DEPARTMENT OF

CIVIL ENGINEERING

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

CURRICULUM & SYLLABUS

FOR

B.Tech – CIVIL ENGINEERING

(Full Time)

(Based on Outcome Based Education)

(I- VIII Semester)

REGULATIONS – 2018

Bachelor of Technology in Civil Engineering (Full Time)

SEMESTER I

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XMA101	BSC	Calculus and Linear Algebra	3	1	0	4
XES102	MAN	Environmental Sciences	2	0	0	0
XBE103	ESC	Electrical and Electronics Engineering Systems	3	1	1	5
XAP104	BSC	Applied Physics for Engineers	3	1	4	6
XEG105	ESC	Engineering Graphics	2	1	0	3
	TOTAL		**13**	**4**	**6**	**18**

SEMESTER II

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XMA201	BSC	Calculus, Ordinary Differential Equations and Complex Variables	3	1	0	4
XCP202	ESC	Programming for Problem Solving	3	0	4	5
XGS203	HSM	English	2	0	2	3
XAC204	BSC	Applied Chemistry for Engineers	3	1	2	5
XWP205	ESC	WorkshopPractices	1	0	4	3
	TOTAL		**12**	**2**	**12**	**20**

SEMESTER III

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE301	BSC	Transforms and Computational Techniques	2	0	0	2
XCE302	PCC	Disaster Preparedness & Planning	1	1	0	2
XCE303	ESC	Computer Aided Civil Engineering Drawing	1	0	3	3
XCE304	ESC	Engineering Mechanics	3	1	0	4
XCE305	ESC	Energy Science and Engineering	1	1	0	2
XCE306	PCC	Surveying – I	2	0	2	3
XCE307	HSM	Introduction to Civil Engineering	3	0	0	3
XGS308	HSM	Effective Technical Communication	3	0	0	3
XCE309		In-plant Training - I	0	0	2	0
XCEM0*		Minor Course - I	1	0	1	0
	TOTAL		**17**	**3**	**8**	**22**

SEMESTER IV

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE401	ESC	Mechanical Engineering	2	1	0	3
XCE402	PCC	Instrumentation & Sensor Technologies for Civil Engineering Applications	2	0	2	3
XCE403	PCC	Engineering Geology	1	0	2	2
XCE404	PCC	Mechanics of Fluids	2	0	2	3
XCE405	PCC	Mechanics of Solids	2	0	2	3
XUM406	HSM	Entrepreneurship Development	3	0	0	0
XCE407	PCC	Geotechnical Engineering	2	0	2	3
XCE408	PCC	Surveying – II	2	0	2	3
XCE409	PCC	Materials Testing & Evaluation	2	0	2	3
	TOTAL		**18**	**1**	**14**	**23**

SEMESTER V

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE501	PCC	Mechanics of Materials	3	0	0	3
XCE502	PCC	Hydraulic Engineering	2	0	2	3
XCE503	PCC	Structural Analysis	2	1	0	3
XCE504	PCC	Hydrology & Water Resources Engineering	2	2	0	3
XCE505	PCC	Environmental Engineering	2	0	2	3
XUM506	HSM	Constitution of India	2	0	0	0
XCE507	PCC	Transportation Engineering	2	0	2	3
XCE508	PCC	Construction Engineering & Management	2	1	0	3
XMG509	HSM	Professional Practice, Law & Ethics	2	0	0	2
XCE510		In-plant Training - II	0	0	2	0
XCEM0*		Minor Course – II	1	0	1	0
	TOTAL		**20**	**4**	**9**	**23**

SEMESTER VI

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE601	PCC	Structural Engineering	2	1	0	3
XCE602	PCC	Engineering Economics, Estimation & Costing	2	1	4	5
XCEE**	PEC	Elective-I	3	0	0	3
XCEE**	PEC	Elective-II	3	0	0	3
XCEE**	PEC	Elective-III	3	0	0	3
XCEE**	PEC	Elective-IV	3	0	0	3
	OEC	Open Elective-I	3	0	0	3
	TOTAL		**19**	**2**	**4**	**23**

SEMESTER VII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE**	PEC	Elective V	3	0	0	3
XCEE**	PEC	Elective-VI	3	0	0	3
XCEE**	PEC	Elective VII	3	0	0	3
	OEC	Open Elective-II	3	0	0	3
XCE705	Project	Project Phase – I	0	0	8	4
XCE706		In--plant Training - III	0	0	4	2
XCEM0*		Minor Course – III	0	0	0	0
	TOTAL		**12**	**0**	**12**	**18**

SEMESTER VII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE**	PEC	Elective VIII	2	0	0	2
	OE	Open Elective-III	3	0	0	3
	OE	Open Elective-IV	3	0	0	2
XCE804	Project	Project Phase– II	0	0	12	6
	TOTAL		**11**	**0**	**12**	**16**

TOTAL CREDITS - 160

PROFESSIONAL ELECTIVE COURSE TRACKS- CIVIL ENGINEERING [PEC-CE]

The following Seven Mandatory Professional Specialized Tracks identified to offer electives.

TRACK	Professional Coré Courses (PCC-CE)
I.	Transportation Engineering
II.	Structural Engineering
III.	Geotechnical Engineering
IV.	Hydraulics
V.	Structural Engineering
VI.	Hydrology & Water Resources Engineering
VII.	Construction Engineering & Management
VIII.	Environmental Engineering

TRACK I

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE01	PEC	Pavement Design	3	0	0	3
XCEE02	PEC	Airport Planning and Design	3	0	0	3
XCEE03	PEC	Port and Harbour Engineering	3	0	0	3
XCEE04	PEC	Railway Engineering	3	0	0	3

TRACK II & TRACK V

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE05	PEC	Advanced Structural Analysis	3	0	0	3
XCEE06	PEC	Design of Concrete Structures	3	0	0	3
XCEE07	PEC	Concrete Technology	3	0	0	3
XCEE08	PEC	Design of Steel Structures	3	0	0	3
XCEE09	PEC	Prestressed Concrete Structures	3	0	0	3
XCEE10	PEC	Bridge Engineering	3	0	0	3

TRACK III

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE11	PEC	Foundation Engineering	3	0	0	3
XCEE12	PEC	Environmental Geotechnology	3	0	0	3
XCEE13	PEC	Geotechnical Design	3	0	0	3
XCEE14	PEC	Earthquake Engineering	3	0	0	3

TRACK IV

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE15	PEC	Design of Hydraulic Structures	3	0	0	3
XCEE16	PEC	Basics of Computational Hydraulics	3	0	0	3
XCEE17	PEC	Urban Hydrology and Hydraulics	3	0	0	3
XCEE18	PEC	Groundwater Engineering	3	0	0	3

TRACK VI

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE19	PEC	Water Quality Engineering	3	0	0	3
XCEE20	PEC	Surface Hydrology	3	0	0	3
XCEE21	PEC	Environmental Fluid Mechanics	3	0	0	3
XCEE22	PEC	Water Resources Field Methods	3	0	0	3

TRACK VII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE23	PEC	Repairs and Rehabilitation of Structures	3	0	0	3
XCEE24	PEC	Building Construction Practice	3	0	0	3
XCEE25	PEC	Construction Equipment and Automation	3	0	0	3
XCEE26	PEC	Contracts Management	3	0	0	3

TRACK VIII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE27	PEC	Environmental Law and Policy	3	0	0	3
XCEE28	PEC	Solid and Hazardous Waste Management	3	0	0	3
XCEE29	PEC	Air and Noise Pollution and Control	3	0	0	3
XCEE30	PEC	Environmental Impact Assessment	3	0	0	3

MINOR COURSES

Sub. Code	Name of the Course	Hours per week			C
		L	T	P	
XCEM01	Real Estate and Valuation	1	0	0	0
XCEM02	Digital Land Surveying and Mapping	0.5	0	0.5	0
XCEM03	General repairs and Remedial Water proofing	0.25	0	0.75	0
XCEM04	Building Regulations and Approval Process	1	0	0	0
XCEM05	Computational skills for Geotechnical Applications	0.25	0	0.75	0
XCEM06	Structural Quality Assessment	0.25	0	0.75	0
XCEM07	Plumbing and Sanitary Installations	0.25	0	0.75	0
XCEM08	Survey Camp	0.25	0	0.75	0

OPEN ELECTIVE COURSES

Sub. Code	Name of the Course	Hours per week			C
		L	T	P	
XCEOE1	Remote Sensing & GIS	3	0	0	3
XCEOE2	Building Services	3	0	0	3
XCEOE3	Metro Systems and Engineering	3	0	0	3

Note: **L – Lecture, T – Tutorial, P – PRACTICAL, C - Credit**

Semester : **I**

Course Code : **XMA 101**

Course Name : **Mathematics I (Calculus and Linear Algebra)**

Prerequisite : **Differentiation and Integration**

L	T	P	C
3	0	0	3

C	P	A
2.5	0	0.5

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	**Apply** orthogonal transformation to reduce quadratic form to canonical forms.	Cognitive	Remembering Applying
CO2	**Apply** power series to tests the convergence of the sequences and series.	Cognitive	Applying Remembering
	Half range Fourier sine and cosine series.	Psychomotor	Guided Response
CO3	**Find** the derivative of composite functions and implicit functions	Cognitive	Remembering
	Euler's theorem and Jacobian	Psychomotor	Guided Response
CO4	**Explain** the functions of two variables by Taylors expansion, by finding maxima and minima with and without constraints using Lagrangian Method.	Cognitive	Remembering Understanding
	Directional derivatives, Gradient, Curl and Divergence.	Affective	Receiving
CO5	**Apply** Differential and Integral calculus to notions of curvature and to improper integrals.	Cognitive	Applying

COURSE CONTENT

UNIT 1	**MATRICES**	**15**

Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only).

