Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme name
1	Bachelor of Technology(Civil Engineering)(Full Time)
2	Master of Technology(Environmental Engineering)(Full Time)
3	Master of Technology(Environmental Engineering)(Part Time)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Purple Color** - Skill Development

1. List of Courses

Name of the Course	Course Code	Year of Introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
Environmental Sciences	XES102	2018-19	Skill Development - Album and Seminar
Electrical and Electronics Engineering Systems	XBE103	2018-19	Employability- Test,Assignment, Seminar,Poster Presentation
Applied Physics for Engineers	XAP104	2018-19	Skill Development - Assignment and Seminar
Engineering Graphics and Design	XEG105	2018-19	Skill Developement- Quiz, Test, Assignment,Seminar, Group Discussion
Disaster Preparedness & Planning	XCE302	2018-19	Skill Development - Album and Seminar
Computer Aided Civil Engineering Drawing	XCE303	2018-19	Skill Development-Assignment and Tutorial
Engineering Mechanics	XCE304	2014-15	Skill Development-Assignment and Tutorial
Energy Science and Engineering	XCE305	2018-19	Employability-Field work and Assignments
Surveying – I	XCE306	2018-19	Skill development- Assignment
Introduction to Civil Engineering	XCE307	2018-19	Skill Development - Assignment and Seminar
Effective Technical Communication	XGS308	2016-17	Skill Development-Field work
Inplant Training - I	XCE309	2014-15	*****
Mechanics of Materials	XCE501	2020-2021	Employability-Tutorials, solvingcomplex problems
Hydraulic Engineering	XCE502	2008-09	Skill Development-Assignment and Tutorial
Structural Analysis	XCE503	2013-14	Employability-Tutorials, solving complex problems

Hydrology & Water Resources Engineering	XCE504	2008-09	Skill development- Assignment
Environmental Engineering	XCE505	2018-2019	Employability-Field work and Assignments
Constitution of India	XUM506	2020-2021	Employability –Case Study and Seminar
Transportation Engineering	XCE507	2008-09	Employability-Field work and Assignments
Construction Engineering & Management	XCE508	2008-09	Employability-Field work and Document Preparation
Professional Practice, Law & Ethics	XCE509	2008-09	Employability-Field work and Assignments
In-plant Training-II	XCE510	2014-2015	
Survey Camp	XCEM08	2020-2021	Employability - Field work and Lab scale performance
Construction Project Management	XCE702	2008-09	Employability-Field work and Document Preparation
Cost Estimation and Valuation	XCE703	2008-09	Employability-Field work and Document Preparation.
Prestressed Concrete Structures	XCE704A	2008-09	Employability-Field visit
Solid and Hazardous Waste Management	XCE705D	2008-09	Employability-Tutorials and Assignments
Cyber Security	XCE706C	2013-14	Employability- Field visit
Project Phase – I	XCE707	2008-09	Employability - Design and Analysis
Career Development Skills	XCE708	2018-19	Skill development-Field work
In-plant Training-III	XCE709	2013-14	Skill development-Field work
Calculus, Ordinary Differential Equations and Complex Variables	XMA201	2008-09	*****

Programming for Problem Solving	XCP202	2013-14	Employability-Test,Assignment, Seminar,Poster Presentation
English	XGS203	2018-19	Skill Development-Assignment,Seminar
Applied Chemistry for Engineers	XAC204	2008-09	Skill Development - Assignment and Seminar
Workshop Practices	XWP205	2018-19	Skill Development- Understand the views of the objects, Drawings under various views
Mechanical Engineering	XCE401	2013-14	*****
Concrete Technology	XCE402	2011-12	Skill development-Literature survey
Engineering Geology	XCE403	2008-09	Employability- Quiz/case study
Mechanics of Fluids	XCE404	2015-16	Skill Development-Assignment and Tutorials
Entrepreneurship Development	XUM405	2013-14	Skill development- Tutorials and Assignment
Mechanics of Solids	XCE406	2016-17	Employability-Quiz/case study
Geotechnical Engineering	XCE407	2015-16	Skill Development-Assignment, Seminar, Technical Report
Surveying – II	XCE408	2014-15	Employability-Field work and Assignments
Materials Testing & Evaluation	XCE409	2018-19	Skill Development-Assignment and Tutorial
Structural Engineering	XCE601	2008-09	Employability-Tutorials, solvingcomplex problems
Engineering Economics, Estimation & Costing	XCE602	2008-09	Employability-Field work and Document Preparation
Railway Engineering	XCEE04	2008-09	Skill Development-Assignment and Tutorials

Advanced Structural Analysis	XCEE05	2008-09	Employability-Field work and Document Preparation
Earthquake Engineering	XCEE14	2008-09	Skill Development-Assignment and Tutorials
Design of Hydraulic Structures	XCEE15	2008-09	Skill Development-Assignment,Seminar
Prefabricated Structures	XCE802A	2008-09	Employability –Assignments and Design
Urban and Regional Planning-Future Trends	XCE803B	2008-09	Skill Development-Assignment, Seminar
Project Phase - II	XCE804	2008-09	Employability- Field work and Lab scale performance
Real Estate and Valuation	XCEM01	2019-20	*****
Digital Land surveying and mapping	XCEM02	2019-20	Entrepreneurship-Case study
General Repairs and Remedial Water Proofing	XCEM03	2019-20	*****
Building Regulations and Approval Process	XCEM04	2019-20	*****
Computational Skills for Geotechnical Applications	XCEM05	2019-20	*****
Structural Quality Assessment	XCEM06	2019-20	*****
Plumbing and Sanitary Installations	XCEM07	2019-20	*****
Survey Camp	XCEM08	2008-09	*****
Chemistry and Microbiology for Environmental Engineers	YEN101	2014-15	Skill development-Case study, Assignment
Unit Operation and Processes in Environmental Systems	YEN102	2014-15	Employability- Case study, Problem solving
Air Pollution and Control	YEN103C	2014-15	Employability- Case study, Assignment

Environmental Policies and Legislation	YEN104C	2018-19	Employability- Case study, Seminar
Environmental Quality Measurements Laboratory - I (Water & Wastewater)	YEN105	2014-15	Skill development-Analysis
Microbiology Laboratory	YEN106	2014-15	Skill development- Analysis
Research Methodology and IPR	YRM107	2018-19	Skill development-Report writing
Audit Course- 1	YEGOE1	2018-19	*****
Ground Water Contamination and Transport Modeling	YEN301A	2014-15	Employability- Case study
Environmental Impact Assessment	YEN302B	2014-15	Employability- Case Study, Report writing
Project work Phase -I	YEN303	2014-15	Employability- Design and Analysis
Transport of Water and Wastewater	YEN201	2014-15	Employability-Case study, Assignments
Biological Treatment of Wastewater	YEN202	2018-19	Employability- Case Study
Solid and Hazardous Waste Management	YEN203	2014-15	Employability- Case study, field visit
Environmental Geotechnology	YEN 204	2018-19	Skill development- Case study, Assignments
Environmental Quality Measurements Laboratory - II (Air, Noise and Solidwaste)	YEN205	2014-15	Skill development- analysis
Unit Operation Laboratory	YEN206	2014-15	Skill Development- analysis
Mini Project	YEN207	2014-15	Skill development- Experimental work

Audit Course- 2	YPSOE1	2018-19	*****
Project work phase -II	YEN401	2014-15	Employability- Design, Analysis Fabrication, Testing , Report preparation
Chemistry and Microbiology for Environmental Engineers	QEN101	2018-19	Skill development-Case study, Assignment
Microbiology Laboratory	QEN103	2018-19	Skill development- Analysis
Research Methodology and IPR	QEN104	2018-19	*****
Transport of Water and Wastewater	QEN301	2012-13	Employability-Case study, Assignments
Sustainable Urban Development Concepts and Strategies	QEN302B	2018-19	*****
Environmental Quality Measurements Laboratory - II(Air, Noise and Solid waste)	QEN303	2018-19	Skill development- analysis
Audit Course - 2	QPSOE1	2018-19	*****
Project Work - Phase I	QEN501	2012-13	Employability- Design and Analysis
Unit Operation and Processes in Environmental Systems	QEN201	2018-19	Skill development- Analysis
Environmental Quality Measurements Laboratory - I (Water &Waste water)	QEN203	2018-19	Skill development- Analysis
Audit Course- 1	QEN204	2018-19	*****
Biological Treatment of Waste water	QEN401	2018-19	Employability- Case Study, Report writing
Simulation Modelling in Environmental Systems	QEN402C	2018-19	*****

Unit Operation Laboratory	QEN403	2018-19	*****
Mini Project	QEN404	2012-13	Employability- Design and Analysis
Membrane Separation for water and Waste Water	QEN501C	2018-19	*****
English for Research paper Writing	QEGOE1	2018-19	*****
Constitution of India	QPSOE1	2018-19	*****
Business Analytics	QCOOE1	2018-19	*****
Industrial Safety	QMEOE1	2018-19	*****
Operations Research	QMAOE1	2018-19	*****
Cost Management of Engineering Projects	QCOOE2	2018-19	*****
Project Work - Phase II	QEN601	2012-13	Employability - Field work and Lab scale performance

Semester	:	I
Course Code	:	XES 102
Course Name	:	**ENVIRONMENTAL SCIENCES**
Prerequisite	:	-

L	T	P	C		C	P	A		L	T	P	H
2	0	0	0		1.4	0.3	03		3	0	0	3

Course Outcome: After the completion of the course, students willbe able to		*Domain C or P or A*	*Level*	
CO1	*Describe* the significance of natural resources and *explain* anthropogenic impacts.	Cognitive	Remember Understand	
CO2	*Illustrate* the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand	
CO3	*Identify* the facts, consequences, preventive measures ofmajor pollutions and *recognize* the disaster phenomenon	Cognitive Affective	Remember Receive	
CO4	*Explain* the socio-economic, policy dynamics and*practice* the control measures of global issues for sustainable development.	Cognitive	Understan dApply	
CO5	*Recognize* the impact of population and the concept of various welfare programs, and *apply* themodern technology towards environmental protection.	Cognitive	Understan dAnalysis	

COURSE CONTENT						
UNIT 1	**INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY**					**12**
	Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource, land degradation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.					
UNIT 2	**ECOSYSTEMS AND BIODIVERSITY**					**7**
	Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquaticecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In- situ and Ex-situ conservation of					

9

UNIT III	ENVIRONMENTAL POLLUTION				10
	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– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.					

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	10
	Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Public awareness.	

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	6
	Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and humanhealth.	

L	T	P	Total
45	0	0	45

E RESOURCES

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4
5. http://bookboon.com/en/pollution-prevention-and-control-ebook

Mapping of CO with GA's

	GA 1	GA 2	GA 3	GA 4	GA 5	GA6	GA 7	GA 8	GA 9	GA10	GA11	GA12
CO 1	3	--	--	--	--	--	--	--	--	--	--	1
CO 2	2	--	--	--	--	2	1	--	--	1	--	1
CO 3	2	1	3	--	--	3	1	--	2	1	--	1
CO 4	1	1	2	--	--	3	2	3	--	--	--	1
CO 5	2	1	1	--	--	3	--	--	--	--	--	1
Total	10	3	6	0	0	11	4	3	2	2	0	5
Scaled Value	2	1	2	0	0	3	1	1	1	1	0	1

Note:

Total	0	1-5	6-10	11 - 15
Scale	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	I									
Course Code	:	XBE103									
Course Name	:	ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS									
Prerequisite	:	PHYSICS									
L	T	P	C		C	P	A		L	T	P	H
3	1	1	5		3	1	0		3	2	2	7

Course Outcome: After the completion of the course, students willbe able to	*Domain C or P or A*	*Level*
CO1	***Define, Relate,*** the fundamentals of electrical parameters and ***build*** and ***explain*** AC, DC circuits by Using measuring devices	Cognitive Psychomotor	Remember Understand Mechanismset
CO2	***Define and Explain*** the of operation of DC and ACmachines.	Cognitive	Remember Understand
CO3	***Recall, Illustrate,*** various semiconductor Devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive Psychomotor	Remember Understand Mechanism
CO4	***Relate Explain,*** the number systems and logic gates. ***Construc***t the different digital circuit.	Cognitive Psychomotor	Remember Understand Orgination
CO5	***Label, Outline*** different types of microprocessors andheir applications.	Cognitive	Remember Understand

COURSE CONTENT

UNIT 1	FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS	9
	Fundamentals of DC– Ohm"s Law – Kirchoff"s Laws - Sources - Voltage and Current relations –Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter).	
UNIT 2	**UNIT II – ELECTRICAL MACHINES**	**9**
	Construction, Principle of Operation, Basic Equations, Types and Application of DCGenerators, DC motors - Basics of Single Phase Induction Motor and Three Phase Induction Motor- Construction, Principle of Operation of Single Phase Transformer,Three phase transformers, Auto	

transformer.

UNIT III	UNIT III – SEMICONDUCTOR DEVICES	9
	Classification of Semiconductors, Construction, Operation and Characteristics: PN Junction Diode – Zener Diode, PNP, NPN Transistors, Field Effect Transistors and Silicon Controlled Rectifier – Applications.	
UNIT IV	UNIT IV – DIGITAL ELECTRONICS	9
	Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.	
UNIT V	UNIT V – MICROPROCESSORS	9
	Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts – Simple Programming concepts	

PRACTICAL	30

1. Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies.
2. Study of Active and Passive elements – Resistors, Inductors and Capacitors, Bread Board.
3. Verification of AC Voltage, Current and Power in Series and Parallel connection.
4. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
5. Fluorescent lamp connection with choke.
6. Staircase Wiring.
7. Forward and Reverse bias characteristics of PN junction diode.
8. Forward and Reverse bias characteristics of zener diode.
9. Input and Output Characteristics of NPN transistor.
10. Construction and verification of simple Logic Gates.
11. Construction and verification of adders.
12. Construction and verification of subtractor.

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Metha V.K., 2008. Principles of Electronics. Chand and Company.
2. Malvino, A. P., 2006. Electronics Principles. 7th ed. New Delhi: Tata McGraw-Hill.
3. Rajakamal, 2007. Digital System-Principle & Design. 2nd ed. Pearson education.
4. Morris Mano, 1999. Digital Design. Prentice Hall of India.
5. Ramesh, S. Gaonkar, 2000. Microprocessor Architecture, Programming and its Applications with the 8085. 4th ed. India: Penram International Publications.

REFERENCE BOOKS:

1. Corton,H.,2004. Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967. Electronics Devices.New Delhi: McGraw-Hill.
4. Millman, J. andHalkias, C. C., 1972. Integrated Electronics: Analog and Digital Circuits andSystems.   Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. Microprocessors - Theory and Applications: Intel andMotorola. Prentice Hall International.

E-REFERENCES:

1. NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya andProf. G. D. Roy, IIT Kharagpur.
2. Prof.L.Umanand, http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, IIScBangalore.
3. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr.NagendraKrishnapura , IIT Madras.
4. Dr.LUmanand   ,   http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISCBangalore

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	1	1	1	1	--	--	1	1	1	3	3	1
CO 2	3	3	1	1	1	1	--	--	1	1	1	3	3	1
CO 3	2	2	2	1	2	2	1	1	1	1	1	2	2	2
CO 4	2	2	1	1	1	1	1	1	1	1	1	2	2	1
CO 5	2	2	1	1	1	1	1	1	1	1	1	2	2	1
Total	12	12	6	5	6	6	3	3	5	5	5	12	12	6
Scaled Value	3	3	2	1	2	2	1	1	1	1	1	3	3	2

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

14

Semester	:	I
Course Code	:	XAP 104
Course Name	:	**APPLIED PHYSICS FOR ENGINEERS**
Prerequisite	:	**Basic Physics in HSC level**

L	T	P	C		C	P	A	L	T	P	H
3	1	2	6		2.8	0.8	0.4	3	1	3	7

Course Outcome: After the completion of the course, students willbe able to

			Domain C or P or A	Level
CO1	*Identify* the basics of mechanics, *explain* the principles of elasticity and *determine* its significance in engineeringsystems and technological advances.		Cognitive Psychomotor	Remember, Understand Mechanism
CO2	*Illustrate* the laws of electrostatics, magneto-statics and electromagnetic induction; *use* and *locate* basic applications of electromagnetic induction to technology.		Cognitive PsychomotorAffective	Remember,Analyze, MechanismRespond
CO3	*Understand* the fundamental phenomena in optics by measurement and *describe* the working principle and application of various lasers and fibre optics.		Cognitive PsychomotorAffective	Understand,Apply MechanismReceive
CO4	*Analyse* energy bands in solids, *discuss* and *use* physics principles of latest technology using semiconductordevices.		Cognitive PsychomotorAffective	Understand,Analyze MechanismReceive
CO5	*Develop* Knowledge on particle duality and *solve* Schrodinger equation for simple potential.		Cognitive	Understand,Apply

COURSE CONTENT

UNIT 1	MECHANICS OF SOLIDS	9

Mechanics: Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.

Elasticity: Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending.

UNIT 2	ELECTROMAGNETIC THEORY	9

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarisation, Dielectric constant, internal field - ClausiusMossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for plane, circularly and elliptically polarized light - quarter and half wave plates - production and

detection of plane, circularly and elliptically polarized light.

UNIT III	OPTICS, LASERS AND FIBRE OPTICS	9

Optics: Dispersion- Optical instrument: Spectrometer - Determination of refractive index
and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating.

LASER: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - CO_2 laser - Applications

Fibre Optics: Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system (Block diagram).

UNIT IV	SEMICONDUCTOR PHYSICS	9

Semiconductors: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors
- Hall effect.

Diodes and Transistors: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

UNIT V	QUANTUM PHYSICS	9

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension -Degeneracy.

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", DhanpatRai Publications, 2009.
2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., NewDelhi, 2010

REFERENCE BOOKS:

1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers,Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.

E-REFERENCES:

1. NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

PRACTICAL   30

1. Torsional Pendulum - determination of moment of inertia and rigidity modulus of the givenmaterial of the wire.
2. Uniform Bending - Determination of the Young's Modulus of the material of the beam.
3. Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam.
4. Meter Bridge - Determination of specific resistance of the material of the wire.
5. Spectrometer - Determination of dispersive power of the give prism.
6. Spectrometer - Determination of wavelength of various colours in Hg source using grating.
7. Air wedge - Determination of thickness of a given thin wire.
8. Laser - Determination of wavelength of given laser source and size of the given micro particleusing Laser grating.
9. Post office Box - Determination of band gap of a given semiconductor.
10. PN Junction Diode - Determination of V-I characteristics of the given diode.

REFERENCE BOOKS:

1. Samir Kumar Ghosh, "A text book of Advanced PRACTICAL Physics", New Central Agency (P)Ltd, 2008.
2. Arora C.L., "PRACTICAL Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. UmayalSundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012

L	T	P	Total
45	15	30	90

Mapping of CO with PO's

	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	2	2	1	-	-	-	1	-	-	1		
CO 2	3		1		1	-	-	-		-	-	1		
CO 3	3	2	2	2	1	-	-	-	1	-	-	1		
CO 4	3	2	2	2	1	-	-	-	1	-	-	1		
CO 5	3		2			-	-	-		-	-	1		
Total	15	6	9	6	4				3			5		
Scaled Value	3	2	2	2	1				1			1		

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	I										
Course Code	:	XEG105										
Course Name	:	**ENGINEERING GRAPHICS AND DESIGN**										
Prerequisite	:	--										

L	T	P	C		C	P	A		L	T	P	H
2	0	1	3		1.75	1	0.25		2	0	2	4

Course Outcome: After the completion of the course, students willbe able to		*Domain C or P or A*		*Level*
CO1	*Apply* the national and international standards, *construct* and *practice* various curves	Cognitive, Psychomotor Affective		Applying, Guided response Responds to Phenomena
CO2	*Interpret*, *construct* and *practice* orthographic projectionsof points, straight lines and planes.	Cognitive Psychomotor Affective		Understanding,Mechanism Responds to Phenomena
CO3	*Construct Sketch* and *Practice* projection of solids in various positions and true shape of sectioned solids.	Cognitive Psychomotor Affective		Applying Complex Over Response Responds to Phenomena
CO4	*Interpret*, *Sketch* and *Practice* the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive Psychomotor Affective		UnderstandingComplex Over Response Responds to Phenomena
CO5	*Construct sketch* and *practice* isometric and perspectiveviews of simple and truncated solids.	Cognitive Psychomotor Affective		Applying Complex Over Response Responds to Phenomena

COURSE CONTENT		
UNIT 1	**INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS ANDCONSTRUCTION OF PLANE CURVE**	**6+6**

	Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003.			
	Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects.			
	Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves.			
UNIT 2	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**			**6+6**
	General principles of orthographic projection – first angle projection – layout of views –projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection ofpolygonal surfaces and circular lamina inclined to both the planes of projection.			
UNIT 3	**PROJECTION OF SOLIDS AND SECTION OF SOLIDS** 6+6			
	Projection of simple solids like prism, pyramid, cylinder and conewhen the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections.			
UNIT 4	**DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS** **6+6**			
	Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset			
UNIT 5	**ISOMETRIC AND PERSPECTIVE PROJECTIONS** **6+6**			
	Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.			

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Bhatt,N.D, "Engineering Drawing", Charotar Publishing House, 46th Edition-2003.
2. Natarajan,K.V, " A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2006 .
3. Dr. P.K. Srividhya, P. Pandiyaraj, "Engineering Graphics", PMU Publications, Vallam, 2013

REFERENCE BOOKS:

1. Luzadder and Duff, "Fundamentals of Engineering Drawing" Prentice Hall of India PvtLtd, XI Edition - 2001.
2. Venugopal,K. and Prabhu Raja, V., "Engineering Graphics", New Age International(P) Ltd.,2008.
3. Gopalakrishnan.K.R,. "Engineering Drawing I & II", Subhas Publications, 1998.
4. Shah,M.B and Rana,B.C.,"Engineering Drawing", Pearson Education,2005.

E-REFERENCES:
1. http://periyarnet/Econtent
2. http://nptel.ac.in/courses/112103019/

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	3	2	3	2	3	1	1	2	3	3	3	-
CO 2	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO 3	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO 4	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO 5	3	3	3	1	3	1	3	1	1	1	2	3	3	-
Total	15	15	15	6	15	6	15	5	5	6	11	3	3	-
Scaled Value	3	3	3	2	3	2	3	1	1	2	3	3	3	-

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	II
Course Code	:	**XMA201**
Course Name	:	**CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS ANDCOMPLEX VARIABLE**
Prerequisite	:	**Mathematics I (Calculus and Linear Algebra)**

L	T	P	C		C	P	A		L	T	P	H
3	**1**	**0**	**4**		**3**	**0.5**	**0.5**		**3**	**1**	**0**	**4**

Course Outcome: After the completion of the course, students willbe able to	*Domain C or P or A*	*Level*
CO1 **Find** double and triple integrals and to find line, surface and volume of an integral by **Applying** Greens, Gauss divergence and Stokes theorem.	Cognitive	Applying Remembering

20

CO2	**Solve** first order differential equations of different typeswhich are solvable for p, y, x and Clairaut's type.	Cognitive	Applying
CO3	**Solve** Second order ordinary differential equations withvariable coefficients using various methods.	Cognitive	Applying
CO4	**Use** CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius ransformation.	Cognitive Psychomotor	Rememberin gApplying Guided Response
CO5	**Apply** Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent'sseries.	Cognitive Affective	Applying Receiving

COURSE CONTENT

UNIT 1	**MULTIVARIABLE CALCULUS (INTEGRATION)**	12
	Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes.	
UNIT 2	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**	12
	Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree:equations solvable for p - equations solvable for y- equations solvable for x and Clairaut'stype.	
UNIT III	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS**	12
	Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties.	
UNIT IV	**COMPLEX VARIABLE – DIFFERENTIATION**	12
	Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and theirproperties.	

UNIT V	COMPLEX VARIABLE – INTEGRATION	12

Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)-Liouville"s theorem (without proof)- Taylor"s series-zeros of analytic functions- singularities- Laurent"s series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour.

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th[th] Edition, 2008.

REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint,2002.

2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

3. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary ValueProblems", 9[th]Edn. Wiley India, 2009.

4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.

5. E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India,1995.

6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

7. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGraw Hill,2004.

8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications,Reprint, 2008.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2	--	--	2	--	--	--	--	1	--	2
CO 2	3	1	--	--	--	--	--	--	--	1	--	1
CO 3	3	1	--	--	--	--	--	--	--	1	--	1
CO 4	3	2	--	--	--	--	--	--	--	1	--	1
CO 5	3	2	--	--	1	--	--	--	--	1	--	2
Total	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2	0	0	1	0	0	0	0	1	0	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	**II**									
Course Code	:	**XCP202**									
Course Name	:	**PROGRAMMING FOR PROBLEM SOLVING**									
Prerequisite	:										

L	T	P	C	C	P	A	L	T	P	H
3	**0**	**2**	**5**	**3**	**0.5**	**0.5**	**3**	**0**	**2**	**5**

Course Outcome: After the completion of the course, students willbe able to	*Domain* *C or P or A*	*Level*
CO1	*Define* programming fundamentals and *Solve* simpleprograms using I/O statements	Cognitive	Remember
		Psychomotor	UnderstandApply
CO2	*Define* syntax and *write simple programs* using controlstructures and arrays	Cognitive	Remember
		Psychomotor	UnderstandApply
CO3	*Explain* and *write simple programs* using functions andpointers	Cognitive	UnderstandApply
		Psychomotor	
CO4	*Explain* and *write simple programs* using structures andunions	Cognitive	Understand
		Psychomotor	Apply Analyze
CO5	*Explain* and *write simple programs* using files and *Build* simple projects	Cognitive	Remember
		Psychomotor	UnderstandCreate

COURSE CONTENT

UNIT 1	PROGRAMMING FUNDAMENTALS AND INPUT / OUTPUTSTATEMENTS	
	Theory	**9**
	Introduction to components of a computer system, Program – Flowchart – Pseudo code–Software–Introduction to C language–Character set–Tokens: Identifiers, Keywords, Constants and Operators–sample program structure - Header files – DataTypes-Variables- Output statements –Input statements.	
	Practical	**6**
	1. Program to display a simple picture using dots.	
	2. Program for addition of two numbers	
	3. Program to swap two numbers	
	4. Program to solve any mathematical formula.	
UNIT 2	CONTROL STRUCTURE AND ARRAYS	
	Theory	**9**

Control Structures–Conditional Control statements: Branching, Looping-Unconditional control structures: switch, break, continue, goto statements–Arrays: One Dimensional Array–Declaration–Initialization–Accessing Array Elements–Searching–Sorting–Two Dimensional arrays-Declaration – Initialization– Matrix Operations – Multi Dimensional Arrays-Declaration–

Initialization. Storage classes: auto–extern–static. Strings: Basic operations on strings.

