software's ETABS, SAP, CYPE

17CE4801/A EARTHQUAKE RESISTNAT DESIGN

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	Nil	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	understand about an Engineering seismology
	CO2	understand building categories, seismic behavior and dynamics of structures earthquake causes, ground motion behavior, Seismic resistant building architecture
	CO3	analyze equivalent lateral seismic loads and carryout a seismic design as per IS codal provisions and ductility design for RC elements
	CO4	evaluate the earthquake resistant of design and analyze the concept of base isolation and design principles

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	H												H	
CO2		H		M									H	
CO3		H		M									H	
CO4		H		M									H	

Course Content

UNIT-I

INTRODUCTION TO EARTHQUAKES: SEISMOLOGY

Introduction, Terminology, Classification of Earthquakes, causes of earthquakes, effects of earthquakes, recording of an earthquake, distribution of earthquakes.

EFFECTS OF GROUND MOTION:

Strong ground motion, seismic hazards, liquefaction, engineering considerations, earthquake problems in India, tsunami.

UNIT-II

SEISMIC-RESISTANT BUILDING ARCHITECTURE

Introduction; Lateral load resisting systems- moment resisting frame, building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions;

	BUILDING CHARACTERISTICS Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstability/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements. **UNIT-III** **DESIGN FORCES FOR BUILDINGS** Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS 1893(Part 1) – Equivalent static method, Model analysis using response spectrum. **DUCTILITYDESIGN OF RC ELEMENTS:** Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920. **UNIT-IV** **EARTHQUAKE RESISTANT DESIGN OF RC BUILDING** Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of an exterior joint as per IS13920. **BASE ISOLATION OF STRUCTURES:** Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; seismic-isolation design principle; Feasibility of seismic isolation; Seismic-isolation configurations.
Text books and Reference books	**Text Books:** [T1] Agarwal, P. and Shrikhande, M. *Earthquake resistant design of structures* , PHI, NDLS, 2006. [T2] Paulay, T. and Priestley, M.J.N, *Seismic design of reinforced concrete and masonry buildings* , John Wiley, LN, UK, 1991. [T3] Mukhopadhyay. M, *Vibrations, dynamics and structural systems* , Oxford and IBH , NDLS, 2000. **Reference Books:** [R1] Krishna. J, Chandrasekharan, A.R, Chandra. B, *Elements of Earthquake Engineering*, South Asian, NDLS, 1994. [R2] IS:1893(Part-I):*Criteria for Earthquake Resistant Design of Structures*, 2016 [R3] IS:13920, *Ductile Detailing of Reinforced Concrete Structures subjected to Seismic forces*- Code of Practice, 1993
E-resources and other digital material	http://onlinecourses.nptel.ac.in nptel.ac.in/courses/105101004; nptel.ac.in/courses/105101004/4; nptel.ac.in/courses/105108074

17CE4801/B GROUND IMPROVEMENT TECHNIQUES

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE3608 - Foundation Engineering	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**													
	CO1	Understand need and methods of ground improvement techniques												
	CO2	Apply suitable ground improvement technique for a given site												
	CO3	Apply different grouting techniques, geotextiles and their functions												
	CO4	Evaluate the expansivity of soils and recommended types of foundations for expansive soils and suggest soil stabilization techniques based on field conditions												
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	**H**	**M**	**H**		**H**						**H**			**M**
	CO2	**H**		**H**		**H**						**H**			**M**
	CO3	**H**	**M**	**H**								**H**		**M**	**M**
	CO4	**H**	**M**	**H**	**H**	**H**								**M**	**M**

Course Content

UNIT - I

INTRODUCTION:
Need of Ground Improvement: Different methods of Ground improvement, Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods.

GROUND IMPROVEMENT METHODS IN GRANULAR SOILS
In place densification by Dynamic Compaction, Vibroflotation, Compaction pile, Vibro-Compaction Piles and Blasting.

UNIT - II

DENSIFICATION METHOD IN COHESIVE SOILS
Introduction, Preloading, Vacuum dewatering, Sand Drains, Stone columns, Prefabricated vertical drains.