UNIT 2	**SEQUENCES AND SERIES**	**15**

Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence: comparison test, Integral test and D'Alembert's ratio test-. Fourier series: Half range sine and cosine series- Parseval's Theorem.

UNIT III	**MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION**	**15**

Limits and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian.

UNIT IV	**MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS**	**15**

Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables: with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl.

UNIT V DIFFERENTIAL AND INTEGRAL CALCULUS 15

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

L	T	P	Total
60	15	0	75

TEXT BOOKS

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit-1, Unit-3 and Unit-4).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit-2).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit-5).**

REFERENCES

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearso Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

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
Scale	0	1	2	3
Relation	No	Low	Medium	High

Semester : I

Course Code : **XES 102**

Course Name : **ENVIRONMENTAL SCIENCES**

Prerequisite : -

L	T	P	C
2	0	0	0

C	P	A
1.4	0.3	03

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	***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 of major 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	Understand Apply
CO5	***Recognize*** the impact of population and the concept of various welfare programs, and ***apply*** themodern technology towards environmental protection.	Cognitive	Understand Analysis

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) Aquatic ecosystem (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 biodiversity.

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 human health.

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

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	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
3	1	1	5

C	P	A
3	1	0

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	***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 AC machines.	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 and their 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 DC Generators, 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 and Systems. Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. Microprocessors - Theory and Applications: Intel and Motorola. Prentice Hall International.

E-REFERENCES:

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

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

Semester : I

Course Code : **XAP 104**

Course Name : **APPLIED PHYSICS FOR ENGINEERS**

Prerequisite : **Basic Physics in HSC level**

L	T	P	C
3	1	2	6

C	P	A
2.8	0.8	0.4

L	T	P	H
3	1	3	7

Course Outcome: After the completion of the course, students will be 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 engineering systems 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 Psychomotor Affective	Remember, Analyze, Mechanism Respond
CO3	***Understand*** the fundamental phenomena in optics by measurement and ***describe*** the working principle and application of various lasers and fibre optics.	Cognitive Psychomotor Affective	Understand, Apply Mechanism Receive
CO4	***Analyse*** energy bands in solids, ***discuss*** and ***use*** physics principles of latest technology using semiconductor devices.	Cognitive Psychomotor Affective	Understand, Analyze Mechanism Receive
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., New Delhi, 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 given material 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 particle using 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	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	-	-	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
2	0	1	3

C	P	A
1.75	1	0.25

L	T	P	H
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	*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 projections of 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	Understanding Complex Over Response Responds to Phenomena
CO5	*Construct sketch* and *practice* isometric and perspective views 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 AND CONSTRUCTION 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 of polygonal surfaces and circular lamina inclined to both the planes of projection.

UNIT III	PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS	6+6

Projection of simple solids like prism, pyramid, cylinder and cone when 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 IV	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 V	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 AND COMPLEX VARIABLE**
Prerequisite	**:**	**Mathematics I (Calculus and Linear Algebra)**

L	T	P	C
3	1	0	4

C	P	A
3	0.5	0.5

L	T	P	H
3	1	0	4

Course Outcome: After the completion of the course, students will be 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
CO2	**Solve** first order differential equations of different types which are solvable for p, y, x and Clairaut's type.	Cognitive	Applying
CO3	**Solve** Second order ordinary differential equations with variable 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 transformation.	Cognitive Psychomotor	Remembering Applying 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's series.	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's type.

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 their properties.

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, 40thth 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 Value Problems", 9thEdn. 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
3	0	2	5

C	P	A
3	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	*Define* programming fundamentals and *Solve* simple programs using I/O statements	Cognitive Psychomotor	Remember Understand Apply
CO2	*Define* syntax and *write simple programs* using control structures and arrays	Cognitive Psychomotor	Remember Understand Apply
CO3	*Explain* and *write simple programs* using functions and pointers	Cognitive Psychomotor	Understand Apply
CO4	*Explain* and *write simple programs* using structures and unions	Cognitive Psychomotor	Understand Apply Analyze
CO5	*Explain* and *write simple programs* using files and *Build* simple projects	Cognitive Psychomotor	Remember Understand Create

COURSE CONTENT

UNIT 1 PROGRAMMING FUNDAMENTALS AND INPUT / OUTPUT STATEMENTS

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 – Data Types-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 looping Statement
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(no implementation).

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 function to 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-Definingandopeninga file-Closingafile-Thegetwandputwfunctions-Thefprintf&fscanf functions - fseek function– 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), TMH publications, 2010
2. Yeshwant Kanethker,“Let us C”, BPB Publications, 2008
3. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. 2005
4. Behrouz A. Forouzan and Richard. F. Gilberg,"A Structured Programming Approach Using 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
2	0	1	3

C	P	A
2.6	0.4	0

L	T	P	H
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	***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 and etiquettes	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 in documents - 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 PRACTICES 9

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
3	1	1	5

C	P	A
3.5	1.0	0.5

L	T	P	H
3	1	2	6

Course Outcome: After the completion of the course, students will be 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 Psychomotor	Remember Perception
CO2	***Explain*** *and* ***Measure*** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understand Set
CO3	***Interpret*** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Apply Mechanism Receive
CO4	***Describe, Illustrate*** *and* ***Discuss*** the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remember Analyze Perception Respond
CO5	***Apply, Measure*** and ***Distinguish*** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remember Apply Mechanism

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 trajectories on 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 in transitional 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), New Delhi, 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 Book Company, 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 International Publishers, 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-Hill Publishing 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 EDTA method. **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 Quantitative Chemical 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

Semester : II
Course Code : XBW205
Course Name : WORKSHOP/MANUFACTURING PRACTICES
Prerequisite :

L	T	P	C
1	0	2	3

C	P	A
1	3	0

L	T	P	H
1	0	4	5

Course Outcome: After the completion of the course, students will 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 Origination

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	CO3
10.	Mortise And Tenon Joint – Carpentry	CO3
11.	Study Of Fitting Tools	CO3
12.	Square Fitting	CO3
13.	Triangular Fitting	CO3
14.	Study Of Welding Tools	CO4
15.	Square Butt Joint - Welding	CO4
16.	Tee Joint – Welding	CO4
17.	Introduction To House Wiring	CO5
18.	One Lamp Controlled By One Switch	CO5
19.	Two Lamps Controlled By Single Switch	CO5
20.	Staircase Wiring	CO5

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 Promoters and 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
2	0	0	2

C	P	A
2	0	0

L	T	P	H
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. Find Interpolation with equal and unequal intervals.	Cognitive Psychomotor	Apply 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 I **TRANSFORM CALCULUS I** **6**

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. 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", Revised Second 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 of India 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
1	1	0	2

C	P	A
2	0	0

L	T	P	H
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 I	**INTRODUCTION**	**3**

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, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
4. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

REFERENCE BOOKS

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

E-Resources – MOOC's

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
1	0	2	2

C	P	A

L	T	P	H
1	0	4	5

	Course Outcome:	Domain	Level
CO1	Develop Parametric design and the conventions of formal engineering drawing	Cognitive Psychomotor	Understand Perception
CO2	Draw and interpret 2D & 3D drawings.	Cognitive Psychomotor	Understand Mechanism
CO3	Communicate a design idea/concept graphically/ visually	Cognitive Affective	Understand Perception
CO4	Examine a design critically and with understanding of CAD	Psychomotor Affective	Mechanism 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, Text and 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 and one 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, standard fittings & 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 all MEP, joinery, rebars, finishing and other details .
3. Reinforcement drawings for typical slabs, beams, columns and spread footings
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 AUTOCAD 200I", Tata- McGraw-Hill Company Limited, New Delhi
3. Sham TickooSwapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education
4. Venugopal (2007), "Engineering Drawing and Graphics+AUTOCAD", New Age International Pvt. Ltd

REFERENCES

1. Corresponding set of CAD Software Theory and User Manuals.
2. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing KDR building, Calicut,
3. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New 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
3	1	0	4

C	P	A
1.5	0	1.5

L	T	P	H
3	1	0	4

Course Outcome: After the completion of the course, students will be able to		***Domain C or P or A***	***Level***
CO1	Capability to apply mathematics, science, and engineering	Cognitive Affective	Understand Receiving
CO2	Ability to identify, formulate, and solve engineering problems	Cognitive Affective	Understand Receiving
CO3	Skill to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.	Cognitive Affective	Understand Receiving
CO4	Capacity to design and conduct experiments, as well as to analyze and interpret data	Cognitive Affective	Understand Receiving
CO5	Ability to comprehend the thermodynamics and their corresponding processes that influence the behaviour and response of structural components	Cognitive Affective	Understand 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. Applications of energy method for equilibrium. Stability of equilibrium

UNIT V	DYNAMICS	6

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", Tata McGraw-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
1	1	0	2

C	P	A
1.5	0	1.5

L	T	P	H
3	1	0	4

Course Outcome: After the completion of the course, students will be able 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	Understand Respond
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 the environment.	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	Understand Respond
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 ENGINEERINGFOR 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 Renewable Energy Technologies and Sustainable Living, Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the 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	PO 10	PO 11	PO 12	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
2	0	4	6

C	P	A
0.80	1.7	0.5

L	T	P	H
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 ***determine*** the reduced levels	Cognitive Affective Psychomotor	Applying Responding Manipulation
CO3	***Classify*** the methods of Contouring an***d Measure*** the capacity of Reservoir	Cognitive Psychomotor	Understanding Manipulation
CO4	***Describe*** the methods and ***measure*** the angles and distances using Theodolite	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO5	**Understand** the measurement of distance and heights of objects 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 disadvantages of plane tabling.