Practical   6

1. Program to find greatest of 3 numbers using Branching Statements
2. Program to display divisible numbers between n1and n2 using loopingStatement
3. Program to remove duplicate element in an array.
4. Program to perform string operations.
5. Performing basic sorting algorithms

UNIT III	FUNCTIONS AND POINTERS

Theory   9

Functions: Built in functions–User Defined Functions-Parameter passing methods- Passing arrays to functions–Recursion-Programs using arrays and functions. Pointers- Pointer declaration-Address operator-Pointer expressions & pointer arithmetic-Pointers and function-Call by value-Call by Reference-Pointer to arrays-Use of Pointers inself-referential structures-Notion of linked list(noimplementation).

Practical   6

1. Program to find factorial of a given number using four function types.
2. Programs using Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort
3. Programs using Pointers

UNIT IV	STRUCTURES AND UNIONS

Theory   9

Structures and Unions –Giving values to members-Initializing structure-Functions and structures- Passing structure to elements to functions-Passing entire functionto functions- Arrays of structure –Structure within a structure and Union.

Practical   6

1.Program to read and display student mark sheet Structures with variables

2.Program to read and display student marks of a class using Structures with arrays

3.Program to create linked list using Structures with pointers

UNIT V   FILES

Theory   **9**

FilemanagementinC-FileoperationfunctionsinC- file-Definingandopeninga Closingafile-Thegetwandputwfunctions-   -   fseek Thefprintf&fscanf

function

sfunction– Files andStructures.

Practical   **6**

1.Program for copying contents of one file to another file.2.Program usingfiles usingstructure with pointer

L	T	P	Total
45	0	30	75

TEXT BOOKS / REFERENCE

1. Byron Gottfried,"Programming with C" , III Edition, (Indian Adapted Edition), TMHpublications, 2010

2. Yeshwant Kanethker,"Let us C", BPB Publications, 2008

3. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PearsonEducation Inc. 2005

4. Behrouz A. Forouzan and Richard. F. Gilberg,"A Structured Programming ApproachUsing C", II Edition, Brooks–Cole Thomson Learning Publications, 2001

5. Johnson baugh R. and Kalin M., "Applications Programming in ANSIC", III Edition,Pearson Education India, 2003

6. E. Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	--	--	3	--	--	--	--	--	2	3	2	-
CO 2	3	2	--	--	2	--	--	--	--	--	2	3	2	-
CO 3	2	2	1	2	2	--	--	--	--	--	2	2	2	-
CO 4	2	2	1	2	2	--	--	--	--	--	2	2	2	-
CO 5	2	2	1		2	--	--	1	--	2	2	2	2	-
Total	12	10	3	4	11	0	0	1	--	2	10	12	10	-
Scaled Value	3	2	1	1	3	0	0	1	--	1	2	3	2	-

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	II								
Course Code	:	XGS203								
Course Name	:	ENGLISH								
Prerequisite	:									

L	T	P	C	C	P	A	L	T	P	H
2	0	1	3	2.6	0.4	0	2	0	2	4

Course Outcome: After the completion of the course, students willbe able to		*Domain C or P or A*	*Level*
CO1	*Ability* to recall the meaning for proper usage	Cognitive	Remember
CO2	*Apply* the techniques in sentence patterns	Cognitive	Apply
CO3	*Identify*the common errors in sentences	Cognitive	Remember
CO4	*Construct* the Nature and Style of sensible Writing	Cognitive	Create
CO5	*Practicing*thewriting skills	Psychomotor	Guided Response
CO6	*Grasping* the techniques in learning sounds andetiquettes	Psychomotor	Adapting

COURSE CONTENT

UNIT 1	VOCABULARY BUILDING	9
	The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives - Synonyms, antonyms, and standard abbreviations..	
UNIT 2	BASIC WRITING SKILLS	9
	Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence - Organizing principles of paragraphs indocuments - Techniques for writing precisely	
UNIT III	IDENTIFYING COMMON ERRORS IN WRITING	9
	Subject-verb agreement - Noun-pronoun agreement - Misplaced modifiers –Articles – Prepositions – Redundancies - Clichés	
UNIT IV	NATURE AND STYLE OF SENSIBLE WRITING	9
	Describing – Defining – Classifying - Providing examples or evidence - Writing introduction and conclusion	
UNIT V	WRITING	9

	PRACTICES
	Comprehension - Précis Writing - Essay Writing

UNIT VI	ORAL COMMUNICATION	9

Listening Comprehension - Pronunciation, Intonation, Stress and Rhythm - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations

Note : This unit involves interactive practice sessions in Language Lab

L	T	P	Total
45	0	30	75

TEXT BOOKS / REFERENCE

1. PRACTICAL English Usage. Michael Swan. OUP. 1995
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO 2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO 3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO 4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
Scaled Value	2	0	0	0	0	0	2	0	1	0	0	0	0	0

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	II										
Course Code	:	XAC204										
Course Name	:	**Applied Chemistry for Engineers**										
Prerequisite	:											
L	**T**	**P**	**C**			**C**	**P**	**A**		**L**	**T**	**P**	**H**
3	**1**	**1**	**5**			**3.5**	**1.0**	**0.5**		**3**	**1**	**2**	**6**

Course Outcome: After the completion of the course, students willbe able to		*Domain C or P or A*	*Level*
CO1	*Identify* the periodic properties such as ionization energy,electron affinity, oxidation states and electro negativity. *Describe* the various water quality parameters like hardness and alkalinity.	Cognitive Psychomot or	Remembe r Perceptio n
CO2	*Explain andMeasure* microscopic chemistry in terms ofatomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understand Set
CO3	*Interpret* bulk properties and processes usingthermodynamic and kinetic considerations.	Cognitive Psychomot orAffective	Apply Mechanis mReceive
CO4	*Describe, Illustrate* and *Discuss* the chemical reactionsthat are used in the synthesis of molecules.	Cognitive Psychomot orAffective	Remembe rAnalyze Perceptio n Respond
CO5	*Apply, Measure* and *Distinguish* the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopictechniques	Cognitive Psychomotor	Remembe r Apply Mechanis m

COURSE CONTENT

UNIT I	PERIODIC PROPERTIES AND WATER CHEMISTRY	11
	Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity.	

UNIT II	USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA	15

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion- Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB).

UNIT III	ATOMIC AND MOLECULAR STRUCTURE	13

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles.. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band
structure of solids and the role of doping on band structures.

Intermolecular forces and potential energy surfaces

Ionic, dipolar and Vander waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectorieson these surfaces

UNIT IV	SPECTROSCOPIC TECHNIQUES AND APPLICATIONS	10

Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering.

UNIT V	STEREOCHEMISTRY AND ORGANIC REACTIONS	11

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism intransitional metal compounds

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization reactions and ring opening reactions. Synthesis of a commonly used drug molecule- Aspirin and paracetamol.

TEXT BOOKS

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), NewDelhi, ShobanLalNagin Chand & Co., 1993

2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.

3. Trapp. C, Cady, M. Giunta. C, Atkins"s Physical Chemistry, 10th Edition, Oxford publishers, 2014.

4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan& Co. Ltd, 1983.

5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New

    York, Allyn& Bacon Ltd., 1976.

6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill BookCompany, Europe 1983.

7. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd.New Delhi, 1977.

8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age InternationalPublishers, 2017.

REFERENCE BOOKS

1. Puri B R Sharma L R and Madan S Pathania, " Principles of Physical Chemistry", Vishal publishing Co., Edition 2004

2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-HillPublishing Co. Ltd. New Delhi, 2000

E-Resources – MOOC's

1. http://www.mooc-list.com/course/chemistry-minor-saylororg
2. https://www.canvas.net/courses/exploring-chemistry
3. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
4. http://freevideolectures.com/Course/3001/Chemistry-I
5. http://freevideolectures.com/Course/3167/Chemistry-II
6. http://ocw.mit.edu/courses/chemistry/

PRACTICALS   30

1. Determination of chloride ion present in the water sample by Argentometric method.   **CO1**
2. Determination of total, temporary and permanent hardness of water sample by EDTAmethod.   **CO1**

3.	Determination of cell constant and conductance of solutions.	**CO2**
4.	Potentiometry - determination of redox potentials and emfs.	**CO2**
5.	Determination of surface tension and viscosity.	**CO3**
6.	Adsorption of acetic acid by charcoal.	**CO3**
7.	Determination of the rate constant of a reaction.	**CO4**
8.	Estimation of iron by colorimetric method.	**CO4**
9.	Synthesis of a polymer/drug.	**CO5**
10.	Saponification/acid value of an oil.	**CO5**

L	T	P	Total
45	**15**	**30**	**90**

REFERENCE BOOKS

1. Mendham, Denney R.C,. Barnes J.D and Thomas N.J.K., "Vogel"s Textbook of QuantitativeChemical Analysis", 6th Edition, Pearson Education, 2004.

2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.;McGraw-Hill: New York, 2003.

E-Resources – MOOC's

1. http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques

2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011

3. http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO 2	2	0	0	0	0	0	1	2	2	0	0	0	0	0
CO 3	3	0	0	0	0	0	2	3	3	0	0	0	0	0
CO 4	3	0	0	0	0	0	3	3	3	0	0	0	0	0
CO 5	3	0	0	0	0	0	2	2	3	0	0	0	0	0
Total	15	0	0	0	0	0	10	13	14	0	0	0	0	0
Scaled Value	3	0	0	0	0	0	2	3	3	0	0	0	0	0

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

	Sem	:	II
ester			
Course Code		:	**XWP205**
Course Name		:	**WORKSHOP/MANUFACTURING PRACTICES**
Prerequisit		:	
e			

L	T	P	C		C	P	A		L	T	P	H
1	**0**	**2**	**3**		**1**	**3**	**0**		**1**	**0**	**4**	**5**

Course Outcome: After the completion of the course, studentswill be able to

		Domain C or P or A	*Level*
CO1	*Summarize* the machining methods and *Practice* machining operation.	Cognitive Psychomotor	Understanding Guided response
CO2	*Defining*metal casting process, moulding methods and **relates**Casting and Smithy applications.	Cognitive Psychomotor	Remembering Perception
CO3	*Plan* basic carpentry and fitting operation and *Practice* carpentry and fitting operations.	Cognitive Psychomotor	Applying Guided response
CO4	*Summarize* metal joining operation and *Practice* welding operation.	Cognitive Psychomotor	Understanding Guided response
CO5	*Illustrate* the, electrical and electronics basics and *Makes* appropriate connections*.*	Cognitive Psychomotor	Understanding gOrigination

COURSE CONTENT

PRACTICALS		30
Exp.no	**Title**	**Co relation**
1.	Introduction To Machining Process	CO1
2.	Plain Turining Using Lathe Operation	CO1
3.	Introduction To CNC	CO1
4.	Demonstration Of Plain Turning Using CNC	CO1
5.	Study Of Metal Casting Operation	CO2
6.	Demonstration Of Moulding Process	CO2
7.	Study Of Smithy Operation	CO2
8.	Study Of Carpentry Tools	CO3

9.	Half Lap Joint – Carpentry	CO 3
10.	Mortise And Tenon Joint – Carpentry	CO 3
11.	Study Of Fitting Tools	CO 3
12.	Square Fitting	CO 3
13.	Triangular Fitting	CO 3
14.	Study Of Welding Tools	CO 4
15.	Square Butt Joint - Welding	CO 4
16.	Tee Joint – Welding	CO 4
17.	Introduction To House Wiring	CO 5
18.	One Lamp Controlled By One Switch	CO 5
19.	Two Lamps Controlled By Single Switch	CO 5
20.	Staircase Wiring	CO 5

L	T	P	Total
0	0	45	45

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promotersand Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCE BOOKS

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
3. Workshop Technology by B.S. Raghuwanshi, DhanpatRai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E-Resources

http://nptel.ac.in/courses/112107145/

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	1	2	2	1	0	0	1	1	0	1	2	0	0
CO 2	2	1	2	2	1	0	0	1	1	0	1	2	0	0
CO 3	2	1	2	2	1	0	0	1	1	0	1	2	0	0
CO 4	2	1	2	2	1	0	0	1	1	0	1	2	0	0
CO 5	2	1	2	2	1	0	0	1	1	0	1	2	0	0
Total	10	5	10	10	5	0	0	5	5	0	5	10	0	0
Scaled Value	2	1	2	2	1	0	0	1	1	0	1	2	0	0

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	**III**
Course Code	:	**XCE301**
Course Name	:	**TRANSFORMS AND COMPUTATIONAL TECHNIQUES**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
2	**0**	**0**	**2**		**2**	**0**	**0**		**2**	**0**	**0**	**2**

Course Outcome: After the completion of the course, students will be able to

			Domain C or P or A	Level
CO1	**Find** the Laplace Transform of standard functions and to **solve** ODE and PDE (simple problems).		Cognitive	Remember / Apply
CO2	**Find** the Fourier Transform and Z-transform of standard functions.		Cognitive	Remember
CO3	**Solve** polynomial and transcendental equation using by Newton-Raphson method.		Cognitive	Apply
	Find Interpolation with equal and unequal intervals.		Psychomotor	Guided Response
CO4	**Find** numerical differentiation and integration by trapezoidal rule, simpson's $1/3^{rd}$ and $3/8^{th}$ rule.		Cognitive	Remember
CO5	**Solve o**rdinary differential equations by Taylor's series method, Euler and modified Euler's method and Runge-kutta method of fourth order.		Cognitive	Remember Apply

COURSE CONTENT

UNIT	TRANSFORM CALCULUS	6

I	I	
	Laplace Transform, Properties of Laplace Transform, Laplace transform of periodicfunctions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.	
UNIT II	**TRANSFORM CALCULUS II**	6
	Fourier transforms, Z-transforms: properties, methods, inverses and their applications.	
UNIT III	**NUMERICAL METHODS-I**	6
	Solution of Polynomial and transcendental equations:Newton –Raphson Method- Interpolation using Newton"s forward and Backward difference formulae- Interpolation with unequal intervals: Newton divided difference and Lagrange"s formulae.	
UNIT IV	**NUMERICAL METHODS-II**	6
	Numerical Differentiation and Integration:Trapezoidal rule, simpson"s $1/3^{rd}$ and$3/8^{th}$ rules.	
UNIT V	**NUMERICAL METHODS-III**	6
	Ordinary Differential Equations:Taylor"s series- Euler and modified Euler"s method- Runge-kutta method of fourth order for solving first and second order equations.	

L	T	P	Total
30	0	0	30

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi(2015).
2. Jain M.K. , Iyengar S.R.K, Jain R.K, "Numerical Methods problems and solutions", RevisedSecond Edition (2007).

REFERENCE BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons,2006.

2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications,Reprint, 2010.

3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition,Khanna Publishers, New Delhi, (2004).

3. SankaraRao, K. "Numerical methods for Scientists and Engineers", 3rd Edition, Prentice Hall ofIndia Private Ltd., New Delhi, (2007).

E-Resources – MOOC's

NPTEL: Elementary Numerical Analysis Prof. Rekha P. Kulkarni. Department of Mathematics, Indian

Institute of Technology, Bombay.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	0	0	0	0	0	0	0	0	1	0	1
CO 2	3	0	0	0	0	0	0	0	0	1	0	1
CO 3	3	2	0	0	0	0	0	0	0	1	1	2
CO 4	3	2	0	0	1	0	0	0	0	1	1	1
CO 5	3	2	0	0	1	0	0	0	0	1	1	1
Total	15	6	0	0	2	0	0	0	0	5	3	6
Scaled Value	3	2	0	0	2	0	0	0	0	1	1	2

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	III
Course Code	:	XCE302
Course Name	:	DISASTER PREPAREDNESS & PLANNING
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
1	1	0	2		2	0	0		1	1	0	2

Course Outcome: After the completion of the course, students will be able to	*Domain C or P or A*	*Level*
CO1 To Understand basic concepts in Disaster Management	Cognitive	Understand
CO2 To Understand Definitions and Terminologies used in Disaster Management and able to Analyzing Relationship between Development and Disasters	Cognitive Psychomotor	Understand Guided Response
CO3 Ability to understand Categories of Disasters	Cognitive Affective	Understand Receiving
CO4 To Understand the Challenges posed by Disasters	Cognitive Affective	Understand Receiving
CO5 To understand Impacts of Disasters Key Skills	Cognitive	Understand

COURSE CONTENT

UNIT	INTRODUCTION	3

I		
	Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation).	
UNIT II	**DISASTERS**	**6**
	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 III	**DISASTER IMPACTS**	**6**
	Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.	
UNIT IV	**DISASTER RISK REDUCTION (DRR)**	**10**
	Disaster Risk Reduction (DRR) - 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 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 V	**DISASTERS, ENVIRONMENT AND DEVELOPMENT**	**5**
	Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods	

L	T	P	Total
15	15	0	30

TEXT BOOKS

1. PradeepSahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, RajatPublication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
4. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State ofCalifornia, EMSA no.214, June 2003

REFERENCE BOOKS

1. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on MentalHealth and Psychosocial Support in Emergency Settings. Geneva: IASC

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affais).

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1			2	1	1	2	2	3	2	1	1	1	2	2
CO 2	1	1	3	2	3	1		2		2				
CO 3				2	1	2	2	2	2					
CO 4	1	1	2	2	2	2	1	2	1	2	1	1	1	1
CO 5	2	3		2	3	2		1	1	2		2		
Total	4	5	7	7	11	8	5	10	6	9	2	4	3	3
Scaled Value	1	1	2	2	3	2	1	2	2	2	1	1	1	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	III
Subject Name	COMPUTER AIDED CIVIL ENGINEERING DRAWING
Subject Code	XCE 303
Prerequisite	Engineering Graphics

L	T	P	C		C	P	A		L	T	P	H
1	0	2	2						1	0	4	5

	Course Outcome:		Domain	Level
CO1	Develop Parametric design and the conventions of formalengineering drawing		Cognitive	Understand
			Psychomotor	Perception
CO2	Draw and interpret 2D & 3D drawings.		Cognitive	Understand
			Psychomotor	Mechanism
CO3	Communicate a design idea/concept graphically/ visually		Cognitive	Understand
			Affective	Perception

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CO4	Examine a design critically and with understanding of CAD	Psychomotor	Mechanism	
		Affective	Response	
CO5	Get a Detailed study of an engineering artifact	Cognitive	Apply	

COURSE CONTENT

UNIT I	**INTRODUCTION**	3

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, coordinate systems, reference planes.

Symbols and Sign conventions: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT II	**COMMANDS**	3

Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Textand Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT III	**MASONRY BONDS**	3

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall andone and half brick wall

UNIT IV	**BUILDING DRAWING**	3

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standardfittings & fixtures, finishes.

UNIT V	**PICTORIAL VIEW**	3

Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM)

PRACTICAL	30

1. Buildings with load bearing walls including details of doors and windows.
2. Taking standard drawings of a typical two storied building including allMEP, joinery, rebars, finishing and other details .
3. Reinforcement drawings for typical slabs, beams, columns and spread footing**s**
4. RCC framed structures
5. Industrial buildings - North light roof structures – Trusses
6. Perspective view of one and two storey buildings

L	T	P	H
15	0	30	45

TEXT BOOKS

1. Subhash C Sharma &Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on

AUTOCAD200I", Tata- McGraw-Hill Company Limited, New Delhi

3. Sham TickooSwapna D (2009), "AUTOCAD for Engineers and Designers", PearsonEducation

4. Venugopal (2007), "Engineering Drawing and Graphics+AUTOCAD", New AgeInternational Pvt. Ltd

REFERENCES

1. Corresponding set of CAD Software Theory and User Manuals.

2. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishingKDR building, Calicut,

3. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication LtdNew Asian

4. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1			3	1			2	3	1		3	2	2
CO 2				3	3	2		1	3	2	1	1	1	1
CO 3		2	1	3	1	3		3	3	1		3	2	
CO 4	1		2	3	2	3		2	1			3	1	2
CO 5		2	1	3	3	1	1	1	2	2		3	2	2
Total	2	4	4	15	10	9	1	9	12	6	1	13	8	7
Scaled Value	1	1	1	3	2	2	1	2	2	1	1	3	2	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	III					
Course Code	:	XCE304					
Course Name	:	ENGINEERING MECHANICS					
Prerequisite	:						

L	T	P	C		C	P	A		L	T	P	H
3	1	0	4		1.5	0	1.5		3	1	0	4

Course Outcome: After the completion of the course, studentswill be able to

Domain

C or P or A

Level

40

CO1	Capability to apply mathematics, science, andengineering	Cognitive	Understand
		Affective	Receiving
CO2	Ability to identify, formulate, and solve engineeringproblems	Cognitive	Understand
		Affective	Receiving
CO3	Skill to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.	Cognitive	Understand
		Affective	Receiving
CO4	Capacity to design and conduct experiments, as well asto analyze and interpret data	Cognitive	Understand
		Affective	Receiving
CO5	Ability to comprehend the thermodynamics and their corresponding processes that influence the behaviour and response of structural components	Cognitive	Understand
		Affective	Receiving

COURSE CONTENT

UNIT I	INTRODUCTION TO ENGINEERING MECHANICS	12
	Introduction - Units and Dimensions - Laws of Mechanics –Coplanar and Non coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility – single equivalent force. Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.	
UNIT II	CENTROID AND CENTRE OF GRAVITY&MOMENT OF INERTIA	12
	Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.	
UNIT III	FRICTION,MOTION OF BODIES	20
	Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D‟Alembert‟s principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation	

| UNIT IV | INTRODUCTION TO MECHANICAL VIBRATIONS | 10 |

Introduction To Mechanical Vibrations (DOF, Frequency, Amplitude And Damping) Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (Elastic and Gravitational), energy equation for equilibrium.

| UNIT V | DYNAMICS | 6 |

Applications of energy method for equilibrium. Stability of equilibrium Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton"s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Engineering Mechanics: Statics (14th Edition) by Russell C. Hibbeler , Best Sellers, 2015
2. Engineering Mechanics: Dynamics (14th Edition) by Russell C. Hibbeler , Best Sellers, 2015
3. D.S.Kumar "A text book of Engineering Mechanics" Publishers S.K.Kataria and Sons , 2012
4. Velusami.M.A. "Engineering Mechanics with Vector Approach": S.Chand Publishers, 2012
5. J. L. Meriam, L. G. Kraige "Engineering Mechanics: Dynamics",Sixth Edition 2012
6. R.S.Khurmi "A Textbook of Engineering Mechanics" , S. Chand Publishers, 2011

REFERENCE BOOKS

1. Jayakumar and Kumar , Engineering Mechanics, PHI Learning Pvt Ltd, 2013
2. Chandramouli, Engineering Mechanics, PHI Learning Pvt Ltd, 2011
3. K.V.Natarajan, "Engineering Mechanics", Dhanalakshmi Publishers, Chennai, 2006.
4. Beer F.P and Johnson E.R., "Vector Mechanics for Engineers – Statics and Dynamics", TataMcGraw-Hill Publishing Company Ltd., New Delhi, 2001.
5. N.Kottiswaran, "Engineering Mechanics, Statics & Dynamics", Sri Balaji Publications, 2004

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1			3	1			2	3	1		3	2	2
CO 2				3	3	2		1	3	2	1	1	1	1
CO 3		2	1	3	1	3		3	3	1		3	2	
CO 4	1		2	3	2	3		2	1			3	1	2
CO 5		2	1	3	3	1	1	1	2	2		3	2	2
Total	2	4	4	15	10	9	1	9	12	6	1	13	8	7
Scaled Value	1	1	1	3	2	2	1	2	3	2	1	3	2	2

Note:

	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	**III**
Course Code	:	**XCE 305**
Course Name	:	**ENERGY SCIENCE AND ENGINEERING**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
1	**1**	**0**	**2**		**1.5**	**0**	**1.5**		**3**	**1**	**0**	**4**

Course Outcome: After the completion of the course, students will beable to		*Domain C or P or A*	*Level*
CO1	*List* and generally *explain* the main sources of energy and their primary applications nationally and internationally	Cognitive Affective	Understan dRespond
CO2	*Understand* effect of using these sources on the environment and climate	Cognitive	Understand
CO3	*Describe* the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on theenvironment.	Cognitive	Understand
CO4	*List* and describe the primary renewable energy resources and technologies.	Cognitive	Understand
CO5	*Quantify* energy demands and make comparisons among energy uses, resources, and technologies.	Cognitive Affective	Understan dRespond
CO6	*Understand* the Engineering involved in projects utilizing these sources	Cognitive	Understand

COURSE CONTENT

UNIT I	INTRODUCTION TO ENERGY SCIENCE	4

Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

UNIT II	ENERGY SOURCES	5

Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor- based energy storages, high efficiency batteries)

UNIT III	ENERGY AND ENVIRONMENT	6

Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy

UNIT IV	CIVIL ENGINEERING PROJECTS	10

Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems

UNIT V	ENGINEERING FOR ENERGY CONSERVATION	5

Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability:Power for a Sustainable Future. Oxford University Press
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to RenewableEnergy Technologies and Sustainable Living, Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics ofDecision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy andthe Environment, 2nd Edition, John Wiley

REFERENCE BOOKS

1. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment

2. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	1		1	2	2	1	2	1	2	2
CO 2	3		3	2		1		2	2	1	3	1	2	2
CO 3	3	2	1		2	2	1	3	2	1	1	2	2	**2**
CO 4	2	3	2	1				2	2	1	2	1	2	**2**
CO 5	3	2		2	1	2		1	2	1	1	1	2	**2**
CO6		3	2	1		1	2	1	2	1	2	2	2	**2**
Total	14	12	9	7	4	6	4	11	12	6	11	8	12	**12**
Scaled Value	3	3	2	2	1	2	1	3	3	2	3	2	3	3

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	III
Course Code	:	**XCE 306**
Course Name	:	**SURVEYING - I**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
2	**0**	**4**	**6**		**0.80**	**1.7**	**0.5**		**2**	**0**	**4**	**6**

Course Outcome: After the completion of the course, students will be able to	*Domain C or P or A*	*Level*
CO1 *Identify* the Principles and functions of various surveying methods	Cognitive Psychomotor	Understanding Manipulation
CO2 *Identify* the methods of Levelling and [1]*determine* the educed levels	Cognitive Affective Psychomotor	Applying Responding Manipulation
CO3 *Classify* the methods of Contouring and *Measure* the capacity of Reservoir	Cognitive Psychomotor	Understanding Manipulation

45

CO4	*Describe* the methods and *measure* the angles anddistances using Theodolite	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO5	**Understand** the measurement of distance and heights ofobjects using tachometric principle	Cognitive Psychomotor Affective	Understanding Manipulation Responding

COURSE CONTENT

UNIT I	TRADITIONAL METHODS	12
	Introduction to Plane and Geodetic Surveying, Chain surveying, Instruments used in chain surveying, Ranging and chaining lines, chaining past obstacles, Chaining on sloping ground, Corrections applied, Field book, Trapezoidal and Simpson"s rule for computation of areas with irregular boundaries.	
	Compass Instrument, Measurement of angles and directions, Bearing, WCB & RB, Magnetic declination and its variation, Local attraction, Plotting of compass traverse, Latitude and departure	
	Plane Table Surveying: Principle, equipment, methods, orientation, two point and three-point problem and their solutions, errors & precautions, advantages and disadvantagesof plane tabling.	
UNIT II	LEVELLNG N	09
	Levelling, terms and definitions, Instruments and its parts, Temporary and permanent adjustments, Reduction of level, Height of collimation and Rise and fall methods, Inverted levels, Reciprocal levelling, Longitudinal and cross sectioning, Capacity of reservoirs	
UNIT III	CONTO RING U	09
	Definition, Contour interval, Characteristics of contours, Types of contours, Steep slopecontours, Flat terrain contours, Methods of locating contours, interpolation of contours, Contour gradient, Uses of contour maps, Definition for TIN, DTM, mass points.	
UNIT IV	THEODOLITE SURVEYING	09
	Description of theodolite, Measurement of horizontal angles and vertical angles,Methods of repetition and reiteration, Problems of heights and distances by single	
UNIT V	TACHOMETR	06
	planeand double plane method.	
	Tachometry – Tachometric systems – Determination of Instrument Constants-Problems in tachometric survey.	
PRACTICAL		30

1. Chain surveying- Distance Measurements

2. Compass Surveying- Magnetic declination and its variation

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3.	Plane Table Surveying-Two point and three-point problem

4.	Levelling-Height of collimation and Rise and fall methods

5.	Levelling- Longitudinal and cross sectioning

6.	Contouring – Radial and Square

7.	Theodolite surveying-Single plane method and double plane method.

8.	Tachometric surveying-Determination of Instrument constants

9.	Stadia Tachometry – Staff held Vertical (Angle of Elevation and Depression)

10.	Tangential tachometry – Both angles of Elevation and Depression

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Punmia B.C. Surveying, Vols. I, II and III, Laxmi Publications, 2007
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station,GIS andRemote Sensing, Pearson India, 2006.
3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.