	GROUTING TECHNIQUES Grouting in soil, Desirable characteristics, Grouting pressure, Grouting methods. **UNIT - III** **GEOSYNTHETICS** Introduction – Type of geosynthetics: Functions and their applications, geogrid – functions. **REINFORCED EARTH** Principles – Components of reinforced earth – factors – governing design of reinforced earth walls – design principles of reinforced earth walls. **UNIT - IV** **EXPANSIVE SOILS** Problems of expansive soils, Identification tests for expansive soils, I.S. test methods for swelling – pressure of a soil, Improvement methods for expansive soils. **SOIL STABILIZATION** Types of soil stabilization, Lime stabilization - Base exchange mechanism, Pozzolanic reaction, lime-soil interaction. Lime stabilization mix design, Cement stabilization: Mechanism, amount, age and curing.
Text books and Reference books	**Text Books:** [T1] Hausmann, M.R., *Engineering Principles of Ground Modification*, McGraw-Hill International Editions, NY, US, 1990. [T2] Purushothama, R. P., *Ground Improvement Techniques*, Tata McGrawHill, NDLS, 1995. **Reference Books:** [R1] Chattopadhyay, B. C. and Maity, J., *Ground Control and Improvement Techniques*, PEEDOT, HWH, 2011. [R2] Korner, R. M., *Design with Geosynthetics*, Prentice Hall, NJ, US, 2002. [R3] Han, J., *Principles and Practice of Ground Improvement*, John Wiley, NJ, US 2015.
E-resources and other digital material	[1] https://nptel.ac.in/courses/105108075/

17 CE 4801/C GROUND WATER HYDROLOGY

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:	17CE4801/3 - Irrigation Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand components, fluctuations and budgeting of ground water.
	CO2	Evaluate and Design of wells ad assessment of ground water quality.
	CO3	Evaluate sea water intrusion.
	CO4	Understand the artificial ground water recharge.

Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	H						M			L				
	CO2	H		M	M									M	
	CO3	H		M	M									H	
	CO4	H		H		M		M			L			H	

Course Content

UNIT – I

INTRODUCTION TO GROUND WATER HYDROLOGY:
General Water Balance, Regional Ground Water Balance, Distribution of subsurface water, Components of ground water studies, Ground water budgeting, Ground water level fluctuations.

OCCURRENCE AND MOVEMENT OF GROUND WATER:
Origin & age of ground water, Heterogeneity &Anisotropy, Ground water flow rates & flow directions, general flow equations through porous media, Ground Water velocity measurement- Preliminary and chemical methods.

UNIT – II

METHODS OF LOCATIONG GROUND WATER:
General-Investigations- Geologic maps- Field Procedures, Depth Sounding Curve

	method-Cumulative curve method, inverse slope method, schlumberger method. **GROUND WATER ASSESSMENT & BUDGETING:** Discharge by wells, Safe yield & overdraft, Calculation of safe yield- Hill method hardening method, Haley's method, Simpson's method, calculation of Ground Water Storage capacity and ground water potential. **UNIT-III** **METHODS OF WELL DESIGN AND GRAVEL PACKING:** General – Steps involved in the design of a tube well- Mechanical Analysis-Methodology- Effective grain size- Well Screen length-Well screen slot openings well screen diameter-Head losses through the screens-gravel packing and formation stabilization. **GROUND WATER QUALITY:** General- common impurities- Suspended impurities –dissolved impurities – Salts- metals and their compounds-chemical analysis-pH-Total dissolved solids, Hardness, Electrical Conductivity. **UNIT-IV** **SEA WATER INTRUSION IN COSTAL AQUIFERS:** Physical characteristics of water intrusion, causes of salinity and its causes, recognition of sea water in ground water, relationship between salt water and fresh water- Ghyben-Herzdarg concept. **ARTIFICIAL RECHARGE:** Purpose of artificial recharge, direct benefits of artificial recharge, benefits of conjunctive use of all water resources, principles adopted in recharge, factors to be considered in selection of artificial recharge sites, sources of recharge water, Artificial recharge techniques.
Text books and Reference books	**Text Books:** [T1] Ramakrishnan. S, *Ground Water*, SCITECH Publications India Pvt. Ltd, 2011. **Reference Books:** [R1] Rastogi, A.K., Numerical Groundwater Hydrology, Penram International Publishing India Pvt. Ltd, 2007 [R2] Raghunath, H M., *Ground water*, New Age International Publishers, 2011. [R3] Journals in Ground Water.
E-resources and other digital material	http://nptel.ac.in

17CE4801/D AIR POLLUTION AND CONTROL

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Understand various types of air pollutants and their effects
	CO2	Understand the dispersion phenomenon of air pollutants with regard to meteorological parameters
	CO3	Evaluate the sampling of pollutants from chimney stacks and ambient atmosphere
	CO4	Analyze various types of air pollution controlling equipment

Contribution of Course Outcomes towards achievement of Program Outcomes

(L – Low, M - Medium, H – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	**H**													**M**
CO2	**H**													**M**
CO3	**H**	**H**	**L**											**M**
CO4	**H**		**H**	**L**										**M**

Course Content

UNIT - I

INTRODUCTION TO AIR POLLUTION

Composition of air, Air pollution-definition, Prominent air pollution disasters / episodes, Sources of air pollution - Stationary and mobile sources.