UNIT II LEVELLING 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 CONTOURING 09

Definition, Contour interval, Characteristics of contours, Types of contours, Steep slope contours, 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 plane and double plane method.

UNIT V	TACHOMETRY	06

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
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 and Remote 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
2	0	0	2

C	P	A
2	0	0

L	T	P	H
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	Understand the basis of engineering, Building material and Construction methods.	Cognitive	Understanding
CO2	Understand the fundamentals of architecture, construction management 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 advancement in 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, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, …)

TUTORIALS	**15**

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 investigation report 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. Avinash Publications 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
3	0	0	3

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	***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 to write 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
2	2	0	3

C	P	A
2.5	0.5	0.5

L	T	P	H
2	2	0	4

Course Outcome: After the completion of the course, students will be 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 thermodynamic properties 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 high grade and low grade energies.	Cognitive	Understanding
CO5	Student can ***apply*** the energy balance to systems operating at 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 compression cycle 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*, John Wiley 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**

Course Code : **XCE 402**

Course Name : **INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS**

Prerequisite :

L	T	P	C
2	0	2	3

C	P	A
2.5	0.5	0.5

L	T	P	H
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 principles of operation and characteristics of instrumentation and integrated sensor systems.	Cognitive Psychomotor Affective	Understand Mechanism Receive
CO2	***Understand*** right use of sensors and instruments for differing applications along with limitations.	Cognitive Psychomotor Affective	Understand Mechanism Receive
CO3	***Recognize*** and ***Apply*** measurement best practice and identify ways to improve measurement and evaluation	Cognitive Psychomotor Affective	Understand Mechanism Receive
CO4	***Solve*** problems in instrumentation and measurement systems.	Cognitive Psychomotor Affective	Understand Mechanism Receive

COURSE CONTENT

UNIT I **FUNDAMENTALS OF MEASUREMENT, SENSING AND INSTRUMENTATION** **7**

Definition of measurement and instrumentation, physical variables, common types of sensors; Function of these sensors; Terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

UNIT II **SENSOR INSTALLATION AND OPERATION** **7**

Predict the response of sensors to various inputs; Construct a conceptual instrumentation and monitoring program; Describe the order and methodology for sensor installation; and Differentiate between types of sensors and their modes of operation and measurement and Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

UNIT III **DATA ANALYSISAND INTERPRETATION** **8**

Fundamental statistical concepts, Data reduction and interpretation, Piezometer, Inclinometer, Strain gauge, etc. Time domain signal processing, Discrete signals, Signals and noise and few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

UNIT IV	FREQUENCY DOMAIN SIGNAL PROCESSING AND ANALYSIS	8

Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

PRACTICAL **30**

1. Instrumentation of typical civil engineering members/structures/structural elements
2. Use of different sensors, strain gauges, inclinometers,
3. Performance characteristics
4. Errors during the measurement process
5. Calibration of measuring sensors and instruments
6. Measurement, noise and signal processing
7. Analog Signal processing
8. Digital Signal Processing
9. Demonstration & use of sensor technologies

L	T	P	Total
30	15	0	45

TEXT BOOKS

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Heinemann.
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press.

REFERENCE BOOKS

1. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis.
2. IlyaGertsbakh (2010), Measurement Theory for Engineers, Springer.

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	3	1		1						1		1
CO 2	1	1	2	1		1					1			
CO 3		2	1	1		1				1		1	1	
CO 4	2	1	2	1		3					1	1		
CO 5														
Total	4	5	8	4	0	6	0	0	0	1	2	3	1	1
Scaled Value	1	1	2	1	0	2	0	0	0	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 : IV
Course Code : XCE 403
Course Name : ENGINEERING GEOLOGY
Prerequisite :

L	T	P	C
1	0	2	2

C	P	A
2.5	0.5	0.5

L	T	P	H
1	0	2	3

Course Outcome: After the completion of the course, students will be able to		***Domain C or P or A***	***Level***
CO1	Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice	Cognitive Psychomotor	Applying Guided Response
CO2	The fundamentals of the engineering properties of Earth materials and fluids.	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO3	Rock mass characterization and the mechanics of planar rock slides and topples.	Cognitive Affective	Understanding Responding
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), Macmillan Publishers 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).

E-Resources – MOOC's

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
2	0	2	3

C	P	A
2.5	0.5	0.5

L	T	P	H
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 velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

UNIT V	FLOW THROUGH PIPES	6

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 control measures, branching of pipes, three reservoir problem.

PRACTICAL	30

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

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, Wiley Student Edition, 2009.
3. Fluid Mechanics and Machinery, C. S. P. Ojha, R. Bengtsson and P. N. Chadramouli0, Oxford University Press, 2010.
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.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 405**

Course Name : **MECHANICS OF SOLIDS**

Prerequisite :

L	T	P	C
2	0	2	3

C	P	A
2.5	0.5	0.5

L	T	P	H
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	Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress	Cognitive Psychomotor	Analyse Measure
CO2	Calculate the shear force and bending moment occurs at various loading conditions.	Cognitive Affective	Analyse Response
CO3	Evaluate the shear stress distribution for beams of various sections	Cognitive Psychomotor	Analyse Measure
CO4	Calculate the deflection at any point on a beam subjected to a 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 strains and 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: $\frac{M}{I}=\frac{f}{y}=\frac{E}{R}$ - 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 for determinant 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, longitudinal stress in a cylinder, and sphere subjected to internal pressures

PRACTICAL	30

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 elastic deformation,
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 406**

Course Name : **GEOTECHNICAL ENGINEERING**

Prerequisite :

L	T	P	C
2	0	2	3

C	P	A
2.5	0.5	0.5

L	T	P	H
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	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 consolidation settlement 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 any kind of shallow foundation system	Cognitive Affective	Understanding Responding
CO6	Assess the pile and pile group capacity for any kind of soil including 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 OF SLOPES	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 V	FOUNDATIONS	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., New Delhi, 1995.
5. A V NarasimhaRao and C Venkatramaiah, Numerical Problems, Examples and Objective questions 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 Publishers Distributors 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

Semester : IV

Course Code : XCE407

Course Name : SURVEYING - II

Prerequisite :

L	T	P	C
2	0	2	3

C	P	A
2.5	0.5	0.5

L	T	P	H
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	***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 implementation of 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 Reverse curve - 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 Remote Sensing, 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	**XCE 409**
Prerequisite	**---**

L	T	P	C
2	0	2	3

C	P	A
1.5	1.2	0.3

L	T	P	H
2	0	2	4

Course Outcome: After the completion of the course, students will be able to		**Domain**	**Level**
CO1	Understand the use of non-conventional Civil Engineering materials	Cognitive Psychomotor	Understand Perception
CO2	Understand the various modes of failure in compression, tension, and shear	Cognitive Psychomotor	Understand Mechanism
CO3	Understand the standard testing and evaluation procedure	Cognitive Psychomotor	Understand Perception
CO4	Apply the concepts of fracture mechanics to various materials	Cognitive Affective	Apply Response
CO5	Adopt special concreting technologies to meet out the modern construction requirements.	Cognitive Psychomotor	Apply Mechanism

COURSE CONTENT

UNIT - I	**CONSTRUCTION MATERIALS**	**5**

Brick and Stones, Cements, M-Sand, Ceramics, and Refractories, Bitumen and asphaltic materials, 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 and nonferrous metals - Elastic deformation; Plastic deformation; Impact test

UNIT– IV	**FRACTURE MECHANICS**	**8**

Background; Fracture toughness – different materials; Fatigue of material; Creep, concept of fatigue ; Structural integrity assessment procedure and fracture mechanics

UNIT – V	**SPECIAL CONCRETES**	**8**

Plain, Reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance 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 Pavement Testing', 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* (post 2000)
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
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- Understand the deformation and strains under different load action and response in terms of forces and moments
- 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 will be able to		**Domain C or P or A**	**Level**
CO1	Understand the concept of theories of failure	Cognitive	Understanding
CO2	Understand the deformation and strains under different load action 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	Understanding Receiving
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 and strain 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. John Wiley & 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
2	0	1	3

C	P	A
2	1	0

L	T	P	H
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 will be able to		**Domain C or 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.	