REFERENCE BOOKS

1. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
2. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications,2001.
3. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

E-Resources – MOOC's

1. NPTEL Video Lectures on Surveying

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	3	3	3	3	2	3	2	2	3	3	3	2
CO 2	2	2	2	3	3	2	2	3	2	3	2	3	3	3
CO 3	3	1	2	3	3	2	1	3	2	2	2	3	3	3
CO 4	2	1	3	3	3	2	1	3	2	3	3	3	3	3
CO 5	2	1	3	3	3	2	1	3	2	3	3	3	3	3
Total	12	8	13	15	15	11	7	15	10	13	13	15	15	14

Scaled Value	3	2	3	3	3	2	2	3	2	3	3	3	3	3

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	III
Course Code	:	**XCE 307**
Course Name	:	**INTRODUCTION TO CIVIL ENGINEERING**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
2	0	0	2		2	0	0		2	0	0	2

Course Outcome: After the completion of the course, students will beable to		Domain C or P or A	Level
CO1	Understand the basis of engineering, Building material andConstruction methods.	Cognitive	Understanding
CO2	Understand the fundamentals of architecture, constructionmanagement and environmental engineering	Cognitive	Understanding
CO3	Understand the advancement of water & waste water system,energy system	Cognitive	Understanding
CO4	Understand the use of Surveying equipment and advancementin Transportation system.	Cognitive	Understanding
CO5	Get a detailed study of computational methods in civil engineering	Cognitive	Understanding

COURSE CONTENT

UNIT I	Importance of Civil Engineering and Materials	5

Basic Understanding: Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career, Professional ethics.

History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Industrial lectures and Case studies

Overview of National Planning for Construction and Infrastructure Development: Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works

Materials and methods of constructions: Stones, bricks, mortars, Plain, Reinforced &Prestressed Concrete, Construction Chemicals; Structural Steel, High

Tensile Steel, Composites; Plastics

UNIT II	Introduction of Architecture, Environmental and Management Studies	4
	Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Services; Green Buildings; Development of Smart cities	
	Basics of Construction Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management	
	Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Recycling and Sustainability in Construction; Repairs and rehabilitation of structures	
UNIT III	Introduction of Geotechnical, Water resource and Ocean Engineering	5
	Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling **Hydraulics, Hydrology &Water Resources Engineering**: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Multipurpose reservoir projects	
	Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports &Harbors and other marine structures	
UNIT IV	Introduction of Structural Engineering, Transportation Engineering and Remote Sensing	8
	Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Power plant structures;	
	Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbor and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management;	
	Surveying &Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR	
UNIT V	Computational Methods in Civil Engineering	8

Computational Methods, IT in Civil Engineering: Typical software used in Civil

Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modeling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,…GEOSTUDIO,

TUTORIALS	15

EDUSHAKE, MSP,PRIMAVERA, ArcGIS, VisSIM, …)

1. Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project

2. Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City.

3. List top five tunnel projects in India and their features; collect and study geotechnical investigationreport of any one Metro Rail (underground) project;

4. Visit a construction site and make a site visit report. Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other

5. Collect the history of a major rehabilitation project and list the interesting features

L	T	P	Total
30	15	0	45

TEXT BOOKS

1. L S Blake, (1989), Civil Engineer's Reference Book.
2. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract.
3. Archer Green. (2017) An Introduction to Civil Engineering.
4. MeenaRao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. AvinashPublications Mumbai

REFERENCE BOOKS

1. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
3. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
4. Bare text (2005), Right to Information Act
5. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
6. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	0	0	1	0	1	2	0	1	3	0	0	0	0	2
CO 2	0	3	0	0	2	0	0	0	1	1	0	0	1	1
CO 3	2	0	0	0	2	0	0	2	1	2	0	0	2	2
CO 4	0	0	1	0	3	0	2	1	1	1	0	0	2	0
CO 5	2	2	0	2	0	0	0	1	0	1	0	0	1	1
Total	4	5	2	2	8	2	2	5	6	5	0	0	6	6
Scaled Value	1	1	1	1	2	1	1	1	2	1	0	0	2	2

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	**III**
Course Code	:	**XGS 308**
Course Name	:	**EFFECTIVE TECHNICAL COMMUNICATION**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
3	**0**	**0**	**3**		**3**	**0**	**0**		**3**	**0**	**0**	**3**

Course Outcome: After the completion of the course, students willbe able to

		Domain C or P or A	Level
CO1	*Identify* the features of a technical project report and Knowledge on the linguistic competence to write a technical report	Cognitive	Remember
CO2	*Integrate* both technical subject skill and language skill towrite a project.	Cognitive	Create
CO3	The learner *identifies* and absorbs the pronunciation of sounds in English Language and learns how to mark the stress in a word and in a sentence properly	Cognitive	Remember
CO4	Confidence to *present* a project in 10 to 15 minutes	Cognitive	Understand

COURSE CONTENT

UNIT I	BASIC PRINCIPLES	10
	Definition of technical writing - language used in technical writing: technical words, jargons etc	
UNIT II	TECHNIQUES	10

Description of mechanism, Description of a process, Classifications, division and interpretation

UNIT III	LETTER WRITING	10

Formal – Informal – Four types of letter writing

UNIT IV	REPORT/ PROJECT WRITING	15

Layout the formats: chapters, conclusion, bibliography, annexure and glossary, Graphics aids etc - Presentation of the written project

	L	T	P	Total
	30	15	0	45

TEXT BOOKS

1. Gordon H. Mills, Technical Writing – April, 1978, Oxford Univ Press

2. Barun K. Mitra, Effective Technical Communication: A Guide for scientists and Engineers.Author, Publication: Oxford University press. 2007

REFERENCE BOOKS

1. Clifford Whitcomb, Effective Interpersonal and Task Communication Skills for Engineers,Atlantic Publishers. 2010

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	1	1			1	1			1				
CO 2	1	1	1			1	1			1				
CO 3	2	1	1			1	1			1				
CO 4	2		2			3	1			1				
Total	8	3	5	0	0	6	4	0	0	4	0	0	0	0
Scaled Value	2	1	1	0	0	2	1	0	0	1	0	0	0	0

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	IV
Course Code	:	XCE401
Course Name	:	MECHANICAL ENGINEERING
Prerequisite	:	

L	T	P	C	C	P	A		L	T	P	H
2	2	0	3	2.5	0.5	0.5		2	2	0	4

Course Outcome: *After the completion of the course, students willbe able to*	Domain C or P or A	Level
CO1 After completing this course, the students will be able to ***apply*** energy balance to systems and control volumes, in situations involving heat and work interactions	Cognitive	Understanding
CO2 Students can ***Study*** the changes in thermodynamicproperties of substances	Cognitive	Understanding
CO3 The students will be able to ***study*** the performance of energy conversion devices	Cognitive	Understanding
CO4 The students will be able to ***differentiate*** between highgrade and low grade energies.	Cognitive	Understanding
CO5 Student can ***apply*** the energy balance to systems operatingat different cycles.	Cognitive	Understanding

COURSE CONTENT

UNIT I	BASIC CONCEPTS	9

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

UNIT II	LAWS OF THERMODYNAMICS	9

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy

UNIT III	PROPERTIES OF SUBSTANCES AND STEAM TABLES	9

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier"s chart.

UNIT IV	FLOW PROCESS AND THERMO DYNAMIC RELATIONS	9

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal
and external irreversibility; Carnot cycle; Absolute temperature scale.

UNIT V   CYCLES AND PSYCHOMETRY   9

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compressioncycle and comparison with Carnot cycle.

Psychrometry and Psychrometric charts, Psychrometric Processes and Refrigeration Cycles.Vapour compression and absorption Refrigeration systems

L	T	P	Total
30	15	0	45

TEXT BOOKS / REFERENCE BOOKS

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of Thermodynamics*, John Wiley andSons.

2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, JohnWiley and Sons.

4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co.Ltd

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	-	1	-	3	-	2	2	2	-	-	2	0	0
CO 2	3	-	-	2	3	-	1	-	1	-	-	3	0	3
CO 3	1	-	1	3	1	-	1	2	-	2	-	1	2	0
CO 4	2	-	-	1	1	-	2	1	2	2	-	1	0	0
CO 5	-	-	-	1	1	-	-	-	1	1	-	2	2	2
Total	8	-	2	7	9	-	6	5	6	5	-	9	4	5
Scaled Value	2	0	1	2	2	0	2	1	2	1	0	2	1	1

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester   IV

Subject Name   **CONCRETE TECHNOLOGY**

Subject Code   **XCE 402**

L –T –P –C	**C:P:A**	**L –T –P –H**
2 – 0 – 1 –3	**2:0.75:0.25**	**2 – 0 – 2 – 4**

Course Outcome: After the completion of the course, students will be able to		Domain/Level C or P or A
CO1	*Identify* and *test* the properties of ingredients of Concrete	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO2	*Identify* and *test* the properties of Concrete	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO3	*Carry out* the mix design of M20 and M35 as per IS456	Cognitive Psychomotor	Applying Manipulation
CO4	*Ensure* quality during Transporting, Laying, Compacting and finishing of concrete	Cognitive	Analysing
CO5	*Adopt* special concreting technologies to meet out the modern construction requirements.	Cognitive	Applying

COURSE CONTENT

UNIT I   CONSTITUENT MATERIALS   6+0+12 hrs

Cement: - Properties-Testing- Modern methods of analysis- Blended Cements; Aggregates: Classification- Properties-Testing-Artificial aggregates; Water: Various sources-Standards- Admixtures and Chemicals: Properties, Uses.

UNIT II   FRESH CONCRETE   6+0+9hrs

Rheology-Workability: Factors affecting- Measurement- Testing; Manufacture of concrete: Process- Compaction; Properties: Segregation-Bleeding- Setting times- Curing-Finishing.

UNIT III   CONCRETE MIX DESIGN6+0+9hrs

Concepts of Mix Design- Factors influencing mix design- ACI and IS code recommended mix design methods; Non Pumpable concrete; Pumpable Concrete. Compressive Strength of Concrete Cube- Quality control –Sampling and testing

UNIT IV   HARDENED CONCRETE6+0+0hrs

Concepts of mix design - Factors influencing mix design – ACI and IS code

recommended mix design methods; Non-pump able concrete; Pump able concrete.

UNIT V   **SPECIALCONCRETES**   **6+0+0hrs**

Manufacture, Properties and Uses: High strength and high performance concrete - Use of eco-friendly recyclable and sustainable materials - Waterproofing concrete - Fiber Reinforced concrete - Light weight and High Density Concrete - Aerated - No fines - Organic concrete; Special concreting methods: Self compacting concrete - Hot and Cold weather concreting - Prepacked - Vacuum - Gunite and Shotcrete – Ferrocement - Quality control - Sampling and testing-Acceptance criteria

L=45 hrs   Total = 45 hrs

Text Books
- Shetty,M.S. "Concrete Technology: Theory and Practice",7th edition, S.Chand& Company, New Delhi,2014.

References
- Gambhir, M.L. "Concrete Technology", 5th edition, Tata McGraw Hill New Delhi, 2013.
- Santhakumar, A.R., "Concrete Technology", Oxford University Press, New Delhi, 2006
- Neville, A.M. and Brookes, J.J. "Concrete Technology", Pearson Publishers, New Delhi, 2010.
- Sandor Popovic, " Concrete Materials, 2nd Edition, Properties, Specifications and Testing",William Andrew,2012.
- John Newman,"Advanced Concrete Technology Processes" 1st edition, Elsevier Science, 2003

E-References
http://nptel.ac.in/courses/105102012
http://nptel.ac.in/courses/105104030
http://freevideolectures.com/Course/3357/Concrete-Technology
http://engineeringvideolectures.com/course/289

S.No.	List of Experiments	Cos
1.	Determination of Specific gravity of Cement	1
2.	Work out the fineness of Cement	1
3.	Find out the Consistency of Cement	1
4	Compute the Setting time of Cement	1
5	Determine the Fineness modulus of fine aggregate	1
6	Calculate the Specific gravity of fine aggregate	1
7	Find out the Bulking of fine aggregate	1
8	Estimate the Fineness modulus of coarse aggregate	1
9	Compute the Specific Gravity of Coarse aggregate	1
10	Find out the Bulking of coarse aggregate	1

11	Carry out the Aggregate Impact test	1
12	Determine the workability of Concrete through Slump Cone Test	2
13	Compute the Compaction Factor for the given mix ratio of concrete	2
14	Carry out the mix design of M20 and M35 as per IS 456	3
15	Determine the Compressive Strength of Concrete Cube	3

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	1	1	3	2	0	3	2	3	1	3	1	0
CO 2	1	3	3	3	2	3	0	3	1	3	1	3	0	0
CO 3	3	2	3	3	3	3	0	3	3	2	3	1	3	0
CO 4	3	0	0	0	2	3	3	2	3	3	0	1	0	1
CO 5	3	2	3	3	1	3	0	2	2	3	2	3	0	0
Total	**11**	**10**	**10**	**10**	**11**	**14**	**3**	**13**	**11**	**14**	**7**	**11**	**4**	**1**

1 - Low, 2 – Medium, 3 – High

Semester	:	IV
Course Code	:	**XCE 403**
Course Name	:	**ENGINEERING GEOLOGY**
Prerequisite	:	

L	T	P	C		C	P	A		L	T	P	H
1	0	2	2		2.5	0.5	0.5		1	0	2	3

Course Outcome: After the completion of the course, students willbe able to	*Domain C or P or A*	*Level*
CO1 Site characterization and how to collect, analyze, and reportgeologic data using standards in engineering practice	Cognitive Psychomotor	Applying Guided Response
CO2 The fundamentals of the engineering properties of Earthmaterials and fluids.	Cognitive Psychomot orAffective	Applying Guided Response Responding
CO3 Rock mass characterization and the mechanics of planarrock slides and topples.	Cognitive Affective	Understanding Responding

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| CO4 | Soil characterization and the Unified Soil Classification System. | Cognitive Psychomotor Affective | Applying Guided Response Responding |
| CO5 | The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability. | Cognitive Affective | Understanding Responding |

COURSE CONTENT

UNIT I	GENERAL GEOLOGY	6

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology-Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Mineralogical composition, structures & textures in rocks.

UNIT II	PHYSICAL GEOLOGY	6

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay - with flints, Solifluction deposits, mudflows, Coastal deposits.

UNIT III	GEOLOGICAL HAZARDS	6

Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. . Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Rock masses as construction material: Definition of Rock masses. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas.

UNIT IV	ENGINEERING GEOLOGY	6

Geology of dam and reservoir site- Required geological consideration for selecting
dam and reservoir site. Failure of Reservoir. Favourable &unfavorable conditions in
different types of rocks in presence of various structural features, precautions to be
taken to counteract unsuitable conditions, significance of discontinuities on the dam
site and treatment giving to such structures.

UNIT V	ROCK MECHANICS

Rock Mechanics- Sub surface investigations in rocks and engineering characteristics or
rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory
tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks,
Bearing capacity of rocks.

PRUCTICAL	30

1. Study of physical properties of minerals.

2. Study of different group of minerals.

3. Study of Crystal and Crystal system.

4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.

5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.

6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.

7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.

8. Study of topographical features from Geological maps. Identification of symbols in maps.

L	T	P	Total
15	0	30	45

TEXT BOOKS

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons.

2. Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), MacmillanPublishers India.

3. Engineering Geology, N.ChennaKesavalu, JNTU College of Engineering, Hydrabad. (2014)

4. Engineering Geology, SubinoyGangopadhyay,(2016)

REFERENCE BOOKS

1. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

NPTEL Video Lectures on Engineering Geology

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	-	3	1	-	-	-	1	1	2	-	3	2	-
CO 2	2	3	3	2	2	-	1	2	-	-	3	-	2	3
CO 3	2	3	3	3	2	2	1	2	-	-	-	2	2	3
CO 4	-	2	2	2	2	1	2	2	2	-	-	-	-	2
CO 5	3	-	2	3	2	-	2	3	2	2	1	2	3	-
Total	9	8	13	11	8	3	6	10	5	4	4	7	9	8
Scaled Value	2	2	3	3	2	1	2	2	1	1	1	2	2	2

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	IV									
Course Code	:	XCE 404									
Course Name	:	MECHANICS OF FLUIDS									
Prerequisite	:										

L	T	P	C		C	P	A	L	T	P	H
2	0	2	3		2.5	0.5	0.5	2	0	2	4

Course Outcome: After the completion of the course, students will be able to	*Domain* *C or P or A*	*Level*
CO1 Understand the broad principles of fluid statics, kinematics and dynamics	Cognitive	Applying
CO2 Understand definitions of the basic terms used in fluid mechanics	Cognitive	Applying
CO3 Understand classifications of fluid flow	Cognitive Affective	Understanding Responding
CO4 Application of the continuity, momentum and energy principles	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO5 Understanding and analyzing distribution of water through pipe	Cognitive Psychomotor Affective	Understanding Guided Response Responding

COURSE CONTENT

UNIT I	PROPERTIES OF FLUID AND FLUID STATICS	6

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton"s law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics - Fluid Pressure: Pressure at a point, Pascal"s law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro-manometers. Pressure gauges, Hydrostatic pressure and force on horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT II	FLUID KINEMATICS	6

Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and Irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three
-dimensional continuity equations in Cartesian coordinates.

UNIT III	FLUID DYNAMICS	6

Surface and body forces; Equations of motion - Euler"s equation; Bernoulli"s equation –Derivation; Energy Principle; PRACTICAL applications of Bernoulli"s equation: Venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by
fluid flow on pipe bend; Vortex Flow – Free and Forced

| UNIT IV | LAMINAR AND TURBULENT FLOW | 6 |

Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stokes law, Measurement of viscosity.

Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl"s mixing length theory, universal

| UNIT V | FLOW THROUGH PIPES | 6 |

velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody"s diagram.
Loss of head through pipes, Darcy-Wisbech equation, minor losses, total energy equation,
hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and

| PRACTICAL | | 30 |

control measures, branching of pipes, three reservoir problem.

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli"s Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualization -Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. R.K.Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand& Company Ltd., New Delhi,2002.

2. Bansal, R. K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi,2011.

3. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by P. N. Modi& S. M. Sethi StandardPublishers, New Delhi.

4. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by K. R. Arora, Standard Publishers, NewDelhi.

REFERENCE BOOKS

1. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
2. Introduction to fluid mechanics, Robert W. Fox, Philip J. Pritchard & Alan T. Mcdonald, WileyStudent Edition, 2009.
3. Fluid Mechanics and Machinery, C. S. P. Ojha, R. Bengtsson and P. N. Chadramouli0, OxfordUniversity Press, 2010.
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini andE.J.Fennimore, International Student Edition, McGraw Hill.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1			3	1			2	3	1		3	2	2
CO 2				3	3	2		1	3	2	1	1	1	1
CO 3		2	1	3	1	3		3	3	1		3	2	
CO 4	1		2	3	2	3		2	1			3	1	2
CO 5		2	1	3	3	1	1	1	2	2		3	2	2
Total	2	4	4	15	10	9	1	9	12	6	1	13	8	7
Scaled Value	1	1	1	3	2	2	1	2	3	2	1	3	2	2

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	IV									
Course Code	:	XCE 406									
Course Name	:	MECHANICS OF SOLIDS									
Prerequisite	:										

L	T	P	C		C	P	A		L	T	P	H
2	0	2	3		2.5	0.5	0.5		2	0	2	4

Course Outcome: After the completion of the course, students will beable to

		Domain C or P or A	Level
CO1	Analyse various situations involving structural members subjected to combined stresses by application of Mohr"scircle of stress	Cognitive Psychomotor	Analyse Measure
CO2	Calculate the shear force and bending moment occurs atvarious loading conditions.	Cognitive Affective	Analyse Response
CO3	Evaluate the shear stress distribution for beams of varioussections	Cognitive Psychomotor	Analyse Measure
CO4	Calculate the deflection at any point on a beam subjected toa combination of loads	Cognitive Psychomotor	Analyse Measure
CO5	Evaluate torsion problems in bars and thin walled members.	Cognitive Psychomotor	Analyse Measure

COURSE CONTENT

UNIT I	SIMPLE STRESSES AND STRAINS	6
	Concept of stress and strain, St. Venant"s principle,stress and strain diagram,Elasticity and plasticity – Types of stresses and strains, Hooke"s law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson"s ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications, Compound Stresses and Strains- Two dimensional system, stress at a point on aplane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strainsand principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.	
UNIT II	SHEAR FORCE AND BENDING MOMENT	6

Bending moment (BM) and shearforce (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT III	FLEXURAL STRESSES AND SHEAR STRESSES	6

Theory of simple bending –Assumptions – Derivation of bending equation: $\dfrac{M}{I} = \dfrac{f}{y} = \dfrac{E}{R}$

Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula –Shear stress distribution across
variousbeam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV	SLOPE AND DEFLECTION	6

Slope and deflection- Relationship between moment, slope and deflection, Moment area

method, Macaulay''s method. Use of these methods to calculate slope and deflection fordeterminant beams

UNIT V	TORSION AND THIN CYLINDERS	6

Torsion- Derivation of torsion equation and its assumptions. Applications of theequation 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.Thin Cylinders and Spheres- Derivation of formulae and calculations of hoopstress,

PRACTICAL	30

longitudinal stress in a cylinder, and sphere subjected to internal pressures

1. Tension test
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete
4. Impact test
5. Shear test
6. Investigation of Hook''s law that is the proportional relation between force and stretching in elasticdeformation,
7. Measurement of forces on supports in statically determinate beam,
8. Determination of shear forces in beams,
9. Determination of bending moments in beams,
10. Determination of torsion and deflection,
11. Measurement of deflections in statically determinate beam,
12. Measurement of strain in a bar
13. Bend test steel bar;
14. Yield/tensile strength of steel bar;

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. 3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall,2004
4. Laboratory Manual of Testing Materials - William Kendrick Hall
5. Mechanics of Materials - Ferdinand P. Beer, E. RusselJhonston Jr., John T. DEwolf TMH 2002.

REFERENCE BOOKS

1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2012,Second Edition.

2. Srinath L.S, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi,2009, Third Edition.

3. William Nash, Theory and Problems of Strength of Materials, Schaum"s Outline Series, McGraw-Hill International Edition, 2011.

4. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	3		1	3						2		2	
CO 2	1	3				2					2		2	
CO 3	1	2	2	1			1	1			2		1	
CO 4	1	2	2	1			1	1			2		1	
CO 5	1	2												
Total	6	12	4	3	3	2	2	2			8		6	
Scaled Value	2	3	1	1	1	1	1	1	0	0	2	0	2	0

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	IV									
Course Code	:	XCE 407									
Course Name	:	GEOTECHNICAL ENGINEERING									
Prerequisite	:										

L	T	P	C	C	P	A	L	T	P	H
2	0	2	3	2.5	0.5	0.5	2	0	2	4

	Course Outcome: After the completion of the course, students will beable to	*Domain C or P or A*	*Level*
CO1	Carry out soil classification, solve any PRACTICAL problems related to soil stresses estimation, permeability and seepage including flow net diagram	Cognitive Psychomotor Affective	Understanding Observation Responding
CO2	Estimate the stresses under any system of foundation loads solve PRACTICAL problems related to consolidationsettlement and time rate of settlement	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO3	Transfer the concept of soil investigation for any civil engineering construction	Cognitive, Psychomotor Affective	Applying Manipulation Valuing
CO4	Analyze earth retaining structures for any kind of soil medium	Cognitive	Analyse
CO5	Evaluate bearing capacity for proper foundations for anykind of shallow foundation system	Cognitive Affective	Understanding Responding
CO6	Assess the pile and pile group capacity for any kind of soilincluding group efficiency and negative friction	Cognitive Affective	Understanding Responding

COURSE CONTENT

UNIT I	BASIC PROPERTIES AND EFFECT OF WATER IN SOIL	6

Historical development of Soil Engineering - Origin and general types of soils - soil structure, clay minerals-Three phase system- Identification and Classification of soils,

Soil water - capillary phenomena - concept of effective and neutral stresses - Permeability - determination of coefficient of permeability in the laboratory - Seepage flow - Head, gradient, pressure - steady state flow - two dimensional - flow net.