CLASSIFICATION AND EFFECTS OF AIR POLLUTION

Classification - Natural Contaminants; Particulate Matter Aerosols and Gaseous pollutants; Primary and secondary pollutants, Effects of air pollutants on human health; Effects on plants and economic effects.

UNIT - II

METEOROLOGY AND AIR POLLUTION

Meteorological factors influencing dispersion of air pollutants- Wind direction and

	wind speed, Atmospheric stability, temperature inversions, Mixing height, precipitation and humidity **MEASUREMENT OF METEOROLOGICAL PARAMETERS** Wind direction recorder, Wind speed recorder, Humidity Measurement, Temperature measurement; Wind Rose; Plume behavior. **UNIT - III:** **STACK SAMPLING** Stack sampler; Sampling Procedure-Sampling point – size - Isokinetic Conditions, sampling of Particulate matter and Gases. **AMBIENT AIR SAMPLING** Sampling methods- Sedimentation, filtration, impingement methods, electrostatic precipitation and thermal precipitation. Sampling suspended particulates by high volume sampler. Sampling SO2 and NOx and Carbon Monoxide gases. –Indian standard methods of analysis of SO2 and NOx gases Air Quality and Emission standards **UNIT - IV** **METHODS OF CONTROLLING AIR POLLUTION** Different means of control of effluent discharges into the atmosphere. Control of Particulate matter by equipment -Settling chamber, inertial separators-fabric filters, wet scrubbers-Electrostatic Precipitators **CONTROL OF GASEOUS POLLUTANTS** Controlling methods of Gaseous Emissions- combustion, adsorption, absorption, closed collections and recovery systems- Control of SO2 and NOx gases**.**
Text books and Reference books	**Text Books**: 1. Rao, M.N and Rao, H.N, *Air Pollution and Control*, Tata McGraw Hill, NDLS, 2007 2. Environmental Engineering and Management, (2nd Edition), Suresh. S.K., Kartarai & Sons, 2005. **Reference Books:** 1. Trivedy, R.K., *An Introduction to Air pollution,* B.S. Publications, 2005. 2. Wark and Warner, *Air pollution*, Addison-Wesley, NDLS, 2010.
E-resources and other digital material	http://nptel.ac.in/courses/webcourse-contents/IITdelhi/Environmental%20Air%20Pollution/

17CE4801/E URBAN TRANSPORT PLANNING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**													
	CO1	Analyze various stages in transport Planning Process												
	CO2	Apply various methods for data collection												
	CO3	Apply and finalize the route choice and network design												
	CO4	Apply various methods for economic evaluation of transport projects												
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High)**		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1			**H**											**M**
	CO2	**H**	**H**									**H**			**M**
	CO3	**H**	**H**	**H**		**H**								**M**	
	CO4	**H**							**H**					**M**	**M**
Course Content	**UNIT-I** **TRANSPORT PLANNING PROCESS** Systems Approach to Transport Planning, Stages in Transport Planning, Survey and analysis of Existing Conditions, Forecast Analysis of Future Conditions and plan synthesis, Evaluation, Program Adoption and Implementation, Continuing Study, Citizen Participation, Difficulties in the Transport Planning Process. **TRANSPORTATION SURVEY** Study Area, Zoning, Type of Surveys, Home Interview Surveys, Commercial Vehicle Surveys, Road Side Interview Surveys, Public Transport Surveys, Inventory of Transport Facilities, Expansion of Data from Samples **UNIT-II** **TRIP GENERATION**													

	Factors governing trip generation and attraction rates - Multiple linear regression analysis, Category analysis - Critical appraisal of techniques. **TRIP DISTRIBUTION** Uniform factor method, average factor methods - Gravity model and its calibration – opportunity model. **UNIT-III** **TRIP ASSIGNMENT** Traffic assignment - General principles - Assignment techniques - Multiple root assignment Capacity - Restraint assignment - Diversion curves **MODAL SPLIT** Modal split - Advantages and limitations, Earlier Modal split models, trip end type models, trip interchange models, logit model, Multinomial logit model, **UNIT-IV** **ECONOMIC EVALUATION OF TRANSPORTATION PLANS** Economic evaluation techniques – Road user cost, Benefit cost ratio method. **RETURN METHODS** Net present value method, internal rate of return method, comparison of various methods
Text books and Reference books	**Text Books** : [T1] Kadiyali, L.R., *Traffic Engineering and Transport Planning*, Khanna, NDLS, 2006. [T2] Paque, J.R., Ashford, N.J. Wright, P.L.H. *Transportation Engineering Planning and Design*, NY, 2000 **Reference Books:** [R1] Dicky,J.W. *Metropolitan Transportation Planning,* Tata McGraw, NDLS, 2000 [R2] Bruton, M.J. *An Introduction to Transportation Planning*, LN,UK, 2001.
E-resources and other digital material	[1] http://nptel.ac.in/courses/105106058/ [2] http://nptel.ac.in/courses/105107067/ [3] https://ocw.mit.edu/courses/urban-studies-and-planning/11-540j-urban-transportation-planning-fall-2006/ [4] http://nptel.ac.in/courses/105104098/