PRACTICAL 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, New Delhi.
2. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by P. N. Modi& S. M. Sethi Standard Publishers, 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	PO 6	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**
Scaled 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
2	0	1	3

C	P	A
2.5	0	0.5

L	T	P	H
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 will be able to		**Domain or P or A**	**C Level**
CO1	Identify the behavior of structural element under various loading condition.	Cognitive	Understanding
CO2	Analyse the continuous beams and rigid frames by slope defection method.	Cognitive Affective	Understanding Respond
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 the supports over the regular analysis.	Cognitive	Understanding
CO5	Apply knowledge on advanced methods of analysis of structures 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 of indeterminate 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", Laxmi Publications, 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

Semester : **V**
Course Code : **XCE504**
Course Name : **HYDROLOGY AND WATER RESOURCES ENGINEERING**
Prerequisite : **Nil**

L	T	P	C
2	2	0	3

C	P	A
3	0	0

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

C	P	A
2.0	0.5	0.5

L	T	P	H
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, operation and maintenance of water and sewage treatment plants.
- To make the students conversant with the processing and disposal of municipal solid waste and Hazardous Waste

Course Outcome: After the completion of the course, students will be 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	Understanding Mechanism
CO4	Select the most appropriate technique for the treatment of water, 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 disposal

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 - Hill International 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 Publication International 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, New Jersey.
8. Standard methods for the Examination of Water and Wastewater, 17thEdition, WPCF, APHA and AWWA,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 : **XCE506**
Course Name : **TRANSPORTATION ENGINEERING**
Prerequisite : **Nil**

L	T	P	C
2	0	2	3

C	P	A
2.0	0.5	0.5

L	T	P	H
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 rigid pavements

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Carry out surveys involved in planning and highway alignment	Cognitive	Understanding
CO2	Design the geometric elements of highways and expressways	Cognitive	Understanding
CO3	Carry out traffic studies and implement traffic regulation and control measures and intersection design .	Cognitive Affective	Understanding Respond
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, Nem Chand & 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 and Traffic 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	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	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 : XCE507
Course Name : CONSTRUCTION ENGINEERING &MANAGEMENT
Prerequisite : NIL

L	T	P	C
2	1	0	3

C	P	A
2	0	1

L	T	P	H
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 including scheduling, resource management.
- To study the elements of quality control and safety of construction projects.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
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 are administered with respect to contract structuresand issues.	CognitiveAffective	Understanding Respond
CO5	**Ability** to put forward ideas and understandings to others with effective communication processes.	Cognitive Affective	Understanding Respond

COURSE CONTENT

UNIT I BASICS OF CONSTRUCTION 5

Unique features of construction, construction projects types and features, phases of a project, 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 Resolution methods.Classification of costs, time cost, trade-off in construction projects, compression and decompression.

L	T	P	Total
30	15	0	45

TEXT BOOKS

1. Kumar NeerajJha, "Construction Project management", Dorling Kindersley, Publishers, New Delhi.2013.
2. Chitkara.K.K, "Construction Project Management planning, Scheduling and control", Tata McGraw 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 : XMG508

Course Name : PROFESSIONAL PRACTICE LAW& ETHICS

Prerequisite : NIL

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- To make the students understand the types of roles they are expected to play in the society as practitioners 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 or P or A**	**C Level**
CO1	To Understand the various stakeholders roles and ethics governing 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 their profession	Cognitive	Understanding

COURSE CONTENT

UNIT I PROFESSIONAL PRACTICE AND PROFESSIONAL ETHICS 9

Respective roles of various stakeholders: Government Agencies (constituting egulatory bodies 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 by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed 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.

UNIT II	**CONTRACTS MANAGEMENT**	**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 RESOLUTION SYSTEM**	**7**

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 LAWS**	**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 V	**LAW RELATING TO INTELLECTUAL PROPERTY**	**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. AvinashPublications Mumbai
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	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	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 : V
Course Code : XCI509
Course Name : CONSTITUTION OF INDIA
Prerequisite : NIL

L	T	P	C
2	0	0	2

C	P	A
2	0	0

L	T	P	H
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 will be able to		**Domain or P or A**	**C 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 : VI
Course Code : XCE 601
Course Name : STRUCTURAL ENGINEERING
Prerequisite : NIL

L	T	P	C
2	1	0	3

C	P	A
3	0	0

L	T	P	H
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 will be able to		**Domain C or P or A**	**Level**
CO1	Apply their knowledge of structural mechanics in design problems of structural engineering	Cognitive	Understanding
CO2	Acquire the skills to solve problems with different loads on 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 –Design Loads – 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 Publishing Company 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., New Delhi, 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 Publishing Company 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 : VI
Course Code : XCE 602
Course Name : ENGINEERING ECONOMICS, ESTIMATION AND COSTING
Prerequisite : NIL

L	T	P	C
2	1	1	5

C	P	A
2.0	0.5	0.5

L	T	P	H
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 will be able to		**Domain C or P or A**	**Level**
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 determine the unit cost of "components"	Cognitive Psychomotor	Understanding Set
CO4	Learning from Laboratory demonstration and field visits	Cognitive Psychomotor	Understanding Set
CO5	Prepare the actual estimate of any property/project	Cognitive Affective	Understanding Respond

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 Civil Engineering”,Kolkata,1997.

REFERENCE BOOKS

1. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria& Sons, New Delhi.
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	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	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 : XCEE01
Course Name : PAVEMENT DESIGN
Prerequisite : NIL

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

Through this course the students will

- To gain the knowledge on components of highway and airport pavements
- To study the load and stress due to traffic loads
- To design the flexible pavements
- To design the rigid pavements
- To learn maintenance and repair on bituminous and concrete layers
- To gain the knowledge on components of highway and airport pavements

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Understand the components of highway and airport pavements	Cognitive	Understanding
CO2	Utilize identified traffic factors efficiently in the pavement design.	Cognitive	Understanding
CO3	Optimally design of flexible pavements	Cognitive Affective	Understanding Respond
CO4	Optimally design of rigid pavements	CognitiveAffective	Understanding Respond
CO5	Assess pavement performance and suggest rectification options.	Cognitive	Understanding

COURSE CONTENT

UNIT I INTRODUCTION **9**

Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and Deflections. Stresses and deflections in homogeneous masses. Burmister's two layer theory, three layer and multi-layer theories;

UNIT II TRAFFIC FACTORS IN PAVEMENT DESIGN **9**

Wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behaviour under transient traffic loads.

UNIT III FLEXIBLE PAVEMENT DESIGN METHODS FOR HIGHWAYS AND AIRPORTS **9**

Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC; Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

UNIT IV RIGID PAVEMENT DESIGN **9**

Types of joints in cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements

UNIT V PAVEMENT REHABILITATION **9**

Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Yang H. Huang : Pavement Analysis and Design, prentice Hall; second edition, August 18, 2003.
2. T. Papagiannakis, E. A. Masad, Pavement Design and Materials, John Wiley & Sons, 2008.

REFERENCE BOOKS

1. S.K Khanna, C.E.G Justo, A Veeraragavan.Highway Engineering , Nem Chand and Brothers, 10th Edition, Roorkee, 2015.
2. Pavement design from AASHTO American Association of State Highway and Transportation Officials, 2010.
3. IRC-37–2001.Guidelines for the Design of Flexible Pavements, New Delhi, 2012.
4. IRC 58-2002. Guideline for the Design of Rigid Pavements for Highways, New Delhi, 2002

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
CO 2	2	1	-	-	1									2
CO 3	2	1	2	-	1									3
CO 4	3	2	2	1	1									3
CO 5	3	2	-	1	1									2
Total	12	7	4	2	5	0	0	0	0	0	0	0	0	12
Scaled Value	**3**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**

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

Semester :
Course Code : XCEE02
Course Name : Airport Planning and Design
Prerequisite : NIL

L	T	P	C
3	0	0	3

C	P	A
2	0.5	0.5

L	T	P	H
3	0	0	3

Course Objectives

Through this course the students will

- To learn about the aircraft characteristics, planning and components of airport.
- To know about the airport pavement design and maintenance.
- To learn about the navigational aids of airports.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Gain an insight on the planning and site selection of Airport .	Cognitive	Understanding
CO2	Know about layout and passenger facility systems.	Cognitive Affective	Understanding Respond
CO3	Analyze and design the elements for orientation of runways.	CognitivePsychomotor	Understanding Mechanism
CO4	Design and maintain the pavements.	Cognitive Psychomotor	Understanding Mechanism
CO5	Understand the importance of navigational aids	Cognitive	Understanding

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Introduction to air transport - Aircraft characteristics - Airport classification, Airport planning - Site selection- Airport obstructions and Zoning - Environmental guidelines for airport projects	
UNIT II	**AIRPORT LAYOUT**	**8**
	Typical Airport Layouts - terminal area, apron, hangers, parking and circulation Area.	
UNIT III	**GEOMETRIC DESIGN**	**10**
	Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Taxiway Design	
UNIT IV	**AIRPORT PAVEMENTS**	**10**
	Design factors – design methods for flexible and rigid pavements- maintenance and rehabilitation of pavements-airport drainage.	