UNIT II	STRESS DISTRIBUTION IN SOIL AND SHEAR STRENGTH	6

Vertical stress distribution in soil - Boussinesq and Westergaard's equation - Newmark's influence chart - principle, construction and use - Equivalent point load and other approximate methods - pressure bulb.

Shear strength - Mohr-Coulomb failure criterion - shear strength tests - Different drainage conditions - Shear properties of cohesionless and cohesive soils - Use of Mohr's circle - relationship between principal stresses and shear parameters.

UNIT III	COMPRESSIBILITY, CONSOLIDATION AND COMPACTION	6

Terzaghi's one dimensional consolidation theory - pressure void ratio relationship - preconsolidation pressure - Total settlement and time rate of settlement - coefficient of consolidation - curve fitting methods - Correction for construction time. Compaction of soils
- Standard Proctor, Modified Proctor, I.S. light & Heavy Compaction Tests – OMC - Zero Air voids line - Control of compaction - numerical problems

UNIT IV	SOIL EXPLORATION, LATERAL EARTH PRESSURE AND STABILITY OFSLOPES	6

Planning - Augur boring - Soundings - Sampling - Plate load test, static and dynamic penetrations tests - geophysical explorations Plastic equilibrium - Rankine's theory - Active and passive earth pressure for cohesionless and cohesive soils - Earth pressure at rest - Coloumb's wedge theory - Rebhann's and Culmann's graphical solutions, Stability analysis Stability of finite slopes -Toe failure, base failure, slip failure - Swedish Circle Method- Friction circle method- Factor of safety with respect to cohesion and angle of internal friction
- Stability number - Stability charts

UNIT	FOUNDATION	6

Functions and requisites- Different types - choice of foundation type – general principles of design. Bearing capacity - types of failures - Prandtl's and Terzaghi's bearing capacity analysis - Bearing capacity based on settlement and building codes Shallow foundation - spread footings - combined footings - trapezoidal and strap footings - Raft foundation - Contact pressure distribution - settlement analysis - Types of settlement, control

Deep foundation - piles - types - load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule - Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction - under reamed piles, Introduction to piers, caissons, Coffer dams

PRACTICAL	30

1. Field Density using Core Cutter method and Sand replacement method.
2. Natural moisture content using Oven Drying method.
3. Field identification of Fine Grained soils.
4. Specific gravity of Soils.
5. Grain size distribution by Sieve Analysis and Hydrometer Analysis.
6. Atterberg's Limits : Liquid limit , Plastic limit and Shrinkage limit
7. Permeability test using Constant-head test and Falling-head method
8. Compaction test: Standard Proctor test and Modified Proctor test
9. Relative density
10. Consolidation Test
11. Triaxial Test (UU)
12. Vane shear test
13. Direct Shear Test
14. Unconfined Compression Strength Test

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Arora K. R., Geotechnical Engineering, Standard Publishers, 2006.
2. Purushothamaraj P., Soil Mechanics and Foundation Engineering, Dorling Kindersley(India) Pvt.Ltd., 2013
3. Venkatramaiah, Geotechnical Engg, Universities Press, 2000.

4. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., NewDelhi, 1995.

5. A V NarasimhaRao and C Venkatramaiah, Numerical Problems, Examples and Objectivequestions in Geotechnical Engineering, Universities Press (India) Ltd., 2000

REFERENCE BOOKS

1. GopalRanjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited,New Delhi, 2002.

2. Murthy, V.N.S., A text book of Soil Mechanics and Foundation Engineering, UBS PublishersDistributors Ltd., New Delhi, 1999

3. Braja M. Das, Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore,2005.

4. Taylor D.W., Fundamentals of Soil Mechanics, Asia Publishing House, 1948.

5. Terzaghi K. and R. B. Peck, Soil Mechanics in Engineering Practice, John Wiley, 1967

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3			3				1			1	1	1
CO 2	2	3			3				1			2	1	1
CO 3	2	2						1					1	1
CO 4	3	2			1		1		**1**				1	1
CO 5	2	1			1								1	1
Total	2	1			1								1	1
Scaled Value	14	12	0	0	9	0	1	1	3	0	0	3	6	6

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

L	T	P	C		C	P	A		L	T	P	H
2	0	2	3		2.5	0.5	0.5		2	0	2	4

Semester : **IV**

Course Code : **XCE408**

Course Name : **SURVEYING - II**

Prerequisite :

Course Outcome: After the completion of the course, studentswill be able to		Domain C or P or A	Level
CO1	*Illustrate* the features of Triangulation system	Cognitive	Applying
CO2	**Understand** the importance of advanced techniques involved in surveying such as Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.	Cognitive	Applying
CO3	**Apply** the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities	Cognitive Psychomotor	Applying Guided Response
CO4	**Translate** the knowledge gained for the implementationof Civil infrastructure facilities	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO5	**Relate** the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.	Cognitive Affective	Understanding Responding

COURSE CONTENT

UNIT I	TRIANGULATION AND TRILATERATION	9
	Triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Intervisibility of height and distances - Trigonometric levelling - Axis single corrections	
UNIT II	CURVE SETTING	9
	Elements of simple and compound curves – Method of setting out– Elements of Reversecurve - Transition curve – length of curve – Elements of transition curve - Vertical curves	

UNIT III	MODERN FIELD SURVEY SYSTEMS	6

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT IV	PHOTOGRAMMETRY SURVEYING	6

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting

instruments, mosaics, map substitutes.

UNIT V	REMOTE SENSING	6

Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

PRACTICAL		30

Sl.No.	List of Experiments	Cos
1.	Setting out simple circular curve	1
2.	Area calculation and contouring using Total Station	2
3.	Co-ordinate measurement using Global Positioning System	2

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Punmia B.C. Surveying, Vols. I, II and III, Laxmi Publications, 2007
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station,GIS and RemoteSensing, Pearson India, 2006.
3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.

REFERENCE BOOKS

1. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010.
2. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
3. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

E-Resources – MOOC's

NPTEL Video Lectures on Surveying

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	1	3	3	3	2	1	3	2	3	3	3	3	3
CO 2	2	1	3	3	3	2	1	3	2	3	3	3	3	3
CO 3	3	2	3	1	3	2	0	1	1	0	2	3	3	3
CO 4	2	3	2	1	3	3	3	3	1	1	2	3	3	2
CO 5	3	3	1	1	3	2	0	2	2	3	2	3	1	2
Total	2	1			1								1	1
Scaled Value	14	11	12	9	16	11	5	12	8	10	12	15	14	14

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	IV										
Subject Name	MATERIALS TESTING & EVALUATION										
Subject Code											

2	0	2	3		1.5	1.2	0.3		2	0	2	4

Course Outcome: After the completion of the course, students will beable to

		Domain	Level
CO1	Understand the use of non-conventional Civil Engineeringmaterials	Cognitive Understand Psychomotor Perception	
CO2	Understand the various modes of failure in compression,tension, and shear	Cognitive Understand Psychomotor Mechanism	
CO3	Understand the standard testing and evaluation procedure	Cognitive Understand Psychomotor Perception	
CO4	Apply the concepts of fracture mechanics to various materials	Cognitive Apply Affective Response	
CO5	Adopt special concreting technologies to meet out themodern construction requirements.	Cognitive Apply Psychomotor Mechanism	

COURSE CONTENT

UNIT - I	CONSTRUCTION MATERIALS	5
	Brick and Stones, Cements, M-Sand, Ceramics, and Refractories, Bitumen and asphalticmaterials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material, geo-textiles, rubber, asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses	
UNIT - II	INTRODUCTION TO MATERIAL TESTING	4
	Mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different materials (brittle, quasi-brittle, elastic etc.,) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramics; Internal friction, creep – fundamentals and characteristics; Brittle fracture of steel – temperature transition approach	
UNIT- III	STANDARD TESTING & EVALUATION	5
	Mechanical testing and discussion, Naming systems for various irons, steels andnonferrous metals - Elastic deformation; Plastic	
UNIT– IV	FRACTURE MECHANICS	8
	deformation; Impact test Background; Fracture toughness – different materials; Fatigue of material; Creep,concept of fatigue ; Structural integrity assessment	

UNIT – V   SPECIAL CONCRETES   **8**

Plain, Reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, HighPerformance Concrete, Polymer Concrete

PRACTICAL

1. Test on Bricks and Blocks
2. Test on Timber specimens
3. Tests on coarse and fine aggregates
4. Tests on Concrete Cubes and Beams
5. Hardness tests (Brinnel''s and Rockwell)
6. Tests on closely coiled and open coiled springs
7. Concrete Mix Design as per BIS
8. Tests on unmodified bitumen and modified binders with polymers
9. Bituminous Mix Design and Tests on bituminous mixes - Marshall method

L	T	P	Total
30	---	30	60

TEXT BOOKS

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and PavementTesting', Nem Chand& Bros, Fifth Edition
3. KyriakosKomvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella

REFERENCES

1. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc.corresponding to materials used for Civil Engineering applications
2. E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition
3. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post2000)
4. Related papers published in international journals

Mapping of CO with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	0	0	2	2	0	0	0	0	0	0	2	0	0
CO2	0	1	2	2	0	2	0	0	0	2	1	1	0	0
CO3	1	0	2	2	0	2	0	0	0	2	1	1	0	0
CO4	2	0	2	2	0	2	0	0	0	2	1	1	0	0
CO5	3	2	3	3	1	3	0	2	2	3	2	3	0	0
Total	6	3	9	11	3	9	0	2	2	9	5	8	0	0
Scaled value	1	1	2	2	1	2	0	1	1	2	1	2	0	0

Note:

Total	0	1-5	6-10	11-15
Scaled value	0	1	2	3
Relation	No	Low	Medium	High

Semester	:	V									
Course Code	:	XCE501									
Course Name	:	MECHANICS OF MATERIALS									
Prerequisite	:	Nil									

L	T	P	C		C	P	A	L	T	P	H
3	0	0	3		2	0	1	3	0	0	3

Course Objectives

- Understand the deformation and strains under different load action and response in terms of forces andmoments
- To gain the knowledge on energy methods used to derive the equations to solve engineering problems
- Make use of the capabilities to determine the forces and moments for design

Course Outcome: After the completion of the course, students willbe able to **Domain** **Level**

			Cor P or A	
CO1	Understand the concept of theories of failure		Cognitive	Understanding
CO2	Understand the deformation and strains under different loadaction and response in terms of forces and moments		Cognitive	Understanding
CO3	Able to understand the Thin-walled Pressure Vessels		Cognitive	Understanding
CO4	Understand the energy methods used to derive the equations to solve engineering problems		Cognitive Affective	Understandin gReceiving
CO5	Illustrate stability of columns and plastic design		Cognitive Affective	Understanding Receiving

COURSE CONTENT

UNIT I	STRESS – STRAIN RELATIONSHIP	9
	Stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-Westerguard‟s stress space – Plastic stress strain relation – Saint Venant‟s principles, Principle of superposition and Uniqueness theorem	
UNIT II	**FORCE, MOMENT AND DEFORMATION**	**9**
	Forces and Moments Transmitted by Slender Members, Shear Force and Bending Moment Diagrams, Momentum Balance, Stress States / Failure Criterion - Force- deformation Relationships and Static Indeterminacy, Uniaxial Loading and Material Properties, Trusses and Their Deformations, Statically Determinate and Indeterminate Trusses,	

UNIT III	ELASTICITY AND ELASTICITY BOUNDS	7
	Stress-strain-temperature Relationships and Thin-walled Pressure Vessels,Stress andstrain Transformations and Principal Stress, Failure of Materials	
UNIT IV	COMBINED STRESSES AND ENERGY METHODS	11
	Pure Bending, Moment-curvature Relationship, Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams, Shear and Torsion, Torsion and Twisting, Thermoelasticity, Energy methods, Variational Methods; Strain energy, elastic, complementary and total strain energy, Strain energy of axially loaded bar, Beam in bending, shear and torsion; General energy theorems, Castigliano"s theorem, Maxwell Bettie"s reciprocal theorem; Virtual work and unit load method for deflection,Application to problems of beams and frames.	
UNIT V	STRUCTURAL STABILITY	9
	Stability of columns, Euler"s formula, end conditions and effective length factor, Columns with eccentric and lateral load; Plasticity and Yield Design covering 1D- Plasticity – An Energy Approach, Plasticity Models, Limit Analysis and Yield Design	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Nash, W. A. Strength of Materials. 3d ed. Schaum's Outline Series, McGraw-Hill, 1994.
2. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
3. Kazmi, S. M. A., „Solid Mechanics" TMH, Delhi, India.

REFERENCE BOOKS

1. Hertzberg, R. W. Deformation and Fracture Mechanics of Engineering Materials. 4thed. JohnWiley & Sons, 1996
2. Collins, J. A. Failure of Materials in Mechanical Design. 2nd ed. John Wiley & Sons,1993.
3. Courtney, T. H. Mechanical Behavior of Materials. McGraw-Hill, 1990.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	1											1	1
CO 2	1	2											2	2
CO 3	2		2	2			2	2					2	2
CO 4	2						2	2					3	3
CO 5	2												3	3
Total	8	3	2	2			4	4					11	11
Scaled Value	2	1	1	1	0	0	1	1	0	0	0	0	3	3

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V
Course Code	:	XCE502
Course Name	:	HYDRAULIC ENGINEERING
Prerequisite	:	FLUID MECHANICS

L	T	P	C		C	P	A		L	T	P	H
2	0	1	3		2	1	0		2	0	2	4

Course Objectives

- To understand the importance of study on model and prototype analysis.
- To introduce hydraulic engineering problems like open channel flows and hydraulic jump.
- To relate the theory and practice of problems in hydraulic engineering

Course Outcome: After the completion of the course, students willbe able to

		Domain **Cor P or A**	**Level**
CO1	Compute the coefficients using the theory of boundary layer	Cognitive	Understanding
CO2	*Perform* dimensional analysis for problems in fluid mechanics	Cognitive	Understanding
CO3	*Illustrate* the various theories dealing with the flow phenomenon of fluids and *Design* the open channels	Cognitive	Understanding
CO4	*Classify* and *design* of the hydro-machinery and the components, function and use of different types of turbines.	Cognitive Psychomotor	Understanding Mechanism
CO5	*Describe* and *Discuss* the working principles of pumps.	Cognitive Psychomotor	Understanding Mechanism

COURSE CONTENT

UNIT I	BOUNDARY LAYER ANALYSIS	6

Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, Laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

UNIT II	DIMENSIONAL ANALYSIS AND HYDRAULIC SIMILITUDE	6

Dimensional homogeneity, Rayleigh method, Buckingham"s Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

UNIT III	OPEN CHANNEL FLOW	6

Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section

UNIT IV	TURBINES	6

Turbines – classification –Pelton wheel –Francis and Kaplan turbines –draft tubes – performance of turbines – specific speed and their significance.

UNIT V	PUMPS	6

Centrifugal pump – description and working – head, discharge and efficiency of a Centrifugal pump. Reciprocating pump - description and working – types –working principle and use.

PRACTICA	30

1. Determination of the performance characteristics of a Centrifugal pump
2. Determination of the performance characteristics of a Reciprocating pump
3. Determination of the performance characteristics of a Jet pump
4. Determination of the performance characteristics of a Submersible pump
5. Determination of the performance characteristics of Pelton Turbine
6. Determination of the performance characteristics of a Francis Turbine

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by K. R. Arora, Standard Publishers, NewDelhi.
2. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by P. N. Modi& S. M. Sethi StandardPublishers, New Delhi.
3. Bakhmeteff, "Hydraulics of open channel", Tata McGraw Hill Education (P) Ltd., New Delhi, 2011

REFERENCE BOOKS

1. Open channel Flow, K. Subramanya, Tata McGraw Hill.
2. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill.
3. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi,2011.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	2	0	3	2	1	1	1	1	1	1	2	1
CO 2	3	2	2	0	1	1	1	1	0	1	0	1	1	1
CO 3	3	3	1	1	2	2	1	1	1	1	1	1	1	1
CO 4	2	1	2	1	2	1	0	1	0	1	0	1	2	1
CO 5	2	2	1	1	1	1	1	0	1	1	1	1	1	1
Total	13	11	8	3	2	7	4	5	3	5	3	5	7	5
Scale d Value	3	3	2	1	1	2	1	1	1	1	1	1	2	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V
Course Code	:	XCE503
Course Name	:	STRUCTURAL ANALYSIS
Prerequisite	:	Mechanics of Solids

L	T	P	C		C	P	A		L	T	P	H
2	0	1	3		2.5	0	0.5		2	2	0	4

Course Objectives
- Students will be exposed to the theories and concepts of structural analysis.
- An understanding of real issues in the behaviours of structures.
- To introduce the students to various methods for the analysis of buildings

Course Outcome: After the completion of the course, students willbe able to	**Domain**	**Level**
	Cor P or A	
CO1 Identify the behavior of structural element under variousloading condition.	Cognitive	Understanding
CO2 Analyse the continuous beams and rigid frames by slopedefection method.	Cognitive Affective	Understandin gRespond
CO3 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.	Cognitive	Understanding
CO4 Superimpose the effects of settlement and rotation of thesupports over the regular analysis.	Cognitive	Understanding
CO5 Apply knowledge on advanced methods of analysis ofstructures including arches and cables.	Cognitive	Understanding

COURSE CONTENT

UNIT I	INDETERMINATE FRAMES	12

Degree of static and kinematic indeterminacies for beams and plane frames - analysis ofindeterminate pin-jointed frames - rigid frames.

UNIT II	SLOPE DEFLECTION METHOD	12

Continuous beams and Rigid frames (with And without sway) – Symmetry and Asymmetry–Simplification for hinged end – Support Displacements.

UNIT III	MOMENT DISTRIBUTION METHOD	12

Stiffness and carry over factors-Distribution and carryover of Moments– Analysis of continuous Beams with and without displacement – Plane Rigid Frames with and without Sway

UNIT IV	MOVING LOADS AND INFLUENCE LINES	12

Influence lines for reactions in statically determinate structures – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads.

| UNIT V | ARCHES AND SUSPENSION CABLES | | | | | | | | | | | | 12 |

Types of Arches – Transfer of loads - Arch action- Horizontal forces- Analysis of Parabolic and Circular Arches(Hinged, fixed)- Cables- Components and their functions – Analysis of Suspension Cables, Reaction-Tension and Length of suspension cables.

			L	T	P	Total
			30	30	0	60

TEXT BOOKS

1. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", LaxmiPublications, New Delhi, 2013.

2. L.S. Negi& R.S. Jangid, Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2013

3. S SBhavikatti, Structural Analysis", Vikas Publishing House, 2011.

REFERENCE BOOKS

1. C.K. Wang, "Analysis of Indeterminate Structures", Tata McGraw-Hill, 2010.

2. B.C Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", Laxmi Publication, 2012.

3. DevdasMenon, "Structural Analysis", Narosa Publishers, 2010.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	3				1							1	
CO 2	3	1	1			1								
CO 3	1	3	2					1	1		1			
CO 4	3	2	2		1	1					1		1	
CO 5	1	1	1		1								1	1
Total	10	10	6		2	3	2	1	1		2		3	1
Scaled Value	2	2	2	0	1	1	1	1	1	0	1	0	1	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

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Semester	V									
Course Code	**XCE504**									
Course Name	**HYDROLOGY AND WATER RESOURCES ENGINEERING**									
Prerequisite	N l									

L	T	P	C		C	P	A		L	T	P	H
2	2	0	3		3	0	0		2	2	0	4

Course Objectives

- To prepare the students for a successful career as hydrologist and water resources engineers
- To develop the ability among students to synthesis data and technical concepts for application in hydrology and water resources engineering
- To provide students an opportunity to work as a part of interdisciplinary team
- To promote student awareness of the life-long learning and to introduce them professional ethics and codes of professional practice in water resource engineering

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Understand the interaction among various processes in the hydrologic cycle	Cognitive	Understanding
CO2	Understand the forms of precipitation and measurements.	Cognitive Affective	Understanding Respond
CO3	Understand runoff , ground water and well hydrology	Cognitive	Understanding
CO4	Understand water requirement of crops-Crops and crop seasons in India, Methods of applying water.	Cognitive	Understanding
CO5	Understand application of Distribution systems- cannel, Dams, reservoir and spillway.	Cognitive	Understanding

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**

Hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India

UNIT II	**ABSTRACTIONS FROM PRECIPITATION**	**9**

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration.

UNIT III	**RUNOFF**	**9**

Runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff, hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows.Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests

UNIT IV	WATER WITHDRAWALS AND USES	9

Water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT V	DISTRIBUTION SYSTEMS	9

Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Canal outlets: non- modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Subramanya. K," Engineering Hydrology", Tata Mc-Graw Hill publishing pvt. Ltd., Newdelhi, 2010.
2. K N Muthreja, "Applied Hydrology", Tata Mc-Graw Hill publishing pvt.Newdelhi
3. Larry W. Mays "Water Resources Engineering", Wiley; 2 edition (June 8, 2010)

REFERENCE BOOKS

1. G.L. Asawa "Elementary Irrigation Engineering" New Age International Publisher (1999).
2. G. L. Asawa, "Irrigation Engineering ", John Wiley & Sons Australia, Limited, 1994.
3. J D Zimmerman "Advances in Irrigation" Elsevier, 2013.

Mapping of CO with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2		3		1	1								
CO 2	3	1	3		1	1								
CO 3	2	1	3		1	1								
CO 4	2	1	3		1	1								
CO 5	2		3		1	1								
Total	11	3	15		5	5								
Scaled Value	3	1	3	0	1	1	0	0	0	0	0	0	0	0

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V
Course Code	:	XCE505
Course Name	:	ENVIRONMENTAL ENGINEERING
Prerequisite	:	Nil

L	T	P	C		C	P	A		L	T	P	H
2	0	2	3		2.0	0.5	0.5		2	0	2	4

Course Objectives

- To acquire the knowledge on extent of pollution on land, water and air.
- To understand the physical, chemical, and biological phenomena for successful design, operationand maintenance of water and sewage treatment plants.
- To make the students conversant with the processing and disposal of municipal solid waste andHazardous Waste

Course Outcome: After the completion of the course, students willbe able to	Domain C or P or A	Level
CO1 Understand the impact of humans on environment and environment on humans	Cognitive	Understanding
CO2 Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.	Cognitive	Understanding
CO3 Plan strategies to control, reduce and monitor pollution.	Cognitive Psychomotor	Understandin gMechanism
CO4 Select the most appropriate technique for the treatment ofwater, wastewater solid waste and contaminated air.	Cognitive Psychomotor	Understanding Mechanism
CO5 Conversant with basic environmental legislation	Affective	Respond

COURSE CONTENT

UNIT I	WATER AND SEWAGE	8

Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design.

Sewage- Storm Water- Quantification and design of Storm water; Sewage and Sullage, Quantity of Sewage, Sewage flow variations.Conveyance of sewage-Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems, Pollution due to improper disposal of sewage.Government authorities and their roles in water supply, sewerage diIsposa

UNIT II	WATER AND WASTEWATER TREATMENT	7

*Water Treatment: A*eration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.

Wastewater treatment: Aerobic and anaerobic treatment systems, suspended and attached growth systems, Recycling of sewage.

UNIT III	AIR AND NOISE	6

Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Air quality standards, Control measures for Air pollution, construction and limitations.

Noise- Basic concept, measurement and various control methods.

UNIT IV	SOLID AND HAZARDOUS WASTE MANAGEMENT	6

*Solid waste management-*Municipal solid waste, Composition and various chemical and physical parameters of MSW, Collection, transport,treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes. Government authorities and their roles in Solid waste management and monitoring/control of environmental pollution.

Hazardous waste: Types and nature of hazardous waste

UNIT V	BUILDING PLUMBING	3

Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

PRACTICAL	30

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH

2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile,inorganic etc.

3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness

4. Analysis of ions: chloride and sulfate

5. Optimum coagulant dose

6. Chemical Oxygen Demand (COD)

7. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)

8. Break point Chlorination

9. Ambient noise measurement

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw - HillInternational Editions, New York 1985.

2. MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, Tata McGraw-Hill,New Delhi.

3. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill PublicationInternational Editions, New York 1985.

4. CPHEEO Manual on Water Supply And Treatment,1999

5. CPHEEO Manual on Sewerage And Sewage Treatment,1993

REFERENCE BOOKS

1. B.C. Punmia, Watersupply Engineering, Volume –II, Laxmi Publication 2008
2. B.C. Punmia, Wastewater Engineering, Volume – II, Laxmi Publication 2008
3. S.K. Garg, Wastewater Engineering, Khanna Publishers, New Delhi, 2007
4. Gurucharan Singh," Water supply and Sanitary Engineering", Standard Publishers Distributors,2009
5. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
6. Rangwala, " Water Supply and Sanitary Engineering PB,24/e, Charotar Publishing house Pvt. Ltd.-Anand, 2011
7. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, NewJersey.
8. Standard methods for the Examination of Water and Wastewater, 17[th]Edition, WPCF, APHA andAWWA,USA,1989.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1		1	4	1	1	1			1				1	
CO 2		1	2	1	1	1			2				2	1
CO 3	1		3	2			1		1	1	1		2	
CO 4	1	1	1	1			1	1	2			1	1	
CO 5			2	2				1	4	1		2	5	
Total	2	3	12	7	2	2	2	2	10	2	1	3	11	1
Scaled Value	1	1	3	2	1	1	1	1	2	1	1	1	3	1

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V
Course Code	:	XUM506
Course Name	:	CONSTITUTION OF INDIA
Prerequisite	:	NIL

L	T	P	C		C	P	A		L	T	P	H
2	0	0	2		2	0	0		2	0	0	2

Course Objectives

- To know the Philosophy of Indian Constitution
- To gain the knowledge on Fundamental rights and duties
- To understand the function and role of Election Commission

Course Outcome: After the completion of the course, students willbe able to

		Domain Cor P or A	Level
CO1	Understand the salient features of Indian Constitution	Cognitive	Understanding
CO2	Gather the information on the contours of Constituitional Rights and Duties	Cognitive	Understanding
CO3	know the functions and powers of Governance	Cognitive	Understanding
CO4	Summarise the Responsibilities of Local administration	Cognitive	Understanding
CO5	Able to understand the Function of Election Commission	Cognitive	Understanding

COURSE CONTENT

UNIT I	HISTORY AND PHIOLOSOPHY	9
	History of Making of the Indian Constitution: History-Drafting Committee, (Composition& Working)Philosophy of the Indian Constitution: Preamble-Salient Features	
UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	9
	Fundamental Rights -Right to Equality-Right to Freedom-Right against Exploitation- Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies-Directive Principles of State Policy-Fundamental Duties.	
UNIT III	ORGANS OF GOVERNANCE	7
	Parliament-Composition-Qualifications and Disqualifications-Powers and Functions- Executive-President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications-Powers and Functions	
UNIT IV	LOCAL ADMINISTRATION	11

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

UNIT V	ELECTION COMMISSION	9

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

	L	T	P	Total
	30	0	0	30

TEXT BOOKS

1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

REFERENCE BOOKS

1. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
2. The Constitution of India, 1950 (Bare Act), Government Publication.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	1	1			1	1			1			1	1
CO 2	1	1	1			1	1			1			1	1
CO 3	1	1	1			1	1			1				
CO 4	1	1	2			3	1			1			3	2
CO 5	1	1	3			2	1			1			3	2
Total	5	5	8			8	5			5			8	6
Scaled Value	1	1	2	0	0	2	1	0	0	1	0	0	2	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V									
Course Code	:	XCE507									
Course Name	:	TRANSPORTATION ENGINEERING									
Prerequisite	:	Nil									

L	T	P	C	C	P	A	L	T	P	H
2	0	2	3	2.0	0.5	0.5	2	0	2	4

Course Objectives

- To design the geometric elements of highways
- To understand the fundamentals of traffic stream characteristics
- To characterize the pavement materials and to study the design of flexible pavements and rigidpavements

Course Outcome: After the completion of the course, students willbe able to

			Domain	**Level**
			Cor P or A	
CO1	Carry out surveys involved in planning and highwayalignment		Cognitive	Understanding
CO2	Design the geometric elements of highways andexpressways		Cognitive	Understanding
CO3	Carry out traffic studies and implement traffic regulationand control measures and intersection design .		Cognitive Affective	Understanding gRespond
CO4	Characterize pavement materials		Cognitive Psychomotor	Understanding Mechanism
CO5	Design flexible and rigid pavements as per IRC		Cognitive	Understanding

COURSE CONTENT

UNIT I	INTRODUCTION	9
	Highway development and planning-Classification of roads, road development in India,Current road projects in India; highway alignment and project preparation.	
UNIT II	HIGHWAY GEOMETRIC DESIGN	9
	Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems	
UNIT III	TRAFFIC ENGINEERING	9
	Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.	