17CE2802/A WATER QUALITY ENGINEERING

Course Category:	**Open Elective**	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 – 0
Prerequisites:		**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	**Upon successful completion of the course, the student will be able to:**	
	CO1	Analyze characteristics of water
	CO2	Apply the standards of water quality and treatment process
	CO3	Analyze pollution status of in water bodies
	CO4	Understand the quality behavior of due to discharge of waste load **by** modeling and monitoring

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High)		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
	CO1	M	M		M		H	H							H
	CO2	M	M		M		H	H	M						H
	CO3	L	H		M		H	H	M						M
	CO4	M	L		M		H	H							M

Course Content

UNIT - I

WATER QUALITY CHARACTERISTICS

Introduction: The composition and characteristics of natural waters. Effect of Temperature, Equilibria in water systems. Physical, Chemical and Biological Characteristics of Water. Standard methods of determination of important physical and chemical parameters of water quality, Bacteriological Indicators, and determination of Coliforms

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Concepts of Instrumental/ Analysis on Selective Electrodes, Atomic Absorption spectro-photometric methods, potentiometry including *o*2 electrodes, Gas chromatography.

UNIT-II

BIOCHEMICAL ANALYSIS AND WATER QUALITY STANDARDS

Biochemical cycles of C, N, P and S, Trace Organics, Detergents, Pesticides,

	Fertilisers etc. **WATER-TREATMENT PROCESSES AND WATER QUALITY STANDARDS** Theory and Application- aeration, solid separation, settling operations, Coagulation and flocculation, softening, filtration, disinfection, Different types of settling, sedimentation tank design, Coagulation and flocculation, stability of colloids, destabilization in water treatment, transport of colloidal particles. Other Water-Treatment processes: Dissolved Solids Removal. Water Quality Criteria, Guidelines, and Standards for Various uses. **UNIT-III** **WATER POLLUTION** Natural factors affecting water quality and pollution from various wastes, mechanisms of surface water pollution, point and Non-point sources, Effect of Geological formations on Water quality. **WATER QUALITY IN RECEIVING WATER BODIES** Lakes and Impoundments, Stratification and Eutrophication, Water Quality in Rivers, self purification and Reaeration, Dissolved Oxygen Balance in Rivers, Thermal Pollutions. **UNIT-IV** **GROUND WATER QUALITY** Sources and Mechanisms of groundwater Pollution. Groundwater Pollution from Landfills and Waste Dumps. **WATER QUALITY MODELING** Modeling and Monitoring, evolution of water quality models, types of water quality models, DO and BOD in streams, Transformation and transport processes, Oxygen transfer, Turbulent mixing, **WATER LAW** Groundwater ownership, Prior appropriation, Permit systems, acquisition and use of rights, Uncertainty concepts in Water Resources Planning - Legal aspects of environment systems, Principles of law applied to water rights and water allocation, control acts and legislation.
Text books and Reference books	**Text Books**: [T1] Garg S.K *Environmental Engineering Vol. I* , Khanna, NDLS, 2017 [T2] Peavy, S. Rowe,D. and Tchobanoglous,G. *Environmental Engineering*, McGraw Hill , N.Y. 1985. [T3] Weber Jr. W.J., *Physicochemical Processes for Water Quality Control*. John Wiley , NY,US,1972 [T4] I.S. 10500: 2012, Drinking Water Standards 2012 **Reference Books:** [R1] Tebutt T.H.Y. *Principles of Water Quality Control* Pergamon, Turkey, 1992

	[R2]Masters G.M. *Introduction to Environmental Engineering and Science*, PHI, NDLS, 1994. [R3] Garg S.K. *Water supply Engineering Vol.I*, Khanna, NDLS. 2003
E-resources and other digital material	[1] https://nptel.ac.in/courses/105/106/105106119 [2] http://cpcb.nic.in; [3] http://wrmin.nic.in