UNIT V NAVIGATIONAL AIDS 8

Airport Markings and lighting –need of Air traffic control –air traffic control network – air traffic control aids .

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Khanna S.K., AroraM.G.& Jain S.S Airport Planning and Design, Nemchand and Bros,2012.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
3. Subash C Saxena, "Airport Engineering, Planning and Design"CBS Publishers & Distributors,2015.

REFERENCE BOOKS

1. Niles A.S and Newell Airplane Structures Vol.II John Wiley and sons,New York
2. Environmental guidelines for Airport projects, Ministry of Environment and Forest.
3. IRC : 76-1979 Guidelines for structural strength Evaluation of Rigid Airfield pavements.
4. IRC :105-1928 Specifications for Bituminous Concrete for Airfield Pavements.

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		2		2						2		1		
CO 3			3			1							2	
CO 4			2			1							2	
CO 5									1			1		
Total	1	2	5	2	1	2			2	2	1	2	4	
Scaled Value	**1**	**1**	**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 : XCEE03
Course Name : Port and Harbour Engineering
Prerequisite : NIL

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

Through this course the students will

- To develop a fundamental understanding of Port and Harbour Engineering and its necessity.
- To visualize the relationship between Site Considerations and its Planning of Harbours.
- To know about the various Design Elements of On-Shore and Off-Shore Structures.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Develop an understanding of overall Port and Harbour Engineering and its impact.	Cognitive	Understanding
CO2	Absorbs the Key design Characteristics for design of Elements like Groins,Break waters, jetties etc.	Cognitive	Understanding
CO3	Fully conversant with advanced topics like coastal protection.	Cognitive	Understanding
CO4	Acquire a basic understanding about Navigational Aids	Cognitive	Understanding
CO5	Understand the various features in Ports, their construction, works and coastal Regulations to be adopted.	Cognitive	Understanding

COURSE CONTENT

UNIT I INTRODUCTION 9

Types of water transportation, water transportation in India, requirements of ports and harbours, classification of harbours, selection of site and planning of harbours, location of harbour, Site investigations – hydrographic survey, topographic survey, soil investigations, current observations, tidal observations

UNIT II COASTAL STRUCTURES 9

Design and construction of breakwaters, berthing structures - jetties, fenders, piers, wharves, dolphins, trestle, moles, Harbour docks, use of wet docks, design of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, construction of dry docks, gates for dry docks, pumping plant, floating docks, slipways, locks, size of lock, lock gates, types of gates;

UNIT III DREDGING AND COASTAL PROTECTION 9

Classification, types of dredgers, choice of dredger, uses of dredged materials, coastal erosion and protection, sea wall, revetment, bulkhead, coastal zone and beach profile.

UNIT IV NAVIGATIONAL AIDS 9

Requirements of signals, fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar.

UNIT V PORT FACILITIES 9

Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, shipping terminals, inland port facilities. Inland waterways, Inland water transportation in India, classification of waterways, economics of inland waterways transportation, national waterways.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Oza and Oza, Elements of Dock and Harbour Engineering, Charotar Publishing House, 1996.
2. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.
3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.

REFERENCE BOOKS

1. Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013.
2. Chandola S.P. A text on Transportation Engineering, S. Chand Limited, 2008.
3. B.L. GuptaAmit Gupta "Roads, Railways, Bridges, Tunnels & Harbour Dock",Standard Publishers Distributors ,2018.

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							
CO 2	1			2									2	
CO 3									3	1				
CO 4				1								3		
CO 5			1				3				2	2		
Total	1		1	3			5		3	1	2	5	2	
Scaled Value	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**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 : XCEE04
Course Name : RAILWAY ENGINEERING
Prerequisite : NIL

L	T	P	C
3	0	0	3

C	P	A
2	1	0

L	T	P	H
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 of Materials 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, New Delhi, 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
3	0	0	3

C	P	A
2	0	1

L	T	P	H
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 will be able to		Domain or P or A	C Level
CO1	Identify the behavior of indeterminate structure by influence 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 the supports over the regular analysis.	Cognitive	Understanding
CO4	Apply knowledge of finite element for determinate and indeterminate 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 lines for 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-ordinate transformations – 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- strain displacement 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 – Plastic hinge 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, Laxmi Publications, New Delhi, 2003
2. Structural Analysis", L.S. Negi& R.S. Jangid, Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 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 Matrix approach" –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	Medium	High

Semester :
Subject Name : **DESIGN OF CONCRETE STRUCTURES**
Subject Code : **XCEE06**
Prerequisite : **STRUCTURAL ANALYSIS**

L	T	P	H
3	0	0	3

C	P	A
1.5	0.5	1.0

L	T	P	H
3	0	0	3

Course Objectives

1. Students will be exposed to the theories and concepts of structural design.
2. Hands-on design experience and skills will be gained and learned through problem sets and a comprehensive design project using software.
3. An understanding of real-world open-ended design issues will be developed.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Perceive the knowledge on basics of design	C
CO2	Interpret ultimate and serviceability limit state approaches in current structural design philosophy	C
CO3	Understand the design concept of structural elements	C & A
CO4	Model building structure and analyse structural elements for design actions	C & A

COURSE CONTENT

UNIT I	**METHODS OF DESIGN OF CONCRETE STRUCTURES**	**9 Hrs.**
	Study of the strength, behaviour, and design of indeterminate reinforced concrete structures, Load and stresses, load combinations, Working stress and limit state approach. Concepts of Yield line theory	
UNIT II	**LIMIT STATE DESIGN FOR FLEXURE**	**9 Hrs.**
	Design of one way and two way slab - singly and doubly reinforced beams- continuous beams –Flanged beams – Staircase.	
UNIT III	**LIMIT STATE DESIGN FOR SHEAR, BOND AND TORSION**	**9 Hrs.**
	Behaviour of RC members in bond and anchorage – Design requirements –Behaviour of RC beams in shear and torsion – Design of RC members for combined bending shear and torsion.	
UNIT IV	**DESIGN OF COLUMNS**	**9 Hrs.**
	Types of columns –Design of short columns for axial, uniaxial and biaxial bending – Design of slender column.	
UNIT V	**DESIGN OF FOOTINGS**	**9 Hrs.**
	Design of Isolated footings (Flat and Sloped) – Design of combined rectangular footing for two columns only – Design of Raft Footing.	

Lecture	Tutorial	Practical	Total
45	---	---	45

TEXT BOOKS

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi,Second Edition, 2010.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi,2007.

REFERENCES

1. DevadasMenon&UnnikrishnanPillai, Reinforced Concrete Design,Tata McGraw-Hill Publishing Company Ltd., New Delhi 2011
2. Dr.P.Purushothaman, Reinforced Concrete Structures, Oxford Publication (P) Ltd, Delhi, 2007.
3. M.L.Gambhir, Design of reinforced concrete structures, PHI Learning Private Limited, 2013.
4. IS 456 -2000, Plain and Reinforced Concrete – Code of Practice, 4th revision
5. SP16-1980.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1										2	
CO2	2	3		1		1	1						3	1
CO3	1	1	3	1		1	1	1			1		1	
CO4	1		2	1				1	1		1		3	
	7	4	6	3	1	2	2	2	1		2		9	1

1 - Low, 2 – Medium, 3 – High

Semester :
Course Code : XCEE07
Course Name : CONCRETE TECHNOLOGY
Prerequisite : ----

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

Through this course the students will

- Understand the manufacturing process of concrete
- To get familiar in concrete mix design
- To know the causes and solution for deterioration of structures

Course Outcome: After the completion of the course, students will be able to		**Domain or P or A**	**C Level**
CO1	***Analyse*** the properties of ingredients of Concrete	Cognitive	Analyse
CO2	***Design*** a concrete mix for various grade	Cognitive	Create
CO3	***Assess*** the quality of concrete	Cognitive	Analyse
CO4	***Identify***the causes of distress in concrete	Cognitive	Apply
CO5	***Suggest*** suitable solution for practical problems in concrete construction.	Cognitive	Analyse