UNIT IV	HIGHWAY MATERIALS	9
	Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems	
UNIT V	HIGHWAY PAVEMENT DESIGN	9
	Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems	

PRACTICALS 30

I. Tests on Aggregates

   a)   Determination of Specific Gravity for coarse aggregate.
   b)   Determination of Water absorption for coarse aggregate.
   c)   Determination of Impact Strength for coarse aggregate.
   d)   Determination of Crushing strength for coarse aggregate.
   e)   Determination of Abrasion for coarse aggregate.
   f)   Determination of fineness modulus foe coarse aggregate.
   g)   Determination of Flakiness and Elongation Index for coarse aggregate.
   h)   Determination of CBR value for the given sample.

II. Tests on Bitumen

   a)   Determination of consistency for bitumen
   b)   Determination of Softening point for bitumen

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, NemChand & Bros, 2017

2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

3. ParthaChakraborty, ' Principles Of Transportation Engineering, PHI Learning

REFERENCE BOOKS

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering andTraffic Analysis', 4th Edition, John Wiley

2. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.

3. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

4. IRC: 37-2001 – Guidelines for the Design of flexible Pavements for Highways, IRC, New Delhi, 2012.

5. IRC: 58-2002(Second Revision) – Guidelines for the Design of Rigid Pavements for Highways, IRC,New Delhi, 2002.

Mapping of CO with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1				2	2			1		1	2			
CO 2	2		3			1							2	
CO 3							3					2		
CO 4				2						1				
CO 5		2	3			1			1				2	
Total	2	2	6	4	2	2	3	1	1	2	2	2	4	
Scaled Value	1	1	2	1	1	1	1	1	1	1	1	1	1	0

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V									
Course Code	:	XCE508									
Course Name	:	CONSTRUCTION ENGINEERING &MANAGEMENT									
Prerequisite	:	NIL									

L	T	P	C		C	P	A		L	T	P	H
2	1	0	3		2	0	1		2	1	0	3

Course Objectives

- To introduce the students to the basic concepts and principles of construction management.
- To familiarize the students with the various construction management techniques includingscheduling, resource management.
- To study the elements of quality control and safety of construction projects.

Course Outcome: After the completion of the course, students willbe able to	Domain	Level
	Cor P or A	
CO1	**Understand** the basic concepts of construction management such as types and functions of management, life-cycle stages of projects, project delivery types of contracts, and bidding	Cognitive	Understanding
CO2	**Ascertain** a basic ability to plan, control and monitor construction projects with respect to time and cost	Cognitive Affective	Understanding Respond
CO3	**Understanding** of modern construction practices.	Cognitive	Understanding
CO4	**Receiving** an idea how construction projects areadministered with respect to contract structuresand issues.	CognitiveAffective	Understandin gRespond
CO5	**Ability** to put forward ideas and understandings to otherswith effective communication processes.	Cognitive Affective	Understandin gRespond

COURSE CONTENT

UNIT I	BASICS OF CONSTRUCTION	5

Unique features of construction, construction projects types and features, phases of aproject, Agencies involved and their methods of execution

UNIT II	CONSTRUCTION PLANNING AND SCHEDULING	13

Stages of project planning: pre-tender planning, Pre-construction planning, detailed construction planning, Process of development of plans and schedules, work break- down structure, activity lists, estimating durations, sequence of activities, Techniques of planning- Bar charts, Gantt Charts. Networks:Basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, PERT- determining three time estimates, analysis

UNIT III	CONSTRUCTION METHODS & EQUIPMENT BASICS	9

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Basics of Slip forming for tall structures)Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation
of materials.

UNIT IV	PROJECT PLANNING,ORGANIZING, MONITORING & CONTROL	9

Site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; and S-Curves. Earned Value; Resource Scheduling- Bar chart, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction. Supervision, record keeping, periodic progress, reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures.

UNIT V	CONSTRUCTION QUALITY & CONTRACTS MANAGEMENT	9

Concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health. Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of Various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolutionmethods.Classification of costs, time cost, trade-off in construction projects, compression anddecompression.

L	T	P	Total
30	15	0	45

TEXT BOOKS

1. Kumar NeerajJha, "Construction Project management", Dorling Kindersley, Publishers, NewDelhi.2013.
2. Chitkara.K.K, "Construction Project Management planning, Scheduling and control", TataMcGraw Hill Publishing Company, New Delhi, 2010.
3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.

REFERENCE BOOKS

1. Punmia, B.C., Khandelwal, K.K., "Project Planning with PERT and CPM", Laxmi Publications, 2016.
2. Vohra.N.D., "Quantitative Techniques in Management", Tata McGraw Hill Publishing Company,New Delhi, 2010.
3. Joy.P.K, "Total Project Management", Macmillan India Ltd, New Delhi, 2000.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1				1	3	2	1	1	**1**					1
CO 2	2	1						2	1	1		1	1	1
CO 3	2	1		2		1	1	1	2		1		1	
CO 4						2	1	1	1	1			1	
CO 5			2				1							
Total	4	2	2	3	3	5	4	5	5	2	1	1	3	2
Scaled Value	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V
Course Code	:	**XCE509**
Course Name	:	**PROFESSIONAL PRACTICE LAW& ETHICS**
Prerequisite	:	**NIL**

L	T	P	C		C	P	A		L	T	P	H
3	**0**	**0**	**3**		**3**	**0**	**0**		**3**	**0**	**0**	**3**

Course Objectives
- To make the students understand the types of roles they are expected to play in the society aspractitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession
- To familiarize students with elementary knowledge of laws that would be of utility in their profession, including several new areas of law such as IPR, ADR.

Course Outcome:After the completion of the course, students will be able to

		Domain C or P or A	**Level**
CO1	To Understand the various stakeholders roles and ethicsgoverning the profession	Cognitive	Understanding
CO2	To able to contracts management and dispute resolution mechanisms;	Cognitive	Understanding
CO3	To give an understanding of Intellectual Property Rights,Patents.	Cognitive	Understanding
CO4	Able to understand construction related laws	Cognitive	Understanding
CO5	To develop ideas of the legal and practical aspects of theirprofession	Cognitive	Understanding

COURSE CONTENT

UNIT I	PROFESSIONAL PRACTICE AND PROFESSIONAL ETHICS	9

Respective roles of various stakeholders: Government Agencies (constituting egulatorybodies and standardization organizations, prescribing norms to ensure

safety of the citizens)-Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed bycontracts); Developers (role governed by regulations such as RERA); Consultants (rolegoverned by bodies such asCEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Actsand Standards)

Definition of Ethics, Professional Ethics, Business Ethics,Corporate Ethics,Engineering Ethics, Personal Ethics; Code of Ethics as defined in thewebsite of Institution of Engineers (India); Profession, Professionalism,

ProfessionalResponsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmentalbreaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism,
Whistleblowing,protected disclosures.

UNITII   CONTRACTS   9

Indian Contract Act, 1972 and Amendments covering General principles of contracting;

Contract Formation & Law; Privacy of contract; Various types of   contract and their features; Valid & Voidable Contracts; Prime and   sub-contracts; Joint Ventures & Consortium; Complex contract terminology;   Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation;   Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts;   Differing site conditions; Cost escalation; Delays, Suspensions   & Terminations; Time extensions & Force Majeure; Delay Analysis;   Liquidateddamages& Penalties; Insurance & Taxation; Performance and   Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction;   Case Studies; Build-Own- Operate & variations; Public- Private Partnerships; International Commercial Terms

UNIT III	ARBITRATION, CONCILIATION AND ALTERNATIVE DISPUTE 7RESOLUTION SYSTEM	

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration,confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; LokAdalats

UNIT IV	LABOUR AND LABOUR & OTHER CONSTRUCTION-RELATED	11

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen‟s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT	LAW RELATING TO INTELLECTUAL	9

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks,Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relatingto Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. ProfessionalOffset
3. NeelimaChandiramani (2000), The Law of Contract: An Outline, 2nd Edn. AvinashPublicationsMumbai
4. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill
5. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press

REFERENCE BOOKS

1. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
2. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on
3. UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
4. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
5. The National Building Code, BIS, 2017
6. RERA Act, 2017

E-Resources

1. Construction Contracts:http://www.jnormanstark.com/contract.html
2. Contracts Law : http://www.laderapress.com/laderapress/contractslaw1.html
3. Contract&Agreements: http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
4. Contracts: http://206.127.69.152/jgretch/crj
5. Business & Personal Law: http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
6. Types Of Contracts And Important Provisions: http://www.worldbank.org/html/ opr/consult/guidetxt/types.html
7. Contract Types/Pricing Arrangements: http://www.sandia.gov/policy

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O	P O	P O	PSO1	PSO2
CO 1	1	1	1			1	1			1			1	1
CO 2	1	1	1			1	1			1			1	1
CO 3	2	1	1			1	1			1				
CO 4	2		2			3	1			1			3	2
CO 5	3		3			2	1			1			3	2
Total	9	3	8			8	5			5			8	6
Scaled Value	2	1	2	0	0	2	1	0	0	1	0	0	2	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	VI
Course Code	:	XCE 601
Course Name	:	STRUCTURAL ENGINEERING
Prerequisite	:	NIL

L	T	P	C		C	P	A		L	T	P	H
2	1	0	3		3	0	0		2	1	0	3

Course Objectives

Through this course the students will

- Understand the principles of structural engineering design.
- Exposed to the theories and concepts of both concrete and steel design and analysis
- Develop a solution for structural problems in component level.

Course Outcome: After the completion of the course, students willbe able to

		Domain	Level
		Cor P or A	
CO1	Apply their knowledge of structural mechanics in designproblems of structural engineering	Cognitive	Understanding
CO2	Acquire the skills to solve problems with different loadson concrete and steel	Cognitive	Understanding
CO3	Design the Reinforced concrete elements	Cognitive	Understanding
CO4	Design the steel elements	Cognitive	Understanding
CO5	Understand the behavior of special structural elements	Cognitive	Understanding

COURSE CONTENT

UNIT I	INTRODUCTION TO STRUCTURAL ENGINEERING	9
	Principles of Equilibrium – Stability of structure - Concepts of energy principles,safety, sustainable development in performance; Principles of process of design Functions and role of structural engineer – architect – builder - user	

UNIT II	PLANNING AND DESIGN PROCESS	9
	Introduction to materials , Loads , and design methods , Structural properties of concrete – Grades and Strength of concrete – Durability – Reinforcing steel –DesignLoads – Types – Codal provisions	

UNIT III	DESIGN OF REINFORCED CONCRETE ELEMENTS	9
	Basic design concepts – Limit state design - Design of reinforced concrete slabs –beams – columns – footings.	

UNIT IV	DESIGN OF STEEL ELEMENTS	9
	Introduction to Steel Design, Connections – Types - Design of Tension Members – Compression member – Flexural Member	

UNIT V	SPECIAL ELEMENTS AND APPLICATIONS	9

Concepts of Cable Structures; bunkers and silos , Prestressed Concrete
Bridges;Trusses, Corbels; Constructability and Structural Control; Fire
Protection

	L	T	P	Total
	30	15	0	45

TEXT BOOKS

1. Devadas Menon & Unnikrishnan Pillai, "Reinforced Concrete Design",Tata McGraw-Hill PublishingCompany Ltd., New Delhi 2011
2. Dr. B.C. Punmiya, "Reinforced Concrete Structures", Standard Laxmi Publication,Delhi,1994
3. N.Subramaniyan , " Design of Steel Structures:Theory and Practice" , Oxford University Press , 2010

REFERENCE BOOKS

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., NewDelhi, Second Edition, 2010.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers &Distributors, New Delhi, 2007.
3. Duggal S.K , " Limit State Design of Steel Structures", 2nd Edition , Tata McGraw-Hill PublishingCompany Ltd., New Delhi 2014

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	1	2	1		2	1		1		1		2	2
CO 2	1	2	1			1			1	1			2	1
CO 3	1		3	1		1			1		1		2	1
CO 4	1		3	1		1			1		1		2	1
CO 5	2	2	2	1		1		1	1		1		2	2
Total	8	5	11	4		6	1	1	5	1	4		10	7
Scaled Value	2	1	3	1	0	2	1	1	1	1	1	0	2	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	V I									
Course Code	:	XCE 602									
Course Name	:	ENGINEERING ECONOMICS, ESTIMATION AND COSTING									
Prerequisite	:	NIL									

L	T	P	C		C	P	A	L	T	P	H
2	1	1	5		2.0	0.5	0.5	3	2	2	7

Course Objectives

Through this course the students will

- To acquire knowledge in engineering economics
- To determine the quantities of items and labour requirement of civil engineering works.
- To prepare detailed and abstract estimate for the civil engineering works
- To introduce the students in depth knowledge of professional practice as well the quantity analysis of construction works like, multi-storied structures, Water works & sanitary works, Irrigation works, Road estimates, culverts, etc.

Course Outcome: After the completion of the course, students willbe able to

			Domain	**Level**
			Cor P or A	
CO1		Understand the Economics in general, Economics of India particularly for public sector agencies and private sector businesses	Cognitive	Understanding
CO2		Understand the principles and methods of measurements	Cognitive	Understanding
CO3		Understand the methodology of pricing and to determinethe unit cost of "components"	Cognitive Psychomotor	Understandin gSet
CO4		Learning from Laboratory demonstration and field visits	Cognitive Psychomotor	Understandin gSet
CO5		Prepare the actual estimate of any property/project	Cognitive Affective	Understandin gRespond

COURSE CONTENT

UNIT I	PRINCIPLES AND METHODOLOGY OF ECONOMICS	10

Basic Principles and Methodology, Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes, Public Sector Economics – Welfare, Externalities, Labour Market, Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming, Statements – Cash flow.

UNIT II	BASICS AND ESTIMATION OF BUILDINGS	10

Process of estimating **-** Construction activities and sequence – Units of measurements – Methods of estimating – Calculation of quantities of brick work, PCC, RCC, wood work, plastering, white washing, colour washing, painting, varnishing etc., relating to residential and non-residential multi-storeyed buildings. Introduction of estimation software.

UNIT III	ESTIMATION OF OTHER STRUCTURES	7

Estimation of services – Sanitary and water supply installations – Bituminous and cement concrete roads –Irrigation works **-** Retaining walls and culverts – Steel structures.

UNIT IV	SPECIFICATIONS AND RATE ANALYSIS	8

Objectives and importance of specification - Specification of materials - specification of works - specification as per building classification- Language of specific writing - Detailed and general specifications, Analysis of rates using standard data and schedule of rates for conventional items – Principles of pricing of new items – abstract estimate.

UNIT V	VALUATION	10

Necessity – Basics of valuation – Capitalized value – Depreciation – Escalation – Value of property – Calculation of Standard rent – Report preparation.

TUTORIALS AND PRACTICALS	60

1. Building marking
2. Detailed Estimate of Residential buildings (RCC and Masonry)
3. Detailed Estimate of Water supply & Sanitary work
4. Detailed Estimate of Culverts and Bridges
5. Detailed Estimate of Earthwork for Roads
6. Detailed Estimate of Steel Roof Trusses
7. Preparation of Bar bending schedule

8.   Rate Analysis of Different Items for Construction work

9.   Preparation of valuation report in standard Government form

10.   Estimation using Spread Sheet

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Dutta, B.N., "Estimating and Costing in Civil Engineering Theory and Practice", UBS Publishers& Distributors Pvt. Ltd.,New Delhi, 2010.

2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand& Company Ltd., New Delhi, 2004

3. M.Chakraborty,"Estimating,Costing, Specification and Valuation in CivilEngineering",Kolkata,1997.

REFERENCE BOOKS

1. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria& Sons, NewDelhi.

2. Birdie.G.S., "A Text Book on Estimating and Costing", DhanpatRai and Sons, New Delhi

3. Chandola, S.P. and Vazirani, Estimating and Costing, Khanna Publication

4. Rangwala. S.C., "Elements of Estimating and Costing", Charotar Publishing House,Anand

5. IS 1200-1974, Parts 1-25, Methods of Measurements of Building and Civil Engineering works –Bureau of Indian Standards, New Delhi.

6. Standard Data Books and Schedule of rates of Central and State Public Works Departments

Mapping of CO with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	1		1	2	2		2	2	3	2	1	
CO 2	2	2	1		2	3				3				
CO 3	2		1		3			1			3	3	1	
CO 4	2			2	3			1	3				1	
CO 5	2			2			2	1		2	3	3	1	3
Total	10	3	3	4	9	5	4	3	5	7	9	8	4	3
Scaled Value	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**

1

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:										
Course Code	:	XCEE04									
Course Name	:	RAILWAY ENGINEERING									
Prerequisite	:	NIL									

L	T	P	C		C	P	A		L	T	P	H
3	0	0	3		2	1	0		3	0	0	3

Course Objectives

Through this course the students will

- To know about the basics and design of various components of railway engineering.
- To study about the types and functions of track, junctions and railway stations
- To learn about the construction and maintenance of track

Course Outcome: After the completion of the course, students will be able to		Domain C or P or A	Level
CO1	Understand the methods of route alignment	Cognitive	Understanding
CO2	Identify the elements of permanent way	Cognitive	Understanding
CO3	Design and analyse the geometric elements	Cognitive Psychomotor	Understanding Mechanism
CO4	Design the layout of track junctions	Cognitive Psychomotor	Understanding Set
CO5	Understand the Construction techniques and Maintenance of Track laying and Railway stations.	Cognitive	Understanding

COURSE CONTENT

UNIT I	INTRODUCTION	7
	Introduction to railway engineering - Route alignment surveys, conventional and modern methods	
UNIT II	**COMPONENTS OF PERMANENT WAY**	**10**
	Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails	
UNIT III	**GEOMETRIC DESIGN**	**10**
	Geometric design of railway, gradient, super elevation, widening of gauge on curves	
UNIT IV	**TRACK JUNCTIONS AND SIGNALLING**	**9**
	Track Junctions-Points and crossings - types and functions - design and layout - simple problems - Railway stations and yards. Signalling and interlocking - control systems of train movements.	

UNIT V	CONSTRUCTION AND MAINTENANCE	9

Earthwork – Stabilization of track on poor soil - Track drainage – Calculation ofMaterials required for track laying - Construction and maintenance of tracks

	L	T	P	Total
	45	0	0	45

TEXT BOOKS

1.Chandra S. and M.M. Agarwal, Railway Engineering,Second Edition, Oxford University Press, NewDelhi, 2013.

2.Rangwala, S.C., Railway Engineering, Charotar Publishing House, Pvt. Limited,2008.3.Saxena, S.C. Railway Engineering, DhanpatRai, 2015.

REFERENCE BOOKS

1. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill, 2007.
2. Chandola S.P. A text on Transportation Engineering, S. Chand Limited, 2008
3. AhujaT.D. Birdi G.S. Roads, Railways Bridges and Tunnels Engineering. Standard Book House -2015.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2				1				1	1		1		
CO 2			2								1			
CO 3	2		3			2							2	
CO 4	2		3			2							2	
CO 5									2	1	1	1		
Total	6		6	2	1	4			3	2	2	2	4	
Scaled Value	1	0	1	1	1	1	0	0	1	1	1	1	1	0

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:		
Course Code	:	XCEE05	
Course Name	:	ADVANCED STRUCTURAL ANALYSIS	
Prerequisite	:	STRUCTURAL ANALYSIS	

L	T	P	C		C	P	A		L	T	P	H
3	0	0	3		2	0	1		3	0	0	3

Course Objectives

Through this course the students will

- To introduce the Influence line for indeterminate structures.

- To study the behaviour of different types of frames by classical methods.

- To analyse the plastic nature of the structure using theorems and mechanisms.

	Course Outcome: After the completion of the course, students willbe able to	Domain	Level
		Cor P or A	
CO1	Identify the behavior of indeterminate structure byinfluence lines.	Cognitive	Understanding
CO2	Apply knowledge on advanced methods of analysis of structures including for planes and rigid frames.	Cognitive	Understanding
CO3	Superimpose the effects of settlement and rotation of thesupports over the regular analysis.	Cognitive	Understanding
CO4	Apply knowledge of finite element for determinate andindeterminate structures.	Cognitive	Understanding
CO5	Recognize the plastic analysis of structural elements.	Cognitive	Understanding

COURSE CONTENT

UNIT I	INFLUENCE LINES - INDETERMINATE STRUCTURES	9
	Influence lines -Maxwell Betti‟s theorem- Muller Breslau‟s principle – Influence linesfor continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures.	

UNIT II	STIFFNESS MATRIX METHOD	9
	Element and global stiffness matrices – Analysis of continuous beams – Co-ordinatetransformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames.	

UNIT III	FLEXIBILITY MATRIX METHOD	9
	Equilibrium and Compatibility – Determinate vs indeterminate structures – Indeterminacy - Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).	

UNIT IV	FINITE ELEMENT METHOD	9

Introduction – Discrimination of a structure –differential equilibrium equations- straindisplacement relation- isoparametric elements – Shape functions – Lagrange and
Serendipity elements — Plane stress and plane strain.

UNIT V	PLASTIC ANALYSIS OF STRUCTURES	9

Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastichinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Vaidyanadhan, R and Perumal, P, LaxmiPublications, New Delhi, 2003

2. Structural Analysis", L.S. Negi& R.S. Jangid, Tata McGraw-Hill Publications, New Delhi, SixthEdition, 2003

3. Indeterminate Structures", Wang, C.K., McGraw-Hill

REFERENCE BOOKS

1. Ghali.A, Nebille, A.M. and Brown, T.G. "Structural Analysis" A unified classical and Matrixapproach" –5th edition. Spon Press, London and New York, 2003.

2. Vazirani V.N, &Ratwani, M.M, "Analysis of Structures", Khanna Publishers, Delhi.

3. Structural Analysis – A Matrix Approach – G.S. Pandit& S.P. Gupta, Tata McGraw Hill., 2005

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	3				1							1	
CO 2	3	1	1			1								
CO 3	1	3	2					1	1		1			
CO 4	3	2	2		1	1					1		1	
CO 5	1	1	1		1								1	1
Total	10	10	6		2	3	2	1	1		2		3	1
Scaled Value	2	2	2	0	1	1	1	1	1	0	1	0	1	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Mediu	High

			m	

Semester	:
Course Code	: **XCEE14**
Course Name	: **EARTHQUAKE ENGINEERING**
Prerequisite	: ---

L	T	P	C	C	P	A	L	T	P	H
3	0	0	3	2.5	0	0.5	3	0	0	3

Course Objectives

- To introduce the basics of Earthquake Engineering.
- To teach the analytical methods for evaluation of seismic resistance of buildings.
- To introduce the engineering seismology, building geometrics & characteristics and structuralirregularities.

Course Outcome: After the completion of the course, students will be able to	**Domain** **C or P or A**	**Level**
CO1 Describe the basis of vibrations	Cognitive	Understand
CO2 Analyse SDOF and MDOF systems with distributed massor continuous system.	Cognitive	Understand
CO3 Quantify the effect of seismic waves.	Cognitive Affective	Understand Receiving
CO4 Understand the concept of response spectrum andapplication of structural dynamics.	Cognitive	Understand
CO5 Able to design of Earthquake resistant structures with codalprovisions	Cognitive	Understand

COURSE CONTENT

UNIT I	**THEORY OF VIBRATIONS**	**9**
	Concept of inertia and damping – Types of Damping – Difference between static forces and dynamic excitation – Degrees of freedom – SDOF idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral.	
UNIT II	**MULTIPLE DEGREE OF FREEDOM SYSTEM**	**9**
	Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).	
UNIT III	**ELEMENTS OF SEISMOLOGY**	**9**
	Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes.	

UNIT IV	RESPONSE OF STRUCTURES TO EARTHQUAKE	9

Response and design spectra – Design earthquake – concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction ofsoils – Importance of ductility – Methods of introducing ductility into RC structures.