COURSE CONTENT

UNIT I	**CONCRETE INGREDIENTS**	**9**
	Cement–Types –Properties –Testing; Aggregates: Classification- Properties-Testing-Artificial aggregates; Water – quality and sources – BIS Standards-Admixtures and Chemicals: Properties, Uses.	
UNIT II	**CONCRETEMIXDESIGNAND PRODUCTION.**	**9**
	Introduction to MixDesign – selection of properties – Factors influencing the choice of mix design – Water binder ratio - Methods of concrete mixdesign – design problems – BIS Method –ACI method Batching of materials – mixing of concrete materials – transportation of concrete – Ready mix concrete - Placing of concrete – Curing methods – removal of forms and finishing.	
UNIT III	**PROPERTIES OF FRESH AND HARDENED CONCRETE**	**9**
	Properties of Fresh Concrete – Workability, Factors Affecting Workability, Slump Test Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting Time; Strength of Concrete – Water/Cement ratio, Strengthtest for Compression, Tension, Flexure, Effect of age on Strength, Stress Strain Relation and Young's Modulus, Poisson's Ratio, Creep and Shrinkage - Introduction to Non-Destructive Test	
UNIT IV	**DURABILITY OF CONCRETE**	**9**
	Durability of concrete - Factors affecting durability - water absorption – Permeability – corrosion – Acid attack – Sulphate Attack -Carbonation – Alkali Aggregate reaction – Freeze and Thaw – Chloride attack – Durability under sea water –Temperature Effects – Distress in concrete – Inspection and testing - Causes and remedies	

UNIT V	SPECIALCONCRETES AND CONCRETEING METHODS	9

High strength and high performance concrete -Fibre reinforced concrete - Polymer modified concrete - Self-compacting concrete - Light weight concrete, High density concrete – Flyashconcrete

Special concreting methods: Pumped concrete, Ready mix concrete, Under-water concreting, Hot & cold weather concreting, Precast concrete - Gunite and Shotcrete – Ferrocement

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Shetty,M.S. "Concrete Technology: Theory and Practice",7th edition, S.Chand& Company, New Delhi,2014.
2. Gambhir, M.L. "Concrete Technology", 5th edition, Tata McGraw Hill New Delhi, 2013.
3. Santhakumar, A.R., "Concrete Technology", Oxford University Press, New Delhi, 2006

REFERENCE BOOKS

1. Neville, A.M. and Brookes, J.J. "Concrete Technology", Pearson Publishers, New Delhi, 2010.
2. SandorPopovic, "Concrete Materials, 2nd Edition, Properties, Specifications and Testing", William Andrew,2012.
3. John Newman,"Advanced Concrete Technology Processes" 1st edition, Elsevier Science, 2003.

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		1	1		1	2	3
CO 2	2	2	3			1	1		1	**1**		2	3	2
CO 3	2	3	2			1	1		1	**1**		2	3	3
CO 4	2	3	1			1	1		1	**1**		1	2	2
CO 5	2	2	2			2	1		1	**3**		1	2	2
Total	10	13	9	0	0	6	5	0	5	7	0	7	12	12
Scaled Value	**2**	**3**	**2**	**0**	**0**	**2**	**1**	**0**	**1**	**2**	**0**	**2**	**3**	**2**

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

Semester :
Course Code : XCEE08
Course Name : DESIGN OF STEEL STRUCTURES
Prerequisite : ----

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- This course aims at providing students with a solid background on principles of structural steel connections. Students will be exposed to the theories and concepts of steel design and analysis.
- Hands-on design experience and skills will be gained and learned through problem sets and a comprehensive design project.
- An understanding of real-world open-ended design issues will be developed.

Course Outcome: After the completion of the course, students will be able to		**Domain or P or A**	**C Level**
CO1	Design of structural connections	Cognitive	Analyse
CO2	Design of tension members	Cognitive	Create
CO3	Design of compression members	Cognitive Affective	Analyse Respond
CO4	Understand fabrication of plate girders and gantry girders	Cognitive Affective	Apply Respond
CO5	Understand the plastic behaviour of steel section.	Cognitive	Analyse

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Properties of materials; loads and stresses, Design of semi-rigid, rigid and moment resistant connections; Built-up sections.	
UNIT II	**TENSION MEMBERS**	**9**
	Introduction, Design of tension members subjected to axial tension and bending, splicing of tension member.	
UNIT III	**COMPRESSION MEMBERS**	**9**
	Introduction, Design of compression members, Beam-column connections, Design of columns and their bases.	
UNIT IV	**FLEXURAL MEMBERS**	**9**
	Loads, specification and design of beams and Plate girder – design of purlins, trusses, gantry girders.	
UNIT V	**PLASTIC ANALYSIS**	**9**
	Introduction to Plastic analysis; Simple cases of beams and frames; All design steps/process to as per the most recent BIS code of practices Prerequisite:	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. N.Subramaniayan , “Design of Steel Structures: Theory and Practice” , Oxford University Press, 2010
2. S.S Bhavikatti, “Design of Steel Structures”, I.K International Publishing Houses Pvt. Ltd, 2012.
3. Ramachandra S., “Design of Steel Structures – Vol. I & II”, Standard Publication, New Delhi,2010.

REFERENCE BOOKS

1. Duggal S.K., “Limit state Design of Steel Structures”, 2nd edition, Tata McGraw - Hill Education, 2014
2. Dayaratnam, P., “Design of Steel Structures”, A.H.Wheeler& Co. Ltd., Allahabad, 2008
3. Jack C. McCormac , Stephen F.Csernak , “Structural Steel Design”Prentice Hall, Jul 2011.

IS Codes

1. IS 800 -2007, General Construction in Steel, Code of Practice.
2. SP6 – 1 : ISI Hand Book of Structural Engineers, Part -I

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	1	1				2	
CO 2	2	1	3	2			1		1				2	
CO 3	1	1	3	1		1							1	
CO 4	1	1	3	1		1							1	
CO 5	3	1	3	3	1	1							2	
Total	9	5	14	9	1	3	2	1	2				8	
Scaled Value	**2**	**1**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**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 : XCEE09
Course Name : PRESTRESSED CONCRETE STRUCTURES.
Prerequisite : DESIGN OF CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

C	P	A
2	0.5	0.5

L	T	P	H
3	0	0	3

Course Objectives

- To introduce the concept of prestressing, methods and advantages.
- Todesign the prestressed concrete structures subjected to flexure, shear, tension and compression.
- To acquire knowledge about the concept of circular prestressing and its application.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Understand the need of the prestressed concrete and the methods of prestressing.	Cognitive	Understand
CO2	Identify and apply the design codes relevant for the design of prestressed concrete members	Cognitive Psychomotor	Understand Set
CO3	Accomplish the design calculation to predict circular prestressing behaviour of prestressed concrete structures.	Affective	Respond
CO4	Understand the behaviour of composite section and analyse the stress under different conditions.	Cognitive	Understand
CO5	Analyse the behaviour of statically indeterminate structures for the primary and secondary moments.	Cognitive	Analyse

COURSE CONTENT

UNIT I	**INTRODUCTION – THEORY AND BEHAVIOUR**	**9**
	Basic concepts – Advantages – Materials required – Systems and methods of prestressing –Analysis of sections by Stress concept, Strength concept and Load balancing concept - Effect of tendon profile on deflections – Factors influencing deflections – Calculation of short term and long term deflections –Losses of prestress.	
UNIT II	**DESIGN OF MEMBERS.**	**9**
	Behaviour of flexural members, determination of ultimate flexural strength – Various Codal provisions - Design for shear, bond and torsion,Design of Tension member, Design of Compression member. Stress distribution in end block-Design of anchorage zone reinforcement.	
UNIT III	**CIRCULAR PRESTRESSING**	**9**
	Prestressed Concrete Pipes- Advantages, Loads - Design of cylinder and non-cylinder pipes.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.Partialprestressing - its advantages and applications.	
UNIT V	**CONTINUOUS BEAMS**	**9**
	Analysis of continuous beams - Methods of achieving continuity - concept of linear transformations, concordant cable profile and cap cables.	

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. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.
3. Libby J.R., Modern Prestressed Concrete, 3e,CBS Publishers & Distributors, New Delhi, 2007.

REFERENCE BOOKS

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.
3. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete – A design guide, McGraw Hill, New Delhi,2012..

IS Codes

1. IS1343:2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
2. 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
3. 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

	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	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	1				2	1
CO 4	1		2	1		1	1			1	1	1	1	2
CO 5	1	2	3	1		2		1		1		2	1	2
Total	6	6	11	4	3	7	3	4	1	5	2	6	7	12
Scaled Value	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**

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

Semester :
Course Code : XCEE10
Course Name : BRIDGE ENGINEERING
Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- To get familiar with design concepts of long and short span bridges.
- To design the prestressed concrete, Steel and RC bridges.
- To design the substructure for bridges as per IRC loadings.

Course Outcome: After the completion of the course, students will be able to		**Domain or P or A**	**C Level**
CO1	Understand the components of bridges	Cognitive	Understand
CO2	Assess the behavior of various bridges.	Cognitive	Analyse
CO3	Design the steel and concrete bridges	Cognitive	Create
CO4	Design the Cable and suspension bridges	Cognitive	Create
CO5	Design the substructure of bridges.	Cognitive	Create

COURSE CONTENT

UNIT I INTRODUCTION 9

General Basic Bridge forms – Beam, Arch, Suspension, Various types of Bridges, Selection of type of bridge and economic span length, drainage, road, kerb, Classification, Investigation and Planning. Design Loads for Bridges – Dead Load, Live Load, IRC loading, IRS Loading, AASHTO Loading, Wind Load, Longitudinal forces, Centrifugal Forces, Buoyancy, water current forces, thermal forces deformation and horizontal forces.