UNIT V	DESIGN METHODOLOGY	9

Design as per the codes IS 1893, IS 13920 and IS 4326 — Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. David Dowrick ., "Earthquake Resistant Design And Risk Reduction" John Wiley & Sons, 2011
2. Kavitha S., Damodarasamy S. R. "Basic of Structural Dynamics and Aseismic Design" PHILearning Private Limited publishers,2009.
3. Anil k chopra " Dynamics of structures "" Theory and application to Earthquake Engineering, Prentice Hall.2012

REFERENCE BOOKS

1. George G.Penelis and AndreasJ.Kappos,Earthquake Resistant Concrete Structures, Taylor andFrancis,.London,UK,2014
2. Shashikant K. Duggal "Earthquke resistant design of structures"Oxford University Press, 2013
3. Mario Paz,William Leigh "Structural Dynamics-Theory &Computattions""Kluwar AcademicPublishers, USA,2004

IS Codes
1. IS 1893(Part 1):2002, Criteria for Earthquake Resistant Design of Structures
2. IS 13920 - 2016 Ductile Design and Detailing Of Reinforced Concrete Structures Subjected toSeismic Forces
3. IS 4326 - 2013 Earthquake Resistant Design and Construction of Buildings

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	2			1				1			2	
CO 2	2	3											1	
CO 3	2	1	1			2				1			1	1
CO 4	1	2			1		1	1	1	1	1	1		
CO 5	2		3		1		1	1				1	2	1
Total	10	8	6		2	3	2	2	1	3	1	2	6	2
Scaled Value	2	2	2	0	1	1	1	1	1	1	1	1	2	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:										
Course Code	:	XCEE15									
Course Name	:	DESIGN OF HYDRAULIC STRUCTURES									
Prerequisite	:	---									

L	T	P	C	C	P	A	L	T	P	H
3	0	0	3	2	0	1	3	0	0	3

Course Objectives

- To impart knowledge regarding tank irrigation and impounding structures
- To learn the capacity and design of canal transmission and regulation structures.
- To study on importance of irrigation water management structures.

Course Outcome: After the completion of the course, studentswill be able to	**Domain** C or P or A	**Level**
CO1 *Design* the Tank irrigation structure and *draw* the components.	Cognitive Affective	Create Respond
CO2 *Design* of dams and energy dissipation structures	Cognitive Affective	Create Guided Response
CO3 *Design and plot* canal transmission structures	Cognitive Affective	Create Guided Response
CO4 *Analyse and design* canal regulation structures	Cognitive Affective	Create Respond
CO5 *Develop* strategies for water managementin irrigation structures.	Cognitive	Understand

COURSE CONTENT

UNIT I	TANK IRRIGATION STRUCTURES	9
	Design and Drawing of Tank surplus weirs–Tank sluices weirs on pervious foundations - Percolation ponds	
UNIT Il	IMPOUNDING STRUCTURES	9
	Design of Gravity Dams – Earth dams– Spill ways – Energy dissipation devices	
UNIT III	CANAL TRANSMISSION STRUCTURES	9
	Design and Drawing of Aqueducts – Siphon aqueducts – Super passage – Canal siphon – Canal drops – Notch type – Rapid type fall – Siphon well drops	
UNIT IV	CANAL REGULATION STRUCTURES	9
	Design of lined and unlined channels – Design and Drawing of Canal head works –Canal regulator – Canal escape	
UNIT V	IRRIGATION WATER MANAGEMENT STRUCTURES	9
	On farm development works – Structures for proportional field distribution-Droughtmanagement-Case study.	

	L	T	P	Total
	45	0	0	45

TEXT BOOKS

1. Garg, S.K. Irrigation Engineering and Hydraulic Structures. Khanna Publishers, Delhi," 2008
2. Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co.,New Delhi, 2016
3. N N Basak " Irrigation Engineering', Tata Mcgraw Hill publishing company limited, NewDelhi,2007

REFERENCE BOOKS

1. Punmia, BC; and PandeBrijBansiLal, `Irrigation and Water Power Engineering', Delhi, StandardPublishers Distributors,2016
2. Sharma, SK; `Principles and Practice of Irrigation Engineering', , Prentice Hall of India Pvt. Ltd. ,New Delhi
3. Madan Mohan Das, Mimi Das Saikia, "Irrigation And Water Power Engineering", PHI LearningPrivate Limited, Delhi,2009

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	1	3	2	2				2	1	1	3	2
CO 2	3	2		2	2	2				1	1	1	3	2
CO 3	3	2		3	2	2				1	1	1	3	2
CO 4	3	2		2	2	2				1	1	1	3	2
CO 5					3	2	2	1	1	2		1		1
Total	12	8	1	10	11	10	2	1	1	7	4	5	12	9
Scaled Value	3	2	1	2	3	2	1	1	1	2	1	1	3	2

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Ssemester	:									
Course Code	:	XCEMO1								
Course Name	:	**REAL ESTATE AND VALUATION**								
Prerequisite	:	**Nil**								

L	T	P	C		C	P	A		L	T	P	H
0.5	0	0.5	1		0.2	0.4	0.4		1	0	1	2

Course Objectives

- To study the fundamentals of valuation and carry out valuation by different methods.

Course Outcome: *After the completion of the course, students will be able to*	**Domain** **C or P or A**	**Level**
CO1	*Apply* the concept of property valuation and appraisal	Cognitive	Understanding
CO2	*Practice* valuation for different properties using differentmethods	Psychomotor orAffective	Guided ResponseResponding
CO3	*Perform* an applied real estate analysis in a business situation	Psychomotor Affective	Guided ResponseResponding

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COURSE CONTENT

VALUATION	**15**
Principles and Purposes of valuation - T ypes of value. Various forms of obsolescence including depreciation. Valuation of properties: Hotels, Cinema, Petrol Station, Hill station properties. Effects of legislation. Valuer"s role, functions and responsibility; Code of ethics. International Valuation Standards- Case Study.	
REAL ESTATE	**15**
Types- Investments-Factors affecting urban land value. Market and Guideline Values -globalization and its effect. Management of real-estate - development and administration. Urban development finance with particular reference to real estate: Role of Housing Finance Development Corporation and other financial institutions andagencies. Ownership and tenancies in real estate: Rent control and other Government regulations. Fair rent and Market rent- Case Study	

L	T	P	Total
15	0	15	30

TEXT BOOKS

1. Dr Roshan H Namavati, "Professional Practice: With Elements of Estimating, Valuation, Contractand Arbitration" Lakhani Book Depot, 2016.

2. SyamalesDatta "Valuation of Real Property Principles & Practice", Eastern Law houseprivate Limited, 2004.

3. Somers William A,"The Valuation of Real Estate for the Purpose of Taxation",Wentworth **Press,2019.**

REFERENCES

1. Ashok Nain,"Professional Valuation Practice", Tata McGraw Hill Publishing Co. Ltd. 2009.
2. McElroy Ken," The ABCs of Real Estate Investing", RDA Press, 2010.
3. James H. Boykin & Alfred Ring, "The Valuation of Real Estate", Prentice Hall, 1992.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2	1	1		2							
CO 2	2	2			1							
CO 3	2	2	1	2	2							
Total	6	5	2	2	5							
Scaled Value	3	3	1	1	3	0	0	1	0	0	1	2

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:										
Course Code	:	XCEMO2									
Course Name	:	**DIGITAL LAND SURVEYING AND MAPPING**									
Prerequisite	:	Nil									

L	T	P	C		C	P	A		L	T	P	H
0.5	0	0.5	1		0.50	0.25	0.25		1	0	1	2

Course Objectives

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

- To provide basics of digital surveying and mapping of earth surface using total station, GPS andmapping software.

- The course starts with introduction to land surveying followed by fundamentals of total station andits working & measurements for land surveying.

- Fundamentals, working & measurements using GPS for land surveying will be discussed.

- Followed by mapping fundamentals, digital surveying procedure, working, data reduction etc.

- Finally, the course will deals with working and demonstration of a digital land surveying andmapping of an area.

Course Outcome: *After the completion of the course, students will be able to*	**Domain** **C or P or A**	**Level**
CO1 Understand the importance of digital surveying and mapping of earth surface.	Cognitive	Understanding
CO2 Understand the importance of total station and its working& measurements for land surveying.	Cognitive	Understanding
CO3 Understand the importance of Fundamentals, working &measurements using GPS for land surveying.	Cognitive	Understanding
CO4 Learn some of the best management practices in, digitalsurveying procedure, working, data reduction etc.	Psychomot orAffective	Guided ResponseResponding
CO5 Understand the concepts of preparation of master demonstration of a digital land surveying and mapping ofan area.	Psychomot orAffective	Guided ResponseResponding

st
COURSE CONTENT

FUNDAMENTALS OF LAND SURVEYING & GPS	**10**

Overview -Fundamentals -GPS and Land Surveys- CORS Networks - PracticalApplication /-Strengths -Weaknesses - Coping with Reality.

TOTAL STATION: Introduction to GPS - Spatial data. Total station survey – practice.

GEOGRAPHIC INFORMATION SYSTEM (GIS) REVELUTION:

Building a Foundation - Sources of Information-System Maintenance-Potential Users -Potential for Misapplication,

	GEOMETRY	10
	Plane Geometry - Land Point & Line - Straight Land Line -Plumb Line - Level - Land Distances - Elevation –Area- Horizontal Angles - Degrees, Minutes & Seconds- Mapsor Plats.	
	SURVEY APPLICATIONS	10
	Traversing using various instruments, Contouring Characteristics, uses and methods Measurements of areas and volumes using different methods, setting out worksbuildings, curves, and Project surveys Highways, Railways and Waterways.	

L	T	P	Total
15	0	15	30

TEXT BOOKS

1. A Text Book on GPS Surveying Paperback– December 28, 2015by **Dr. Jayanta Kumar GhoshPh.D.**

2. Robillard, W. G. and Bouman, Lane J. (1998). Clark on Surveying and Boundaries, SeventhEdition. Charlottesville, Va.: LEXIS Law Pub.

3. Paine, D.P. and J.D. Kiser. 2012. Aerial Photography and Image Interpretation. New York. JohnWiley Inc.

4. Kiser, J.D. Surveying for Forestry and the Natural Resources. 2010. Corvallis, OR: John Bell andAssoc.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2			2							2
CO 2	3	2			2							2
CO 3	3	2	1	2	2							2
CO 4	3	2	1	2	2							2
CO 5	3	2	1		2			1			2	2
Total	15	10	3	4	10			1			2	10
Scaled Value	3	2	1	1	2	0	0	1	0	0	1	2

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:		
Course Code	:	XCEM 03 O	
Course Name	:	GENERAL REPAIRS & REMEDIAL WATERPROOFING	
Prerequisite	:	Nil	

L	T	P	C		C	P	A		L	T	P	H
0.25	0	0.75	0		1	2	0		1	0	1	2

Course Objectives

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

- To gain the knowledge on repair mortars,
- To understand the bonding agent and Injection System
- To understand the Protective coating and anti carbonation

Course Outcome: *After the completion of the course, students will be able to*	Domain C or P or A	Level
CO1 Understand the mortars used for repairs	Psychomotor	Guided Response
CO2 Acquire knowledge about bonding agents and injection system	Psychomotor	Guided Response
CO3 Learn the protective coating c	Cognitive	Understanding

St
COURSE CONTENT

Repair Mortars	**2**
Industrial Floors - Concrete maintenance - Holes edges & cracks - Jointing of masonry,floor & expansion joints - Concrete pavements .	
Bonding Agents	**2**
Old-new concrete applications - Extension or repair of structural concrete	
Injection System	**4**
Defective concrete (cracks/honeycombs) - Concrete joints - Basement waterproofing -Drinking water tanks & reservoirs - Waste water tanks, sewers, manholes	
Protective coati ng	**2**
Concrete/steel surfaces -Sewage treatment plants	
Anti carbonation cum decorative coating	**2**
RCC water tanks - All concrete structures exposed to severe atmospheric conditions	
Weather-proof cum decorative coating	**2**
All exterior concrete/masonry surfaces	

	L	T	P	Total
	15	0	15	30

TEXT BOOKS

1. A Text Book on GPS Surveying Paperback– December 28, 2015by Dr. Jayanta Kumar Ghosh Ph.D.

2. Robillard, W. G. and Bouman, Lane J. (1998). Clark on Surveying and Boundaries, Seventh Edition.Charlottesville, Va.: LEXIS Law Pub.

3. Paine, D.P. and J.D. Kiser. 2012. Aerial Photography and Image Interpretation. New York. JohnWiley Inc.

4. Kiser, J.D. Surveying for Forestry and the Natural Resources. 2010. Corvallis, OR: John Bell andAssoc.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	2				1								1
CO 2	1	2				1								1
CO 3	1	2				1								1
CO 4														
CO 5														
Total	3	6	0	0	0	3	0	0	0	0	0	0	0	3
Scaled Value	1	2	0	0	0	1	0	0	0	0	0	0	0	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:	
Course Code	:	XCEMO4
Course Name	:	BUILDING REGULATIONS AND APPROVAL PROCESS

L	T	P	C
1	0	0	0

C	P	A
2	0	1

L	T	P	H
1	0	0	1

Course Objectives

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

- Understanding the building rules and regulations.
- Knowledge about building approval process.

Course Outcome: *After the completion of the course, students will be able to*

		Domain C or P or A	Level
CO1	Prepare building plans according to rules and regulations.	Cognitive	Understanding
			Understanding
CO2	Able to create documents for building approval.	Cognitive Respond	
		Affective	
CO3	Able to apply approval for building.	Cognitive	
		Affective	

COURSE CONTENT

Building Regulations	15

Plan Requirements - Requirement for site approval - Structures in setback spaces - Spaces excluded from FSI and Coverage Computation - Area of special character - Boundaries of land use zones - Rules to override other Rules and Regulations - Planning Parameters for Buildings - Building Rules.

Building Plan Approval	15

Application for Completion Certificate - Application for Planning Permission and Building Permit - Application procedure and documents required for building planapproval.

L	T	P	Total
30	0	0	30

REFERENCES

1. National Building Code of India.
2. Tamil Nadu Combined Development and Building Rules.
3. http://www.tn.gov.in/tcp/building_plan.html

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	2				1								1
CO 2	1	2				1								1
CO 3	1	2				1								1
CO 4														
CO 5														
Total	3	6	0	0	0	3	0	0	0	0	0	0	0	3
Scaled Value	1	2	0	0	0	1	0	0	0	0	0	0	0	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:			
Course Code	:	XCEMO5		
Course Name	:	**COMPUTATIONAL SKILLS FOR GEOTECHNICAL APPLICATIONS**		
Prerequisite	:	Nil		

L	T	P	C		C	P	A		L	T	P	H	
0.25	0	0.75	0		0.25	0.50	0.25		1	0	0	1	

Course Objectives

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

- To gain the knowledge on linear and non-linear equations,
- To understand and apply the finite difference and finite element method in geotech. engg.
- To evaluate the correlation and regression analysis

Course Outcome: *After the completion of the course, students will be able to*	Domain C or P or A	Level
CO1 Solve linear and non-linear equations using numericaltechniques.	CognitivePsychomotorAffective	UnderstandingGuided ResponseResponding
CO2 Apply finite difference and finite element method for analysing behaviour of geotechnical structures.	CognitivePsychomotorAffective	UnderstandingGuided ResponseResponding
CO3 Apply correlation and regression analysis for thegeotechnical data.	CognitivePsychomotorAffective	UnderstandingGuided ResponseResponding

COURSE CONTENT

	Solution of Non-linear Equations	**3**
	Bisection, False Position, Newton-Raphson, Successive approximation method, Iterative methods	
st	**Solution of Linear Equations**	**3**
	Jacobi"s method, Gauss Seidal method, Successive over relaxation method. Finite Difference Method: Two point Boundary value problems – Disichlet conditions, Neumann conditions; ordinary and partial differential equations.	
	Correlation and Regression Analysis	**3**
	Correlation - Scatter diagram, Karl Pearson coefficient of correlation, Limits of correlation coefficient; Regression –Lines of regression, Regression curves, Regression coefficient, Differences between correlation and regression analysis.	
	One-dimensional Consolidation	**3**
	Theory of consolidation, Analytical procedures, Finite difference solution procedure for multilayered systems, Finite element formulation	
	Finite Element Method & Soil Modeling	**3**
	Introduction to basic constitutive soil models (Tresca, Von-Mises, Mohr-Coulomb, Drucker-Prager, Lade"s Model),Application of Cam-Clay, Modified Drucker-Prager, and Lade"s	

L	T	P	Total
7	0	8	15

TEXT BOOKS

1. S. Chandrakant., Desai and John T. Christian, "Numerical Methods in Geotechnical Engineering",Mc. Graw Hill Book Company, 1977.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineeringcomputations", Third edition, New Age International (P) Ltd. Publishers, New Delhi.
3. D.J. Naylor and G.N. Pande, "Finite Elements in Geotechnical Engineering", Pineridge Press Ltd.,UK. 4. Sam Helwany, "Applied soil mechanics", John Wiley & sons, Inc, USA
4. Sam Helwany, Applied Soil Mechanics with ABAQUS applications, John-Wiley and Sons Inc.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	2	2	1			1		1	1				1	1
CO 2	1	1		1			1			1	1			
CO 3	2	1			1	1								1
Total	5	4	1	1	1	2	1	1	1	1	1	0	1	2
Scaled Value	1	1	1	1	1	1	1	1	1	1	1	0	1	1

Note:	Total	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:								
Course Code	:	**XCEMO6**							
Course Name	:	**STRUCTURAL QUALITY ASSESSMENT**							
Prerequisite	:	**Nil**							

L	T	P	C		C	P	A		L	T	P	H
1	**0**	**0**	**1**		**1**	**0**	**0**		**1**	**0**	**0**	**1**

Course Objectives

This course aims at providing

- An exposure to assess the quality of various structures

Course Outcome: *After the completion of the course, students will be able to*	Domain C or P or A	Level
CO1 *Understand* the types of distress in structures.	Cognitive	Understand
CO2 *Analyse* the reason for deterioration of structures	Cognitive	Analyse
CO3 *Suggest* the solution for affected structures.	Cognitive	Create

st

COURSE CONTENT

Maintenance, Repair and rehabilitation, Facets of Maintenance – Inspection – Quality assessment of materials - Assessment procedure for Evaluating damaged structures - Causes of deterioration - Techniques for repair and retrofitting.	**15**

L	T	P	Total
15	**0**	**0**	**15**

TEXT BOOKS

1. Daniel Balageas, Claus-Peter Fritzen and Alfredo Guemes, Structural Health Monitoring, JohnWiley & Sons, 2006.
2. Victor Giurgiutiu, Structural Health Monitoring with Piezoelectric wafer Active Sensors,Academic Press, 2008

REFERENCES

1. Rehabilitation of Concrete Structures , Dr.B.Vidivelli, Anubhav Publishers ,2009

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	2			2	1	1		2	1	1	3	2
CO 2	2	3	2			2	1	1		**1**	2	1	2	2
CO 3	2	2	2			2	1	1		**2**		3	2	2
Total	7	7	6	0	0	6	3	3	0	5	3	5	7	6
Scaled Value	2	2	2	0	0	2	1	1	0	1	1	1	2	2

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	:			
Course Code	:	XCEMO7		
Course Name	:	**PLUMBING AND SANITARY INSTALLATIONS**		
Prerequisite	:	**Nil**		

L	T	P	C		C	P	A		L	T	P	H	
1	0	0	1		0.25	0.75	0		1	0	0	1	

Course Objectives

This course aims at providing

- To gain the knowledge on pipe materials
- To understand the connection between the fixtures
- To understand the Repair and Reconditioning

Course Outcome: *After the completion of the course, students will be able to*	Domain C or P or A	Level
CO1 Understand the type of materials and joining	Cognitive Psychomotor	Understand Guided Response
CO2 Acquire knowledge water line and sanitary line installations	Cognitive Psychomotor	Understand Guided Response
CO3 Learn the safety aspects	Cognitive	Create

COURSE CONTENT

	Pipe materials	3
	ypes of Pipes- Pipe joints-Cutting Pipes in different angle. Joining of pipes of different diameter and angles by gas welding, thread cutting on different types of pipes & fittings accessories. Bending of Pipes	
	Water line Installations	**3**
st	Making of pipe line circuit for water distribution, fixing Cocks & valve, Water analysis test, Water Pressure test	
	Sanitary line Installations	**3**
	Construction of inspection chamber, manhole, gutter, septic tank, socket etc. Testing of drainage pipe , Removal of leakage pipe line	
	Repairing and Reconditioning	**3**
	Repairing & reconditioning of waste pipe line, Repairing & reconditioning, scraping & painting of sanitary fittings	
	Safety Aspects	**3**
	Safety aspects- OSH&E, PPE, Fire extinguisher, First Aid etc.	

	L	T	P	Total
	5	0	10	15

TEXT BOOKS

1. Plumber Engineering Trade Manual, Ministry of skill development and Entrepreneurship,Directorate General of Training Central Staff Training and Research Institute , kolkata
2. Handbook on water supply and drainage (with special emphasis on plumbing) bureau of Indian Standards, New Delhi

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	2				1								1
CO 2	1	2				1								1
CO 3	1	2				1								1
Total	3	6	0	0	0	3	0	0	0	0	0	0	0	3
Scaled Value	1	2	0	0	0	1	0	0	0	0	0	0	0	1

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

137

Semester	:	
Course Code	:	XCEMO8
Course Name	:	SURVEY CAMP

L	T	P	C
0.25	0	0.75	1

C	P	A
0.25	0.75	0

L	T	P	H
1	0	0	1

Course Objectives

This course aims at providing

- Identify the features of the study area.
- To prepare the contour map and calculate area of the given area.Course Outcome: *After the completion of the course, students will be able to*

		Domain C or P or A	Level
CO1	Prepare mapping and contour area	Cognitive Psychomotor	Understand Guided Response
CO2	Prepare radial contouring	Cognitive Psychomotor	Understand Guided Response
CO3 st	Acquire knowledge on total survey station	Cognitive	Understand

COURSE CONTENT

	15

Survey camp using Theodolite, cross staff, levelling staff, tapes, and total station. The camp record shall include all original field observations, calculations andplots.

L	T	P	Total
5	0	10	15

REFERENCES

Triangulation - Trilateration - LS and CS Contouring - Radial Contouring
1. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 2004.
2. James M.Anderson and Edward M.Mikhail, Introduction to Surveying, McGraw-Hill Book Company,1985.
3. Wolf P.R., Elements of Photogrammetry, McGraw-Hill Book Company, Second Edition, 2009.

Mapping of CO with PO's

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	1	2				1								1
CO 2	1	2				1								1
CO 3	1	2				1								1
Total	3	6	0	0	0	3	0	0	0	0	0	0	0	3
Scaled Value	1	2	0	0	0	1	0	0	0	0	0	0	0	1

Note:	**Total**	0	1-5	6-10	11-15
	Scaled value	0	1	2	3
	Relation	No	Low	Medium	High

Semester	VII
Subject Name	CONSTRUCTION PROJECT MANAGEMENT
Subject Code	XCE702

L	T	P	C
3	0	1	4

C	P	A
2	0.5	0.5

L	T	P	H
3	0	2	5

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Formulate and execute the construction projects	Cognitive	Understand
		Psychomotor	Manipulation
CO2	Schedule the activities using network diagrams.	Cognitive	Applying
		Psychomotor	Manipulation
CO3	Plan the resources like materials, men and machine.	Cognitive	Applying
		Psychomotor	Manipulation
CO4	Understand the aspects of quality control	Cognitive	Understand
		Psychomotor	Manipulation
CO5	Know about safety measures to be adopted in the construction field.	Cognitive	Understand
		Affective	Responding

COURSE CONTENT

UNIT I	CONSTRUCTION PROJECT FORMULATION	9

Introduction to Construction Management - Project organization – Construction Economics - Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives –BOT, BOOT, BOM, DBOT Projects.

UNIT II	CONSTRUCTION PLANNING AND SCHEDULING	9

Basic concepts in the development of construction plans– types of project plans - work breakdown structure – planning techniques - bar charts - preparation of network diagram - critical path method -program evaluation and review technique -.

UNIT III	RESOURCE PLANNING	9

Materials- inventory control: types of inventory, EOQ - different tools for inventory controls. Equipment: Classification of construction equipment- planning and selecting of equipment. Manpower: Classes of labour - cost of labour- labour productivity.

UNIT IV	TENDERING AND CONTRACT ADMINISTRATION	9

Tender notice-Tender document-EMD-SD-Prebid conference-Award and signing of contract agreement-Site meeting-Payment of bills-Breach of contract-Liquidated damages-Project closure

UNIT V	QUALITY CONTROL AND SAFETY MANAGEMENT	9

Introduction to construction quality - Inspection, quality control and quality assurance – Quality circle - Quality management system. - Construction safety – accidents and injuries - Personal protective equipments - Health and safety act and OSHAS regulations - Safety and health management system- Safety manual.

PRACTICAL	30

Introduction to Microsoft Projects and Primavera

L	T	P	Total
45	0	30	75

TEXT BOOKS

1. Kumar NeerajJha, "Construction Project management", Dorling Kindersley, Publishers, New Delhi.2013

2. Sengupta .B, Guha .H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 2001.

3. Sharma.S.C, "Construction Engineering and Management",Khanna Publishers,Delhi,2008.

4. Chitkara.K.K, Construction Project Management planning, Scheduling and control, Tata McGraw Hill Publishing Company, New Delhi, 2010.

REFERENCES

1. Joy.P.K, Total Project Management - The Indian context, Macmillan India Ltd, New Delhi, 2000

2. Vohra.N.D., Quantitative Techniques in Management, Tata McGraw Hill Publishing Company, New Delhi, 2010

3. Billy E.Gillett., Introduction to Operations Research - Computer Oriented Algorithmic Approach, Tata McGraw Hill, 2005.

Mapping of CO with PO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO 2	PSO 1	PSO 2
CO 1	--	--	--	1	3	2	1	1	1	--	--	--	--	1
CO 2	2	1	--	--	--	--	--	2	1	1	--	1	1	1
CO 3	2	1	--	2	--	1	1	1	2	--	1	--	1	--
CO 4	--	--	--	--	--	2	1	1	1	1	--	--	1	--
CO 5	--	--	2	--	--	--	1	--	--	--	--	--	--	--
	4	2	2	3	3	5	4	5	5	2	1	1	3	2

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	COST ESTIMATION AND VALUATION
Subject Code	XCE 703

L	T	P	C
3	1	1	5

C	P	A
2	0.5	0.5

L	T	P	H
3	2	2	7

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Understand and test the concept of " components" of a project	Cognitive	Understand
CO2	Understand the principles and methods of measurements	Cognitive	Applying
CO3	Understand the methodology of pricing and to determine the unit cost of "components"	Cognitive Psychomotor	Applying Manipulation
CO4	Learning from Laboratory demonstration and field visits	Cognitive Psychomotor	Understand Manipulation
CO5	Prepare the actual estimate of any property/project	Cognitive Affective	Understand Responding

COURSE CONTENT

UNIT I	ESTIMATION OF BUILDINGS	20

Process of estimating **-** Construction activities and sequence – Units of measurements – Methods of estimating – Calculation of quantities of brick work, PCC, RCC, wood work, plastering, white washing, colour washing, painting, varnishing etc., relating to residential and non-residential multi- storeyed buildings.