UNIT II DESIGN OF REINFORCED CONCRETE BRIDGES 9

Design Principles of Reinforced concrete bridges - Pigeaud curves - Courbon's theory - design of deck slab; T-beam bridge; balanced Cantilever Bridge

UNIT III DESIGN OF PRESTRESSED CONCRETE BRIDGES 9

Basic principles-General Design requirements - steel reinforcement in prestressed concrete member - Concrete cover and spacing of pre-stressing steel slender beams - analysis of section for flexure, shear and bond - losses in prestress - analysis and design of anchorage blocks

UNIT IV DESIGN OF STEEL BRIDGES 9

Introduction to Steel bridges: Plate girder bridge, truss bridge, suspension cable bridge, cable stayed bridge;

UNIT V BEARINGS AND SUBSTRUCTURES, QUALITY CONTROL9 Hrs. 9

Classification and types of bearings; Guidelines for selection of bearings-Design of Bearings - Types of foundations, Piers and abutments- Forces on piers and abutments, Design of piers and abutments, bed blocks.

Seismic design considerations; Aerodynamic stability considerations; special durability measures; provisions for inspection and maintenance;

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. JohnsonVictor.D, “Essentials of Bridge Engineering”, Oxford & IBH, 2009.
2. Krishnaraju.N, “Prestressed Concrete bridges”, CBS Publishers,2012
3. Ponnuswamy.S “Bridge Engineering”, Tata McGrawHill, 2007.

REFERENCE BOOKS

1. Jagadeesh T.R. and Jayaram .M.A., “Design of Bridge Structures”, Prentice Hall of India Pvt Ltd., 2004.
2. V. K. Raina, “Concrete Bridges Practice Analysis, Design and Economics”, Shroff Publications, New Delhi 2nd Ed. 2005.
3. Vazirani, Ratwani and Aswani, “Design of Concrete Bridges”, Khanna Publishers, 2ndEd. 2008.

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	2	1		1	1		1	1			1	2
CO 2	1	3	2			1	1		1	1			1	2
CO 3	2	2	3	2		1	1		1	1		1	3	2
CO 4	2	2	3	2		1	1		1	1		1	3	2
CO 5	2	2	3	2		1	1		1	1		1	3	2
Total	10	12	13	7	0	5	5	0	5	5	0	3	11	10
Scaled Value	2	3	3	2	0	1	1	0	1	**1**	0	1	3	2

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

Semester :
Course Code : XCEE11

Course Name : FOUNDATION ENGINEERING

Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To impart knowledge on common method of sub soil investigation
- To acquires the capacity to select and design a suitable foundation, control settlement of foundation
- To design proper foundation for dynamic and earthquake forces

Course Outcome: After the completion of the course, students will be able to		**Domain or P or A**	**C Level**
CO1	Learn about types and purposes of different foundation systems and structures	Cognitive	Understand
CO2	Explain about the systematic methods for designing foundations	Cognitive	Understand
CO3	Evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.	Cognitive Affective	Understand Respond
CO4	Apply necessary theoretical background for design and construction of foundation systems.	Cognitive Affective	Create Respond
CO5	Assess the load carrying capacity of deep foundation for any kind of soil including group efficiency and negative friction	Cognitive Affective	Create Respond

COURSE CONTENT

UNIT I	**Soil investigation, Analysis and design of foundations**	**10**

Planning for subsurface exploration - Methods of exploration - Geophysical exploration - Soil sampling and samplers - In-situ tests - Soil investigation report

Functions and requisites- Different types - choice of foundation type – general principles of design.

UNIT II	**Bearing capacity and Shallow foundations**	**8**

Bearing capacity - types of failures - Prandtl's and Terzaghi's bearing capacity analysis - Bearing capacity based on building codes, SPT, CPT values, etc.

UNIT III	**Deep foundation, retaining walls, cuts and sheet piles**	**10**

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, under reamed piles, Introduction to piers, caissons, Coffer dams - Design and construction of well foundation, piers etc.

Types of earth pressures - Different theories of earth pressures - Rankine and Coulomb theory - Friction circle method - Terzaghi’s analysis Different types of retaining structures - Stability analysis of rigid walls - Design of anchored sheet piles

UNIT IV	**Ground movements due to construction; analysis and design of excavations**	**7**

Contact pressure distribution - settlement analysis - Settlement of piles and pile groups - Negative skin friction- Types of settlement – control - Calculation of settlements - Codal provision - Techniques of ground improvement - Foundations in swelling soil - Foundations in collapsible soil - Use of soil reinforcement

UNIT V	**Design of Machine Foundations, Design of Foundations under Earthquake Conditions**	**10**

Introduction - Free and forced vibration - Lysmer's method- Dynamically loaded foundations - Dynamic soil properties - Vibration isolation - Different methods of analysis for earthquake conditions - Pseudo-static method of design - Effect of earthquake forces on various foundations

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Holtz R.D. and Kovacs, W.D, An Introduction to Geotechnical Engineering, Prentice Hall, NJ
2. Braja M. Das, Principles of Foundation Engineering, by, Cengage Learning
3. Singh A, Modern Geotechnical Engineering, 3rd Ed., CBS Publishers, New Delhi, 1999.
4. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.

REFERENCE BOOKS

1. N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003.
2. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
3. Taylor D.W., Fundamentals of Soil Mechanics, Asia Publishing House, 1948.
4. 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		1	3			2	1		1	1	2	1
CO 2	2	3	2	1	3	1			1	1	1	2	1	1
CO 3	2	2		1				1			1		1	1
CO 4	3	2	1		1	2	1		1	1			1	1
CO 5	2	1			1								1	1
Total	12	11	3	3	8	3	1	3	3	2	3	3	6	5
Scaled Value	**3**	**3**	**1**	**1**	**2**	**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 : XCEE12
Course Name : ENVIRONMENTAL GEOTECHNOLOGY
Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2	0.5	0.5

L	T	P	H
3	0	0	3

Course Objectives

- Have an exposure to interdisciplinary issues pertaining to environment and geotechnical engineering
- Explain the effects of pollutants in soil properties
- Acquiring the knowledge of the problematic soil deposits under varying environmental conditions
- Awareness about the adverse effects of soil and ground water contaminants
- Analyze and apply the various techniques for remediation of the contaminants

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Analyse the soil contamination concentration and type	Cognitive	Understand
CO2	Be trained to develop sustainable and environmentally sound solutions for geotechnical problems	Cognitive Affective	Understand Respond
CO3	Solving environmental engineering problems unique to several soil and subsurface conditions.	Cognitive Psychomotor	Understand Guided Response
CO4	Monitor and analyse quality of ground water	Cognitive Psychomotor	Create Guided Response
CO5	Suggest the steps to remediation of soil and groundwater	Cognitive	Create Respond

COURSE CONTENT

UNIT I	**FUNDAMENTALS OF GEOENVIROMENTAL ENGINEERING**	**9**

Scope of geo environmental engineering - multiphase behaviour of soil – role of soil in geo environmental applications- sources and type of ground contamination sources, production and classification of waste– health risks posed by heavy metals and emerging pollutants. Impact of climate change, energy resources, case histories on geo environmental problems.

UNIT II	**GROUNDWATER CONTAMINATION**	**8**

Water quality standards - Sources of contamination- Soil-water-contaminant interactions and its implications – Hydro chemical behavior of contaminants - Trace metals - Trace non metals - Nitrogen, organic substances - Measurement of parameters - Velocity - Dispersivity - chemical partitioning- Factors effecting retention and transport of contaminants.

UNIT III	**REMEDIATION OF CONTAMINANTS FROM SOIL AND GROUND WATER**	**10**

contaminant transformation: sorption, biodegradation, ion exchange, precipitation ex situ and insitu remediation – solidification, bio–remediation, soil washing, electro kinetics, soil heating, verification, bio venting, Ground water remediation – pump and treat, air sparging, reactive well-Insitu remediation –Case studies

UNIT IV	SOLID WASTE DISPOSAL AND STABILIZATION	10

Hazardous waste control and storage system- mechanism of Stabilization, incineration-organic and inorganic stabilization reutilization of solid waste for soil improvement. Design of landfill: CNS layer, leachate and air collection units

UNIT V	ADVANCED SOIL CHARACTERIZATION	8

Site characterization – risk assessment of contaminated site -Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation –-. Site selection for dumping

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Rowe R.K.,"Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
2. Reddi L.N. and Inyang, H. I.,"GeoenvironmentalEngineering,Principles and Applications" Marcel Dekker Inc. New York, 2000.
3. Yong, R. N.,"Geoenvironmental Engineering, Contaminated Soils,Pollutant Fate, and Mitigation" CRC Press, New York, 2001.
4. Sharma H.D. and Reddy K.R.,"GeoenvironmentalEngineering:Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004. 5. Zheng C., "Applied Contaminant Transport Modeling", John Wiley & sons, First edition
5. Hsai-Yang Fang, "Introduction to Environmental Geotechnology", CRC Press, New York
6. Berkowitz,B. Dror, I. and Yaron,B.,"Contaminant Geochemistry" Springer, Germany, 2008.
7. Mohamed,A. M. O.,"Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.