UNIT II	ESTIMATION OF OTHER STRUCTURES	20

Estimation of services – Sanitary and water supply installations –Estimation of other structures – Bituminous and cement concrete roads –Irrigation works **-** Retaining walls and culverts – Steel structures.

UNIT III	SPECIFICATION	10

Specifications – Sources – Detailed and general specifications – Introduction of estimation software.

UNIT IV	RATE ANALYSIS	15

Analysis of rates using standard data and schedule of rates for conventional items – Principles of pricing of new items.

UNIT V	VALUATION	10

Necessity – Basics of valuation – Capitalized value – Depreciation – Escalation – Value of property – Calculation of Standard rent – Report preparation.

PRACTICAL   30

1. Building marking
2. Estimation using Spread Sheet

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Dutta, B.N., "Estimating and Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Pvt. Ltd.,New Delhi, 2010.

2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand& Company Ltd., New Delhi, 2004

3. M.Chakraborty,"Estimating,Costing, Specification and Valuation in Civil Engineering",Kolkata,1997.

REFERENCES

1. Birdie.G.S., "A Text Book on Estimating and Costing", DhanpatRai and Sons, New Delhi, 2000

2. Rangwala. S.C., "Elements of Estimating and Costing", Charotar Publishing House,Anand,2011

3. IS 1200-1974, Parts 1-25, Methods of Measurements of Building and Civil Engineering works – Bureau of Indian Standards, New Delhi.

4. Standard Data Books and Schedule of rates of Central and State Public Works Departments.

Mapping of CO with PO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO 2	PSO 1	PSO 2
CO 1	2	--	--	--	1	2	--	--	--	2	--	--	--	--
CO 2	2	--	--	--	2	3	--	--	--	3	--	--	--	--
CO 3	2	--	--	--	3	--	--	1	--	--	3	3	1	--
CO 4	2	--	--	2	3	--	--	1	3	--	--	--	1	--
CO 5	2	--	--	2	--	--	2	1	--	2	3	3	1	3
	10	--	--	4	9	5	2	3	3	7	6	6	3	3

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	**PRESTRESSED CONCRETE STRUCTURES**
Subject Code	**XCE 704A**
Prerequisite	**DESIGN OF CONCRETE STRUCTURES**

L	T	P	C		C	P	A		L	T	P	H
3	**0**	**0**	**3**		**2.0**	**0.5**	**0.5**		**3**	**0**	**0**	**3**

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Identify and apply the applicable industry design codes relevant for the design of prestressed concrete members	Cognitive	Knowledge
CO2	Discuss and appraise the recent advances in the prestressed concrete technology including the use of advanced materials and application of new technologies	Cognitive Psychomotor	Analysis Precision
CO3	Accomplish design calculations to predict service behavior of prestressed concrete structures	Affective	Response

COURSE CONTENT

UNIT I	INTRODUCTION – THEORY AND BEHAVIOUR	9

Basic concepts – Advantages – Materials required – Systems and methods of prestressing –Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections –Losses of prestress – Estimation of crack width.

UNIT II	DESIGN CONCEPTS	9

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending – Stress distribution in end block-Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing – Applications.

UNIT III	CIRCULAR PRESTRESSING	9

Prestressed Concrete Pipes- Advantages ,Loads –Codal Provisions-Design of cylinder and non cylinderPipes.Prestressed Concrete Tanks-Choice of types of tanks.

UNIT IV	COMPOSITE CONSTRUCTION	9

Types of composite Construction - Analysis of stresses – Differential Shrinkage Estimation of Deflection Flexural and shear strength of composite members.

UNIT V	PRE-STRESSED CONCRETE BRIDGES	9

General aspects – Pretensionedprestressed bridge decks – Post tensioned prestressed bridge decks – Principles of design only.

	L	T	P	Total
	45	**0**	**0**	**45**

TEXT BOOKS

1. Krishna Raju. N, Prestressed Concrete, Tata McGraw Hill Publishing Co. Ltd, New Dehi, 2012
2. Fundamentals of Prestressed Concrete by N.C.Sinha&S.K.Roy, S.Chand&Co,New Delhi,2011
3. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.
4. Libby J.R., Modern Prestressed Concrete, 3e,CBS Publishers & Distributors, New Delhi, 2007
5. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd.2007.
6. Rajagopalan, N, "Prestressed Concrete", Alpha Science, 2002

REFERENCES

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
3. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete – A
   design guide, McGraw Hill, New Delhi 1992
4. IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
5. IS 3370-3 (1967): Code of Practice Concrete structures for the storage of liquids, Part 3: Prestressed concrete structures, Bureau of Indian Standards, New Delhi, 2008
6. IS 3370-4 (1967): Code of practice for concrete structures for the storage of liquids, Part 4: Design tables, Bureau of Indian Standards, New Delhi, 2008

Mapping of CO with PO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO 2	PSO 1	PSO 2
CO 1	1	2	1		1	1	**1**	**1**		2	1	1	2	4
CO 2	1		2	1	1	1	**1**	**1**		**1**		2	1	3
CO 3	2	2	3	1	1	2		**1**					2	1
	4	4	6	2	3	4	**2**	**3**		**3**	1	3	5	8

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	SOLID AND HAZARDOUS WASTE MANAGEMENT
Subject Code	XCE705D
Prerequisite	Environmental Engineering

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Characterize the physical and chemical composition of Solid and Hazardous waste	Cognitive Affective	Understand Respond
CO2	Explain the functional elements for solid waste management	Cognitive	Understand
CO3	Identify the methods of collection, segregation and transport of solid and Hazardous waste	Cognitive	Remembering
CO4	Understand the techniques and methods used in energy recovery and recovery of materials from solid wastes	Cognitive Affective	Understand Respond
CO5	Describe methods of disposal of solid and hazardous waste.	Cognitive Affective	Understand Response

COURSE CONTENT

UNIT I	SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK	9

Types and Sources of solid wastes - Need for solid waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes , hazardous wastes, biomedical wastes, E-wastes, Lead Acid batteries, plastics and fly ash - Financing waste management.

UNIT II	WASTE CHARACTERIZATION AND SOURCE REDUCTION	9

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes –Hazardous characteristics - TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse.

UNIT III	STORAGE, COLLECTION AND TRANSPORT OF WASTES	9

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation –compatibility, storage, labeling and handling and Transport of hazardous wastes.

UNIT IV	WASTE PROCESSING TECHNOLOGIES	9

Course Objectives: of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration- solidification and stabilization of hazardous wastes – bio medical waste treatment.

UNIT V	WASTE DISPOSAL	9

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.

2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001

REFERENCES

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

2. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.

Mapping of CO with PO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO 2	PSO 1	PSO 2
CO 1	2	2	--	1	--	--	--	--	--	--	--	1	2	1
CO 2	2	2	1	1	--	--	--	--	--	--	--	2	3	2
CO 3	1	3	1	--	--	1	1	--	--	1	--	1	2	3
CO 4	2	2	3	2	--	1	--	--	--	--	--	--	1	3
CO 5	2	1	3	1	--	--	--	--	--	--	--	2	1	2
	9	10	8	5	--	2	1	--	--	1	--	6	9	11

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	CYBER SECURITY
Subject Code	XUM 706

L	T	P	C
0	0	0	0

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Outcome: After the completion of the course, students will be able to	*Domain C or P or A*	*Level*
CO1 To learn the basic concepts of networks and cyber-attacks.	Cognitive	Understand
CO2 To define the concepts of system vulnerability scanning and the scanning tools	Cognitive	Understand
CO3 To understand the network defence mechanisms and the tools used to detect and quarantine network attacks.	Cognitive	Understand
CO4 To learn the different tools for scanning.	Cognitive	Understand
CO5 To identify the types of cybercrimes, cyber laws and cyber-crime investigations.	Cognitive	Understand

COURSE CONTENT

UNIT I	INTRODUCTION	9

History of Information Systems and its Importance, Basics, Changing Nature of Information Systems, Need for Distributed Information Systems: Role of Internet and Web Services. Information System Treats and attacks, Classification of Threats and assessing Damages Security in mobile and Wireless Computing-Security Challenges in Mobile Devices, authentication service Security, Security Implication for Organizations, Laptops security Concepts in Internet and World Wide Web: Brief review of Internet Protocols TCP/IP, IPV4, and IPV6. Functions of various networking components-routers, bridges, switches, hub, gateway and Modulation Techniques.

UNIT II	SYSTEMS VULNERABILITY SCANNING	9

Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet.

UNIT III	NETWORK DEFENCE TOOLS	9

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction

Detection System, Cryptool.

UNIT IV	TOOLS FOR SCANNING	9

Scanning for web vulnerabilities tools: Metasploittool,Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, THC-Hydra.

UNIT V	INTRODUCTION TO CYBER CRIME AND LAW	9

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.Introduction to Cyber Crime Investigation:Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Nina Godbole, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, w/cd", Wiley Publications, 2008, ISBN 10: 8126516925, ISBN 13 :9788126516926

2. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing and Investigating Intrusions", Wiley Publications, 2013, Kindle Edition,ISBN 10: 812654919X, ISBN 13 :9788126549191

3. D.S. Yadav, "Foundations of Information Technology", New Age International publishers, 3rd Edition, 2006, ISBN-10: 8122417620, ISBN-13: 978-8122417623

REFERENCES

1. Mike Shema, "Anti-Hacker Tool Kit", McGraw Hill Education, 4th edition, 2014,

2. Nina Godbole, SunitBelapure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wileypublilcations, 2013, ISBN 10 : 8126521791, ISBN 13:9788126521791.

3. Corey Schou, Daniel Shoemaker, "Information Assurance for the Enterprise: A Roadmap to Information Security (McGraw-Hill Information Assurance & Security)",

4. Tata McGraw Hill, 2013, ISBN-10: 0072255242, ISBN-13: 978-0072255249.

5. VivekSood, "Cyber Laws Simplified", McGraw Hill Education (INDIA) Private Limited in 2001, ISBN-10: 0070435065, ISBN-13: 978-0070435063.Steven M.Furnell, "Computer Insecurity", Springer Publisher, 2005 Edition.

E- RESOURCES

1. https://www.cryptool.org/en/

2. https://www.metasploit.com/

3. http://sectools.org/tool/hydra/

4. http://www.hping.org/
5. http://www.winpcap.org/windump/install/
6. http://www.tcpdump.org/
7. https://www.wireshark.org/
8. https://ettercap.github.io/ettercap/
9. https://www.concise-courses.com/hacking-tools/top-ten/
10. https://www.cirt.net/Nikto2
11. http://sqlmap.org/

Mapping of CO with GA's

	GA1	GA2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA1 0	GA1 1	GA1 2
CO 1	3	3	3	2	1	1	1	1	1	--	--	1
CO 2	2	1	1	1	1	1	1	1	1	--	--	1
CO 3	2	2	2	1	1	1	1	1	1	--	--	1
CO 4	1	1	1	1	--	--	--	--	--	--	--	1
CO 5	1	1	1	2	2	1	1	2	2	--	--	1
	9	**8**	**8**	**7**	**5**	**4**	**4**	**5**	**5**	**0**	**0**	**5**

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	PROJECT PHASE I
Subject Code	XCE 707

L	T	P	C
0	0	2	2

C	P	A
1.5	0.5	1.0

L	T	P	H
0	0	2	4

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Identify the engineering problem relevant to the domain interest.	Cognitive	Analyse
CO2	Interpret and infer literature survey for its worthiness.	Cognitive	Analyse & Apply
CO3	Analyse and identify an appropriate technique for solve the problem.	Cognitive	Analyze & Apply
CO4	Perform experimentation /Simulation /Programming /Fabrication, Collect and interpret data.	Cognitive Psychomotor	Create, Apply Precision
CO5	Record and report the technical findings as a document.	Cognitive	Remember & Understand
CO6	Devote oneself as a responsible member and display as a leader in a team to manage projects.	Cognitive Affective	Create & Organization Valuing
CO7	Responding of project findings among the technocrats.	Affective	Responding

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	3	--	--	--	1	1	1	--	--	--	1
CO 2	2	2	--	1	--	1	--	--	--	--	--	--
CO 3	1	1	1	2	2	1	1	1	--	--	--	--
CO 4	2	2	3	3	3	1	1	1	--	--	--	--
CO 5	1	1	1	1	1	--	--	--	2	3	2	3
CO 6	--	--	--	2	--	3	1	3	3	3	2	3
CO 7	1	1	--	2	--	3	--	--	1	3	2	1
	10	10	5	11	6	10	4	6	6	9	6	8

1 – Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	CAREER DEVELOPMENT SKILLS
Subject Code	XGS 708

L	T	P	C
0	0	0	0

C	P	A
1.8	0.8	0.4

L	T	P	H
0	0	0	1

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Knowledge on a career related communication and learning the different formats of CV	Cognitive	Apply
CO2	Prepare how to face an interview and to learn how to prepare for an interview	Psychomotor	Set
CO3	Communicates with the group of people in discussion	Affective	Response

COURSE CONTENT

UNIT I	CV WRITING	10

CV Writing; difference between resume and CV; characteristics of resume and CV; basic elements of CV and resume, use of graphics in resume and CV; forms and functions of Cover Letters.

UNIT II	TECHNICAL SKILLS	10

Interview skills; tips for various types of interviews. Types of questions asked ; body language, etiquette and dress code in interview, interview mistakes, telephonic interview , frequently asked questions. Planning for the interview.

UNIT III	WORKSHOP	10

Mock interviews - workshop on CV writing – Group Discussion.

L	T	P	Total
20	0	10	30

TEXT BOOKS

1. Paul McGee, How To Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Hachette UK, 2014
2. Mary Ellen Guffey, Dana Loewy Essentials of Business Communication,Cengage Learning, 2012
3. Michael Spiropoulos, Interview Skills that win the job: Simple techniques for answering all the tough questions, Allen &Unwin, 2005
4. William L. Fleisher,Effective Interviewing and Interrogation Techniques, Nathan J. Gordon, Academic Press, 2010.

E- RESOURCES

1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf
2. http://www.amu.apus.edu/career-services/interviewing/types.htm
3. http://www.careerthinker.com/interviewing/types-of-interview/

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	1				1	2	2					
CO 2	1		2	2			2				2	2
CO 3	1	2			2	2			2			
	3	2	2	2	3	4	4		2		2	2

Semester	VII
Subject Name	**IN-PLANT TRAINING-III**
Subject Code	XCE 708

L	T	P	C
0	0	0	1

C	P	A
2	2	2

L	T	P	H
0	0	0	0

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Relate classroom theory with workplace practice	Cognitive	Understand
CO2	Comply with Factory discipline, management and business practices.	Affective	Response
CO3	Demonstrates teamwork and time management.	Affective	Value
CO4	Describe and display hands-on experience on practical skills obtained during the programme.	Psychomotor	Perception & Set
CO5	Summarize the tasks and activities done by technical documents and oral presentations.	Cognitive	Evaluate

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2	--	--	--	--	--	--	--	--	--	--	--
CO 2	--	--	--	--	--	--	1	3	--	--	1	--
CO 3	--	--	--	--	--	--	--	--	3	1	3	1
CO 4	--	1	2	1	3	--	--	--	--	--	--	3
CO 5	--	--	--	3	--	--	--	--	--	3	--	1
	2	1	2	4	3	--	1	3	3	4	4	5

Semester	VIII
Subject Name	**PREFABRICATED STRUCTURES**
Subject Code	**XCE802 A**
Prerequisite	**Structural Analysis**

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Outcome: After the completion of the course, students will be able to

		Domain C or P or A	Level
CO1	Gain knowledge on prefabrication of structures.	Cognitive	Understand
CO2	Identify the components of prefabricated structures.	Cognitive Affective	Understand Respond
CO3	Design the structures based on prefabrication elements.	Cognitive	Remembering
CO4	Handle the prefabricated structures in the field.	Cognitive	Understand

COURSE CONTENT

UNIT I	INTRODUCTION – PREFABRICATED STRUCTURES	9

General Civil Engineering requirements in the prefabrication techniques – material used in prefabrication - Modular co-ordination, standardization, Disuniting, of Prefabricates, production, transportation, erection.

UNIT II	PREFABRICATED COMPONENTS	9

Prefabricated structures - Long wall and cross-wall large panel buildings - one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, - columns – shear wall.

UNIT III	DESIGN PRINCIPLES	9

Loading criteria - Disuniting of structures- Design of cross section based on efficiency of material used –Problems in design because of joint flexibility – Allowance for joint deformation – Code books used in practice.

UNIT IV	DESIGN OF JOINTS	9

Joints for different structural connections – Dimensions and detailing – Design of expansionjoints.

UNIT V	DESIGN OF INDUSTRIAL BUILDINGS	9

Components of single-storey industrial sheds with crane gantry systems, Design of R.C. Roof Trusses, Roof Panels, Design of R.C. crane - gantry girders, corbels and columns, wind bracing design-case study of industries. Case study in prefabrication industries.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Hubert Bachmann, Alfred Steinle, "Precast Concrete Construction", Wiley-vchVerlag Gmbh, 2011.
2. WaiKwong Lau, Building Construction with Precast Concrete Structural Elements, Lap Lambert Academic Publishing, 2011.

REFERENCES

1. B.Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, New York, 2009.
2. Kim Elliott,"Precast Concrete Structures", Spons Architecture Price Book, April, 2012.
3. Benjamin Pavlich, "Evaluation of Prefabricated Composite Steel Box Girder Systems for Rapid Bridge Construction", Proquest, Umi Dissertation Publishing, 2011.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO0	PO11	PO2	PSO1	PSO2
CO 1	2	2	3	1	--	--	--	--	--	--	2	--	1	3
CO 2	--	3	1	1	1	1	--	--	--	--	1	1	2	1
CO 3	--	--	3	2	1	--	--	--	1	1	1	1	2	3
CO 4	2	2	--	1	1	2	--	--	1	1	1	1	2	2
CO 5														
	4	7	7	5	3	3	--	--	2	2	5	3	7	9

1 - Low, 2 – Medium, 3 – High

Semester	VIII
Subject Name	URBAN AND REGIONAL PLANNING – FUTURE TRENDS
Subject Code	XCE803B
Prerequisite	NIL

L	T	P	C		C	P	A		L	T	P	H
3	0	0	3		2	1	0		3	0	0	3

Course Outcome: After the completion of the course, students will be able to

Domain *C or P or A* — **Level**

		Domain C or P or A	Level
CO1	Explain the serviceable fundamentals for urban and regional planning – future trends.	Cognitive	Understand
CO2	Distinguish the rural and urban concepts and developments.	Psychomotor	Apply
CO3	Make out the methods of gathering and generating new modern transportation.	Cognitive	Understand
CO4	Appreciate the techniques and methods used in Modern Planning Concepts and Role of Information Technology In Regional Planning.	Cognitive	Knowledge

COURSE CONTENT

UNIT I	INTRODUCTION TO LAND USE PLANNING AND PRINCIPLES	9

Basics and Importance of land use planning-zoning principles-zoning laws-Infrastructure parameters: population, size of the city, road, water supply and sanitation-growing trends.

UNIT II	MODERN PLANNING CONCEPTS	9

Urban growth-migration and population explosion-need of modern planning-garden city, radiant city and linear city concepts-development of new towns and cities-organizational structure of municipalities, corporation and urban development.

UNIT III	FUTURE TRANSPORTATION AND SOCIAL LIFE IN CITIES	9

Redevelopment strategy of city, transport in future city-new transport technology-Integrated transport-Future communities-Gated communities.

UNIT IV	ROLE OF INFORMATION TECHNOLOGY IN REGIONAL PLANNING	9

Telemetrically concepts and its impacts on city land use-suitability of software for urban analysis-Modelling with software-simulated city-decision support systems

for urban regional analysis- change detection and mapping through software.

| UNIT V | URBAN UTOPIA | 9 |

Global cities-Underground cities- Floating cities- Under Water cities- Visionary cities- clean air Parks- Skyscraper world.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Clements D, Donald A , Earnshaw M and Williams A The Future of Community, Pluto Press, London, 2013
2. Boeri S, BiswasRK . Future City, Routledge, New York, 2012
3. Richards B, Future Transport in Cities, Spon Press, London, 2013

REFERENCES

1. Read S, Rosemann J and Dldijk J V Future City, Spon Press New York,2012
2. Wagner CG, Seeing through Future New Eyes, 2012
3. Gallian.B. Arthur and Simon Eisner, the urban pattern-City Planning and Design,Affiliated Press PvtLtd,New Delhi,2010

Mapping of CO with PO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO 2	PSO 1	PSO 2
CO 1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO 2	1	2	--	--	2	--	--	--	--	--	--	1	1	1
CO 3	2	--	3	--	--	--	2	--	--	1	1	1	1	1
CO 4	2	1	--	--	1	--	1	--	--	1	1	1	1	1
	6	3	3	--	3	2	3	--	--	2	2	3	3	3

1 - Low, 2 – Medium, 3 – High

Semester	VII
Subject Name	PROJECT PHASE II
Subject Code	XCE 804

L	T	P	C
0	0	12	12

C	P	A
6	3	3

L	T	P	H
0	0	12	24

Course Outcome: *After the completion of the course, students will be able to*	Domain C or P or A	Level
CO1 Identify the engineering problem relevant to the domain interest.	Cognitive	Analyse
CO2 Interpret and infer literature survey for its worthiness.	Cognitive	Analyse & Apply
CO3 Analyse and identify an appropriate technique for solve the problem.	Cognitive	Analyze & Apply
CO4 Perform experimentation /Simulation /Programming /Fabrication, Collect and interpret data.	Cognitive Psychomotor	Create, Apply Precision
CO5 Record and report the technical findings as a document.	Cognitive	Remember & Understand
CO6 Devote oneself as a responsible member and display as a leader in a team to manage projects.	Cognitive Affective	Create & Organization Valuing
CO7 Responding of project findings among the technocrats.	Affective	Responding

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	3	--	--	--	1	1	1	--	--	--	1
CO 2	2	2	--	1	--	1	--	--	--	--	--	--
CO 3	1	1	1	2	2	1	1	1	--	--	--	--
CO 4	2	2	3	3	3	1	1	1	--	--	--	--
CO 5	1	1	1	1	1	--	--	--	2	3	2	3
CO 6	--	--	--	2	--	3	1	3	3	3	2	3
CO 7	1	1	--	2	--	3	--	--	1	3	2	1
	10	10	5	11	6	10	4	6	6	9	6	8

1 - Low, 2 – Medium, 3 – High

Semester	Course Code	Course Name	L	T	P	C
I	YEN101	Chemistry and Microbiology for Environmental Engineers	3	0	0	3

COURSE CONTENT

UNIT I	FUNDAMENTALS ON ANALYTICAL CHEMISTRY	12

Oxidation and reduction reactions, balancing equation by electron method - Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV– visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2 & H_2S by spectrophotometry.

UNIT II	DEGRADATION OF CHEMICALS	6

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons

UNIT III	SOIL CHEMISTRY	9

Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

UNIT IV	MICROORGANISMS AND NUTRITIONAL REQUIREMENTS	9

Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways-Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae. Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection.

UNIT V	MICROBIOLOGY IN WASTE WATER	9

Biological methods to treat waste water- Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.

2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.

3. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition.

4. Tata   McGraw Hill Publishing Company Limited, New Delhi-2001

5. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005

2. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	Course Code	Course Name	L	T	P	C
I	YEN102	**Unit Operation and Processes in Environmental systems**	**3**	**0**	**0**	**3**

COURSE CONTENT

UNIT I	**PRIMARY TREATMENT METHODS**	**9**
	Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation	
UNIT II	**SEDIMENTATION AND FILTRATION**	**9**
	Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters	
UNIT III	**AERATION**	9
	Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays	
UNIT IV	**ADSORPTION**	**9**
	Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics	
UNIT V	**MEMBRANE PROCESSES**	**9**
	Reverse Osmosis and Electro dialysis - Species Transformation Processes - Chemical Oxidation / Reduction Processes, Disinfection using Chlorine and UV, Advanced Oxidation Process.	

L	T	P	Total
45	**0**	**0**	**45**

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002

2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.

3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.
2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011
3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester	Course Code	Course Name	L	T	P	C
I	YEN103 C	**Air Pollution and Control**	**3**	**0**	**0**	**3**

COURSE CONTENT

UNIT I	INTRODUCTION TO AIR POLLUTANTS	9

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals
- Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models - Ambient air quality and emission standards – Air pollution indices – Air Quality Samplingand Monitoring.

UNIT II	CONTROL OF PARTICULATE CONTAMINANTS	9

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III	CONTROL OF GASEOUS CONTAMINANTS	9

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV	EMERGING TRENDS	9

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility of selected emerging technologies for Air pollution control

UNIT V	INDOOR AIR QUALITY	9

Sources and Causes of Indoor Air Quality Problems- Risk due to Indoor Air pollutants- sources of indoor Air pollutants- Indoor Air Quality Regulations-Indoor Air Quality Models- Indoor Air Quality Control- Case Studies

	L	T	P	Total

				45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 2010.
2. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering,Tokyo, 2004.
3. Anjaneyulu. Y, 'Air Pollution and Control Technologies', Allied Publishers (P) Ltd., India, 2002

REFERENCES

1. David H.F. Liu, Bela G. Liptak 'Air Pollution', Lewis Publishers, 2000.
2. Arthur C.Stern, ' Air Pollution (Vol.I – Vol.VIII)', Academic Press, 2006.
3. Wayne T.Davis, 'Air Pollution Engineering Manual', John Wiley & Sons, Inc., 2000

Semester	Course Code	Course Name	L	T	P	C
I	YEN104C	**Environmental Policies and Legislation**	**3**	**0**	**0**	**3**

COURSE CONTENT

UNIT I	INTRODUCTION	8

Basics of jurisprudence – Environmental law relation with other disciplines - Criminal law – Common Law – Relevant sections of the Code of Civil Procedure, Criminal Procedure Code – Indian Penal Code.

UNIT II	INDIAN CONSTITUTION AND ENVIRONMENT	10

Introduction – Fundamental Rights – Directive Principles of State Policy – Article 48 (A) and 51-A(g) Judicial enforceability – Constitution and Resources management and pollution control – Indian Forest Policy (1990) – Indian Environmental Policy (1992).

UNIT III	ADMINISTRATIVE REGIME & LEGAL REGIME	9

Administrative regulations – constitution of Pollution Control Boards Powers, functions, Accounts, Audit etc. – Formal Justice Delivery mechanism Higher and Lower of judiciary – Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement – Equitable remedies for pollution control

UNIT IV	POLLUTION CONTROL LAWS	9

Administrative regulation under recent legislations in water pollution control. Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & controlor Pollution) cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

UNIT V	ENVIRONMENTAL (PROTECTION) ACT 1986	9

Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Eco- labeling, and E.I.A.

	L	T	P	Total
	45	**0**	**0**	**45**

TEXT BOOKS

1. Constitution of India Eastern Book Company Lucknow 12th Edn. 1997.
2. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
3. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.
4. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997

REFERENCES

1. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materialsand Statutes) 1991 Tripathi Bombay.
2. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification

Semester	Course Code	Course Name	L	T	P	C
I	YEN105	Environmental Quality Measurements Laboratory-I (Water and Wastewater)	0	0	2	2

List of Experiments:

1. Determination of pH, Turbidity and Electrical conductivity
2. Determination of Alkalinity
3. Determination of Acidity
4. Determination of Hardness
5. Determination of Sulphates
6. Determination of Fluorides
7. Determination of Nitrates
8. Residual chlorine analysis
9. Test on Dissolved Oxygen and BOD
10. Test on COD

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
I	YEN106	**Microbiology Laboratory**	0	0	2	2

List of Experiments:

1. Preparation of culture media
2. Isolation, culturing and Identification of Microorganisms
3. Microorganisms from polluted habitats (soil, water and air)
4. Measurement of growth of microorganisms
5. Biodegradation of organic matter in waste water Analysis of air borne microorganisms
6. Staining of bacteria.
7. Effect of pH, temperature on microbial growth
8. Pollutant removal using microbes from industrial effluent.
9. Bacteriological analysis of wastewater (Coliforms, *E.coli, Streptococcus*) – MPN
10. Bacteriological analysis of wastewater (Coliforms, *Streptococcus)* - MF techniques

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Benfield, L.D.; Weand, B.L.; Judkins, J.F. (1982) Process chemistry for water and wastewater. Prentice Hall Inc Englewood Cliffs New Jersey.
2. Weber Jr., W.J. (1972) Physico-chemical Process for Water Quality Control. Wiley Inc. Newyork.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York, 1985.

Semester	Course Code	Course Name	L	T	P	C
I	YRM 107	**Research Methodology and IPR**	2	0	0	2

COURSE CONTENT

UNIT I	6

Meaning of research problem, Sources of research problem, Criteria-Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection,analysis, interpretation, Necessary instrumentations

UNIT II	6

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III	6

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV	6

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V	6

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

L	T	P	Total
30	0	0	30

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

5. Mayall, "Industrial Design", McGraw Hill, 1992.

6. Niebel, "Product Design", McGraw Hill, 1974.

7. Asimov, "Introduction to Design", Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester	Course Code	Course Name	L	T	P	C
	YEGOE1	**ENGLISH FOR RESEARCH PAPERWRITING**	2	0	0	0

COURSE CONTENT

UNIT I	6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, AvoidingAmbiguity and vagueness

UNIT II	6

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

UNIT III	6

Review of the Literature, Methods, Results, Discussion, Conclusions, The FinalCheck.

UNIT IV	6

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT V	6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be thefirst- time submission

L	T	P	Total
30	0	0	30

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.

4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011

Semester	Course Code	Course Name	L	T	P	C
II	YEN201	Transport of Water and Wastewater	3	0	0	3

COURSE CONTENT

UNIT I	TRANSPORT OF WATER	9

Water Storage and Transmission, Storage- requirements, impounding reservoirs- intakes, pressure conduits, hydraulics - pumps and pumping units, capacity - selection of water pumps -economic design of pumps and economic design of gravity and pumping mains- Analysis of physical and Chemical characteristics of Water.

UNIT II	MATERIALS FOR PIPES	9

Specification for pipes, merits and demerits, pipe appurtenances, types of loads and stresses, water hammer, causes and prevention, control devices, laying, jointing and Testing of pipes.

UNIT III	DISTRIBUTION SYSTEM	9

Principles of design, analysis of distribution networks, Hardy Cross, equivalent pipe and Newton Raphson methods, computer applications in distributions network analysis, optimal design of networks, maintenance of distribution systems, methods of control and prevention of corrosion, storage, distribution and balancing reservoirs – EPANET- LOOP

UNIT IV	SANITARY SEWERAGE	9

Storm Drainage: Basic philosophy in storm drainage • drainage layouts • storm runoff estimation • Rainfall data analysis • hydraulics of flow in stormwater drains • storm water drain materials and sections • design of storm drains • storm water inlets - Sanitation technology selection

• sanitary sewage flow estimation - sewer materials • hydraulics of flow in sanitary sewers • partial flows • sewer design • sewer layouts. - Analysis of physical and Chemical characteristics of Waste water.

UNIT V	OPERATION & MAINTENANCE	9

Maintenance requirements of sanitary sewerage - storm drainage systems • manpower requirement • Equipment requirement - preventive maintenance • monitoring safety requirements• corrosion in sewers • prevention and control • Specific problems related to waste water pumping • pumping • pump selection • wastewater pumping networks

		L	T	P	Total
		45	0	0	45

TEXT BOOKS

1. G.S.Bridie & J.S. Bridie, Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi,2010.
2. Hammer, M.J. Water & Waste water Technology, John Wiley & Sons, New York, 7TH edition, 2012.
3. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2000
5. Manual on Sewage and Sewerage system, CPHEEO, Government of India, New Delhi, 2000

REFERENCES

1. 'Water supply and wastewater Removal' Vol.I. John Wiley and Sons Manual on Water Treatment,CPHEEO, Government of India, New Delhi, 2010

2. Hussain S.K. A Text book of water supply and sanitary Engineering, Oxford and IBH Publishing Co.,New, 2010.

3. Larry W. Mays, Mays Larry, "Water Distribution System Handbook", McGraw-Hill ProfessionalPublishing, 1999.

Semester	Course Code	Course Name	L	T	P	C
II	YEN202	**Biological Treatment of Wastewater**	3	0	0	3

COURSE CONTENT

UNIT I	INTRODUCTION	9
	Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process- reactors-batch-continuous type	

UNIT II	AEROBIC TREATMENT OF WASTEWATER	9
	Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors- Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends	

UNIT III	ANAEROBIC TREATMENT OF WASTEWATER	9
	Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends.	

UNIT IV	SLUDGE TREATMENT AND DISPOSAL	9
	Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering(mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal – recent advances.	

UNIT V	OPERATION AND MAINTENANCE	9
	Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata Mcgraw Hill, New Delhi, III Edition, 2006.

2. David Hendricks, "Fundamentals of Water Treatment Unit Process", CRC Press, New York, 2010

3. F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York, III, Edition, 2013.

REFERENCES

1. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Government of India,New Delhi, 1999.

2. Metcalf & Eddy, INC, "Wastewater Engineering – Treatment and Reuse", Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.

3. Qasim, S.R. "Wastewater Treatment Plant, Planning, Design & Operation", Technomic Publications, New York, II Edition, 1998.

Semester	Course Code	Course Name	L	T	P	C
II	YEN203C	Solid and Hazardous Waste Management	3	0	0	3

COURSE CONTENT

UNIT I	SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK	9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous wastemanagement – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management.

UNIT II	WASTE CHARACTERIZATION AND SOURCE REDUCTION	9

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse

UNIT III	STORAGE, COLLECTION AND TRANSPORT OF WASTES	9

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

UNIT IV	WASTE PROCESSING TECHNOLOGIES	9

Objectives of waste processing – material separation and processing technologies – biological &chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

UNIT V	WASTE DISPOSAL	9

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods
– site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and

environmental monitoring – Rehabilitation of open dumps – landfill remediation

	L	T	P	Total
	45	**0**	**0**	**45**

TEXT BOOKS

1. George Techobanoglous et al, "Integrated Solid Waste Management", McGraw - Hill, 2014.

2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt.Of. India, New Delhi, 2000.

3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw -Hill 1997.

REFERENCES

1. R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions" ,Lewis, 1997.

2. Blide A.D.& Sundaresan, B.B,"Solid Waste Management in Developing Countries", INSDOC,1993.

3. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management inDeveloping Countries, Commonwealth Publishers, New Delhi, 2000.

4. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal,Mudrashilpa Offset Printers, 2001.

Semester	Course Code	Course Name	L	T	P	C
II	YEN204B	**Environmental Geotechnology**	3	0	0	3

COURSE CONTENT

UNIT I	SOIL PROFILE	9

Soil as a multiphase system; Soil – environment interactions; Properties of water in relation to porous media; Water cycle with special reference to soil medium.

UNIT II	SOIL MINERALOGY	9

Soil mineralogy; significance of mineralogy in determining soil behavior; Mineralogical characterization

UNIT III	MECHANISMS OF SOIL-WATER INTERACTIONS	9

Diffuse double layer models; Force of attraction and repulsion; Soil- Water contaminant interaction; Theories of Ion exchange; Influence of organic and inorganic chemical interaction.

UNIT IV	WASTE & ITS TRANSPORT IN SOIL	9

Concepts of waste containment facilities; desirable properties of soil; contaminant transport and retention; contaminated site remediation

UNIT V	REMEDIAL TECHNIQUES	9

Introduction to advanced soil characterization techniques; volumetric water content; gas permeation in soil; electrical and thermal properties; pore –size distribution; contaminant analysis

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Geotechnical and Geoenvironmental Engineering Handbook, Rowe R. K, Kluwer Academic Publishers 2001

2. Fundamentals of Soil Behavior, Mitchell J.K and Soga K., John Wiley and Sons Inc. 2012

3. Introduction to Environmental Geotechnology, Fang, H.Y., CRC press 1997

4. Geotechnical Practice for Waste Disposal, Daniel D.E, Chapman and Hall 1993

REFERENCES

1. Clay Barrier Systems for Waste Disposal Facilities, Rowe J.R., Quigley R.K., R.M. and Booker, Chapman and Hall 1995

2. Geoenvironmental Engineering: Principles and Applications, Reddi L.N. And Inyang H.F, Marcel Dekker Inc 2000

3. Waste Containment Systems, Waste Stabilization And Landfills: Design and Evaluation, Sharma H. D. And Lewis S.P, John Wiley & Sons Inc 1994

Semester	Course Code	Course Name	L	T	P	C
II	YEN205	**Environmental Quality Measurements Laboratory-II (Air,Noise and Solidwaste)**	0	0	2	2

List of Experiments:

1. Determination of Ambient Air Quality Parameters- SPM, CO, NOx and SOx
2. Soil Analysis – pH and Conductivity,
3. Cation Exchange Capacity
4. Determination of Noise
5. Composition of Municipal Solidwaste
6. Proximate and Ultimate Analysis
7. Total Solids, Suspended Solids, Volatile Solids, Non Volatile Solids

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, NewDelhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
II	YEN206	**Unit Operation Laboratory**	0	0	2	2

List of Experiments:

1. Coagulation and Flocculation
2. Studies on Filtration- Characteristics of Filter media
3. Disinfection for Drinking water (Chlorination
4. Water Softening - Lime and Caustic Soda Process
5. Sludge volume Index
6. Sedimentation - Settling Column Analysis of Flocculating Particles
7. Adsorption - Colour Removal by Adsorption
8. Heavy Metal Precipitation
9. Kinetics of Activated Sludge Process

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
III	YEN 207	Mini Project	0	0	4	2

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a panel of examiners

Semester	Course Code	Course Name
	YPSOE1	CONSTITUTION OF INDIA

COURSE CONTENT

UNIT I	HISTORY AND PHIOLOSOPHY	6

History of Making of the Indian Constitution: History-Drafting Committee, (Composition & Working)Philosophy of the Indian Constitution: Preamble-Salient Features

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES:	6

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

UNIT III	ORGANS OF GOVERNANCE:	6

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

UNIT IV	LOCAL ADMINISTRATION	6

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

UNIT V	ELECTION COMMISSION:	6

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

L	T	P	Total
30	0	0	30

REFERENCES

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Semester	Course Code	Course Name	L	T	P	C
II	YEN301A	Ground Water Contamination and Transport Modeling	3	0	0	3

COURSE CONTENT

UNIT I	INTRODUCTION TO TRANSPORT PHENOMENA	9

Transport phenomenon, diffusion, dispersion, advection, adsorption, conservative and non-conservative pollutants, sources and sinks- point and nonpoint.

UNIT II	FLOW AND TRANSPORT EQUATIONS	9

Governing Equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for lakes, streams, and estuaries.

UNIT III	MODEL COMPLEXITY	9

Selection and development, model resolution, coupled and uncoupled models, Linear and nonlinear models, solution techniques, data requirements for calibration, application and evaluation of environmental control.

UNIT IV	NUMERICAL MODELS	9

FDM, FEM and Finite volume techniques, explicit vs. implicit methods, numerical errors, and stability, High resolution techniques.

UNIT V	SOFTWARE MODELLING	9

Stream quality modeling and Groundwater transport modeling using software.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Alexander H.-d Cheng, Jacob Bear, "Modeling Groundwater Flow and Contaminant Transport", springer 02, 2011.

2. PascualHoracio Benito," Approaches to Modeling Contaminant Transport in Porous Media: Pore-Scale to Regional Scale Investigations,"Proquest, Umi Dissertation Publishing, 09-2011.

3. Mark Goltz, Junqi Huang," Analytical Modeling of Solute Transport in Groundwater: Using Models to Understand the Effect of Natural Processes on Contaminant Fate and

Transport I",John Wiley & Sons, Aug 2010.

REFERENCES

1. Rafael Antonio PrietoPiedrahita," Treatment of Contaminated Sediments Using Reactive Cap Technology: Characterization and Modeling of Geotechnical, Hydraulic and Contaminant Transport", Proquest, Umi Dissertation Publishing, Sep 2011.

2. ChunmiaoZheng, Gordon D. Bennett," Applied Contaminant Transport Modeling", Wiley-Interscience, February 2002.

3. Shahar Shlomi,"Combining Geostatistical Analysis and Flow-And-Transport Models to Improve Groundwater Contaminant Plume Estimation, "Proquest, Umi Dissertation Publishing,2011

Semester	Course Code	Course Name	L	T	P	C
II	YEN302B	Environmental Impact Assessment	3	0	0	3

COURSE CONTENT

UNIT I	INTRODUCTION TO EIA	9

Environmental Impact Assessment (EIA)- Environmental Impact Statement - Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural.

UNIT II	METHODOLOGIES	9

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis –Analysis of alternatives – Case Studies.

UNIT III	PREDICTION AND ASSESSMENT	9

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA.

UNIT IV	ENVIRONMENTAL MANAGEMENT PLAN	9

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to theProject Affected People – ISO 14000

UNIT V	CASE STUDIES	9

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York. 2006.

2. Lawrence, D.P., "Environmental Impact Assessment - Practical solutions to recurrent problems",Wiley-Interscience, New Jersey 2003.

3. Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Conwell ScienceLondon. 2009.

REFERENCES

1. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for DevelopingCountries", Butterworth Heinemann, London. 2004.

2. The World Bank Group, "Environmental Assessment Source Book Vol. I, II and III. The WorldBank, Washington. 2001.

Semester	Course Code	Course Name	L	T	P	C
III	YEN303	Dissertation Phase - I	0	0	20	10

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester	Course Code	Course Name	L	T	P	C
IV	YEN401	Dissertation Phase - II	0	0	32	16

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.

Semester	Course Code	Course Name	L	T	P	C
I	QEN101	Chemistry and Microbiology for Environmental Engineers	3	0	0	3

COURSE CONTENT

UNIT I	FUNDAMENTALS ON ANALYTICAL CHEMISTRY	12

Oxidation and reduction reactions, balancing equation by electron method - Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV– visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2 & H_2S by spectrophotometry

UNIT II	DEGRADATION OF CHEMICALS	6

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons

UNIT III	SOIL CHEMISTRY	9

Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

UNIT IV	MICROORGANISMS AND NUTRITIONAL REQUIREMENTS	9

Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways-Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae. Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection.

UNIT V	MICROBIOLOGY IN WASTE WATER	9

Biological methods to treat waste water- Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.

2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.

3. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition.

4. Tata McGraw Hill Publishing Company Limited, New Delhi-2001

5. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005

2. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	Course Code	Course Name	L	T	P	C
I	QEN103	**Microbiology Laboratory**	0	0	2	2

List of Experiments:

1. Preparation of culture media
2. Isolation, culturing and Identification of Microorganisms
3. Microorganisms from polluted habitats (soil, water and air)
4. Measurement of growth of microorganisms
5. Biodegradation of organic matter in waste water Analysis of air borne microorganisms
6. Staining of bacteria.
7. Effect of pH, temperature on microbial growth
8. Pollutant removal using microbes from industrial effluent.
9. Bacteriological analysis of wastewater (Coliforms, *E.coli, Streptococcus*) – MPN
10. Bacteriological analysis of wastewater (Coliforms, *Streptococcus)* - MF techniques

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Benfield, L.D.; Weand, B.L.; Judkins, J.F. (1982) Process chemistry for water and wastewater. Prentice Hall Inc Englewood Cliffs New Jersey.

2. Weber Jr., W.J. (1972) Physico-chemical Process for Water Quality Control. Wiley Inc. Newyork.

3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York, 1985.

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Semester	Course Code	Course Name	L	T	P	C
I	QEN 104	**Research Methodology and IPR**	2	0	0	2

COURSE CONTENT

UNIT I	6

Meaning of research problem, Sources of research problem, Criteria-Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection,analysis, interpretation, Necessary instrumentations

UNIT II	6

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III	6

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV	6

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V	6

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

L	T	P	Total
30	0	0	30

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

5. Mayall, "Industrial Design", McGraw Hill, 1992.

6. Niebel, "Product Design", McGraw Hill, 1974.

7. Asimov, "Introduction to Design", Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester	Course Code	Course Name	L	T	P	C
II	QEN201	Unit Operation and Processes in Environmental systems	3	0	0	3

COURSE CONTENT

UNIT I	PRIMARY TREATMENT METHODS	9

Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation

UNIT II	SEDIMENTATION AND FILTRATION	9

Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters

UNIT III	AERATION	9

Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays

UNIT IV	ADSORPTION	9

Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics

UNIT V	MEMBRANE PROCESSES	9

Reverse Osmosis and Electro dialysis - Species Transformation Processes - Chemical Oxidation / Reduction Processes, Disinfection using Chlorine and UV, Advanced Oxidation Process.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002

2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.

3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.

2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011

3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester	Course Code	Course Name	L	T	P	C
II	QEN203	Environmental Quality Measurements Laboratory-I (Water and Wastewater)	0	0	2	2

List of Experiments:

1. Determination of pH, Turbidity and Electrical conductivity
2. Determination of Alkalinity
3. Determination of Acidity
4. Determination of Hardness
5. Determination of Sulphates
6. Determination of Fluorides
7. Determination of Nitrates
8. Residual chlorine analysis
9. Test on Dissolved Oxygen and BOD
10. Test on COD

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.

2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
III	QEN301	**Transport of Water and Wastewater**	3	0	0	3

COURSE CONTENT

UNIT I	**TRANSPORT OF WATER**	9

Water Storage and Transmission, Storage- requirements, impounding reservoirs-intakes, pressure conduits, hydraulics - pumps and pumping units, capacity - selection of water pumps -economic design of pumps and economic design of gravity and pumping mains- Analysis of physical and Chemical characteristics of Water.

UNIT II	**MATERIALS FOR PIPES**	9

Specification for pipes, merits and demerits, pipe appurtenances, types of loads and stresses, water hammer, causes and prevention, control devices, laying, jointing and Testing of pipes.

UNIT III	**DISTRIBUTION SYSTEM**	9

Principles of design, analysis of distribution networks, Hardy Cross, equivalent pipe and Newton Raphson methods, computer applications in distributions network analysis, optimal design of networks, maintenance of distribution systems, methods of control and prevention of corrosion, storage, distribution and balancing reservoirs – EPANET- LOOP

UNIT IV	**SANITARY SEWERAGE**	9

Storm Drainage: Basic philosophy in storm drainage • drainage layouts • storm runoffestimation • Rainfall data analysis • hydraulics of flow in storm water drains • storm water drain materials and sections • design of storm drains • storm water inlets - Sanitation technology selection • sanitary sewage flow estimation - sewer materials • hydraulics of flow in sanitary sewers • partial flows • sewer design • sewer layouts. - Analysis of physical and Chemical characteristics ofWaste water.

UNIT V	**OPERATION & MAINTENANCE**	9

Maintenance requirements of sanitary sewerage - stormdrainage systems • manpower requirement • Equipment requirement - preventive maintenance
- monitoring safety requirements• corrosion in sewers •prevention and control
- Specific problems related to waste water pumping • pumping • pump selection *wastewater pumping networks

	L	T	P	Total
	45	0	0	45

TEXT BOOKS

1. G.S.Bridie & J.S. Bridie, Water Supply and Sanitary Engineering, DhanpatRai and Sons, NewDelhi, 2010.

2. Hammer, M.J. Water & Waste water Technology, John Wiley & Sons, New York, 7TH edition,2012.

3. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007

4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2000

5. Manual on Sewage and Sewerage system, CPHEEO, Government of India, New Delhi, 2000

REFERENCES

1. 'Water supply and wastewater Removal' Vol.I. John Wiley and Sons Manual on Water Treatment,CPHEEO, Government of India, New Delhi, 2010

2. Hussain S.K. A Text book of water supply and sanitary Engineering, Oxford and IBH PublishingCo., New, 2010.

3. Larry W. Mays, Mays Larry, "Water Distribution System Handbook", McGraw-Hill Professional

Semester	Course Code	Course Name	L	T	P	C
III	QEN302B	Sustainable Urban development Conceptsand Strategies	3	0	0	3

COURSE CONTENT

UNIT I	Introduction	9
	Introduction to sustainable development –Energy Resources-Renewable Non –conventional energy sources-Energy needs-Conserving natural resources	
UNIT II	Environmental Protection	9
	Environmental protection in urban areas-Co ordination and enforcement – Legislative aspects-Population control-Technological aspects-Application of EIA- Methodology to urban development programme	
UNIT III	Urban Landscape	9
	Principles of urban landscape- Landscape design for front areas and other functionalareas in urban development -Develict areas-Reclamation of derlict areas	
UNIT IV	Community Development	9
	Community involvement in developing settlement – Developmental programsrelated to urban and rural society—Impact of programme on social development	
UNIT V	Development Management	9
	Socio economic factors in the development of urban and rural settlements-Legal administrative and financial frame works –Development management and control	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Neil S. Grigg., " Urban Water Infrastructure Planning - Management and Operations ", John Wileyand Sons, 1986.

2. Overtens D.E. and Meadows M.E., " Storm Water Modelling ", Academic Press, NewYork, 1976.

REFERENCES

1. Environmental, A., Divan and Noble M. Environmental Law and Policy in India(cases, Materialsand Statutes) 1991 Tripathi Bombay.

2. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification

Semester	Course Code	Course Name	L	T	P	C
III	QEN303	**Environmental Quality Measurements Laboratory-II (Air,Noise and Solidwaste)**	0	0	2	2

List of Experiments:

1. Determination of Ambient Air Quality Parameters- SPM, CO, NOx and SOx
2. Soil Analysis – pH and Conductivity,
3. Cation Exchange Capacity
4. Determination of Noise
5. Composition of Municipal Solidwaste
6. Proximate and Ultimate Analysis
7. Total Solids, Suspended Solids, Volatile Solids, Non Volatile Solids

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN401	**Biological Treatment of Wastewater**	3	0	0	3

COURSE CONTENT

UNIT I	INTRODUCTION	9

Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process-reactors-batch-continuous type

UNIT II	AEROBIC TREATMENT OF WASTEWATER	9

Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends

UNIT III	ANAEROBIC TREATMENT OF WASTEWATER	9

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends.

UNIT IV	SLUDGE TREATMENT AND DISPOSAL	9

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering(mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal –

recent advances.

UNIT V	OPERATION AND MAINTENANCE	9

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata Mcgraw Hill, New Delhi, III Edition, 2006.

2. David Hendricks, "Fundamentals of Water Treatment Unit Process", CRC Press, New York, 2010

3. F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York, III, Edition, 2013.

REFERENCES

1. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Government of India,New Delhi, 1999.

2. Metcalf & Eddy, INC, "Wastewater Engineering – Treatment and Reuse", Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.

3. Qasim, S.R. "Wastewater Treatment Plant, Planning, Design & Operation", Technomic Publications, New York, II Edition, 1998.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN402C	Simulation and Modeling in Environmental Systems	3	0	0	3

COURSE CONTENT

UNIT I	9

Scope of Environmental modeling – transport phenomena – advection - diffusion – sediment transport – lake dispersion calculation – simple transport models – equilibrium chemical model – equilibrium principles – numerical solution techniques – redox reactions in equilibrium models .

UNIT II	9

Eutrophication of lakes – conventional pollutants in rivers – toxic organic chemicals
– modeling trace metals – mass balance and waste load allocation for rivers – studystate model for metals in lakes – metals migration in soils .

UNIT III	9

Groundwater contamination – Darcy's law – flow equations – contaminant solutetransport equation – biotransformations - biofilms and bio availability – remediation
– numerical methods.

UNIT IV	9

Atmospheric deposition and biogeochemistry – genesis of acid deposition –neutralizing capacities – biogeochemical models – ecological effects – critical loads
– case studies –metal deposition.

UNIT V	9

Global change and Global cycles – Climate change and general circulation models –global carbon box model – nitrogen cycle – Global sulfur cycle – trace gases.

	L	T	P	Total
	45	0	0	45

TEXT BOOKS

1. Environmental Modelling by Gerald .L. Schnoor, John Wiley and sons, Inc.
2. Process Dynamics in Environmental Systems by Walter .J. Weber,Jr and Francis ,John Wileyand sons, Inc.
3. Transport Modelling for Environmental Engineers and Scientists by Mark .M. Clark, JohnWiley and Sons, Inc.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN403	**Unit Operation Laboratory**	0	0	2	2

List of Experiments:

1. Coagulation and Flocculation
2. Studies on Filtration- Characteristics of Filter media
3. Disinfection for Drinking water (Chlorination
4. Water Softening - Lime and Caustic Soda Process
5. Sludge volume Index
6. Sedimentation - Settling Column Analysis of Flocculating Particles
7. Adsorption - Colour Removal by Adsorption
8. Heavy Metal Precipitation
9. Kinetics of Activated Sludge Process

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN404	Mini Project	0	0	4	2

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a panel of examiners

Semester	Course Code	Course Name	L	T	P	C
V	QEN501	Project work phase- I	0	0	20	10

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester	Course Code	Course Name	L	T	P	C
VI	QEN601	Dissertation Phase - II	0	0	32	16

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.