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			3		2					3
CO 2			1			3	2		2	1				2
CO 3			1	2			3		3	1				2
CO 4			3	3			3		3					3
CO 5			3	3			3		3					3
Total	0	3	10	11	0	3	14	0	13	2	0	0	0	13
Scaled Value	**0**	**1**	**2**	**2**	**0**	**1**	**3**	**0**	**3**	**1**	**0**	**0**	**0**	**3**

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

Semester :
Course Code : XCEE13
Course Name : GEOTECHNICAL DESIGN
Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To apply the knowledge of soil properties
- To acquire knowledge on geotechnical structures and design principles
- To select proper methods of construction for geotechnical structures

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Explain the various investigation specifications as per the infrastructureto be build on the proposed site	Cognitive	Understand
CO2	Evaluate the properties of materials required for the constructing a desired geotechnical infrastructure	Cognitive Affective	Understand Respond
CO3	Understand the design concepts of various foundation systems	Cognitive Affective	Understand Guided Response
CO4	Classify the design principles of dams, pavement and retaining walls	Cognitive Affective	Create Guided Response
CO5	Design a underground storage system, buried structures, Geosynthetics	Cognitive Affective	Create Respond

COURSE CONTENT

UNIT I	**Subsurface site evaluation andgeotechnical structures**	**8**

Planning for subsurface exploration - Methods of exploration – Geophysical exploration - Soil sampling and samplers - In-situ tests - Soil investigation report

Functions and requisites of geotechnical structures - Different types - choice of types – general principles of design - Grouting techniques – Types of grout

UNIT II	**Integrated design of retaining walls**	**10**

Introduction - Types of earth pressures - Different theories of earth pressures - Rankine and Coulomb theory - Friction circle method - Terzaghi's analysis Different types of retaining structures - Stability analysis of rigid walls - Design of anchored sheet piles - Lateral pressure on sheeting in braced excavation - stability against piping and bottom heaving - Earth pressure around tunnel lining, shaft and silos.

UNIT III	**Pavements and materials for airports, highways, harbor, etc.**	**10**

Material characterization for analytical pavement design – CBR and stabilometer tests – Resilient modulus – Fatigue subsystem – failure criteria for bituminous pavements – IRC design guidelines. Pavements types – Approaches to pavement design – vehicle and traffic considerations – behaviour of road materials under repeated loading – Stresses and deflections in layered systems.

UNIT IV	**Design of dams and other water retaining structures**	**10**

Design consideration, Factors influencing design - Types of earth and rockfill dams - Design details - Provisions to control pore pressure - Design consideration - Factors influencing design - Types of earth and rockfill dams - Design details, Provisions to control pore pressure

- Special design problems - Slope protection, Filter design, Foundation treatment - Earth dams on pervious soil foundation - Treatment of rock foundation - Construction Techniques - Quality control and performance measurement - Applications of Geosynthetics in earth and rockfill dams

UNIT V **Underground storage system, buried structures, Geosynthetics** **7**

Design & detailing of Underground Rectangular and Circular Water Tank – buried pipelines - Principles, Concepts and Mechanisms of reinforced earth - Main types of geosynthetics - charactersitics and manufacturing processes - Main functions of geosynthetics and applications in which these functions are most relevant - Principles of design with geosynthetics - Most important geosynthetics characterization tests.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Analysis and Design of Substructures: Limit State Design by Swami Saran
2. Braja M. Das, Principles of Foundation Engineering, by, Cengage Learning
3. Singh A, Modern Geotechnical Engineering, 3rd Ed., CBS Publishers, New Delhi, 1999.
4. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
5. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi

REFERENCE BOOKS

1. AASHTO. (1990). AASHTO Guidelines for Pavement Management Systems, American Association of State Highway and Transportation Officials, Washington DC.
2. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
3. Robert M. Koerne. Designing with geosynthetics. 5th. New York: Prentice Hall, 2005. ISBN 978-0131454156.
4. IS: 12966(Part 2)-1990 “Code of practice for galleries and other openings in dams” (Part 2: Structural design)
5. IS: 13551-1992 “Structural design of spillway piers and crest–criteria”

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	1			2	1		1	1	2	1
CO 2	2	1	2	1	1	2				1	1	2	1	1
CO 3	1	2		1				1		1	1		1	1
CO 4	2	2	2		1	2	1		1	1				1
CO 5	2	1			1								1	
Total	8	9	4	3	4	4	1	3	2	3	3	3	5	4
Scaled Value	2	2	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 :
Course Code : XCEE14
Course Name : EARTHQUAKE ENGINEERING
Prerequisite : ---

L	T	P	C
3	0	0	3

C	P	A
2.5	0	0.5

L	T	P	H
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 structural irregularities.

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 mass for continuous system.	Cognitive	Understand
CO3	Quantify the effect of seismic waves.	Cognitive Affective	Understand Receiving
CO4	Understand the concept of response spectrum and application of structural dynamics.	Cognitive	Understand
CO5	Able to design of Earthquake resistant structures with codal provisions	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 of soils – 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" PHI Learning 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 and Francis,.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 Academic Publishers, 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 to Seismic 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
3	0	0	3

C	P	A
2	0	1

L	T	P	H
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, students will 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 management in 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 II 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-Drought management-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, Standard Publishers 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 Learning Private 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

Semester :
Course Code : XCEE16

Course Name : Basics of Computational Hydraulics

Prerequisite : Hydraulic Engineering

L	T	P	C
2	1	0	3

C	P	A
2.5	0	0.5

L	T	P	H
2	1	0	3

Course Objectives

- Explain the structure of the 1D, 2D and 3D flow equations as representations of conservation laws
- Classify differential equations in terms of ODE /PDE and determine the nature of a given PDE
- Indicate the nature of the initial and boundary and apply the method of characteristics to solve equations
- Implement finite difference schemes to solve ordinary and partial differential equations

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Simulation of the flow of water, together with its consequences	Cognitive	Understand
CO2	Apply hydrodynamic techniques and 1 dimensional expansions and contractions	Cognitive	Understand
CO3	Understand linearized method of characteristics	Cognitive	Understand
CO4	Able to understand forms of conservation and applications	Cognitive Affective	Understand
CO5	Do different flow modeling using software	Cognitive	Understand

COURSE CONTENT

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

Significance of computational hydraulics, discrete forms of the laws of construction of mass, momentum and energy. Examples of free surface flows. Derivation of governing equations for flow and transport in surface and sub-surface (saturated and unsaturated flow)

UNIT II	**1-D EXPANSIONS**	**9**

lateral inflow's 1-D expansions and contractions, homogeneous and stratified fluid flows. Equations for reactive transport; Coupled surface and sub-surface flow models; Basics of finite difference, finite element and finite volume methods

UNIT III	**METHOD OF CHARACTERISTICS**	**9**

Characteristics and invarients, regions of state, computation of hydraulic jump, indeterminary conditions, the linearised method of characteristics.consistency, stability, convergence, order of accuracy computational efficiency application of numerical methods for solving flow and transport equations,

UNIT IV	**FORMS OF CONSERVATION LAWS**	**9**

Difference forms of conservation laws, weak solutions applications, storm-sewer networks, diffusion problems, river morphotogy, linear wave propagation. fully coupled and iteratively coupled models; Model simplification, Parameter estimation (Model calibration and validation),

UNIT V COMPUTATIONAL FLUID DYNAMICS (CFD) 9

Numerical methods – Finite difference method with example 1-D horizontal flow. software for three-dimensional turbulent flow modeling, Software for sub-surface flow simulation.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Brebbia, C.A. and Ferrante, "A.J. Computational Hydraulics" Butterworth & Company (Publishers) Ltd., London, 1983
2. Chaudhary, M.H, "Applied Hydraulic Transients" (2 nd Edition) – Van Nostrand Reinhold Company Inc., New York, 1987

REFERENCE BOOKS

1. Mahmood, K. and Yeyjevieh, V, "Unsteady Flow in Open Channels (Vol. – I & II)" Water Resources Publications, Fort Collins, Colorado, U.S.A., 1975
2. Michael B. Abbott, Anthony W. Minns "Computational Hydraulics" - Routledge, 2017
3. J. A. Cunge, Michael Barry Abbott, "Engineering Applications of Computational Hydraulics" Pitman Advanced Publishing program.
4. Cornelis B. Vreugdenhil,"Computational Hydraulics: An Introduction", Springer Science & Business Media, 2012
5. Michael B. Abbott, Anthony W. Minns , "Computational Hydraulics" 1994 Routledge, 2017

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										
CO 2	3	1												
CO 3	3	1		2										
CO 4	3	1		2										
CO 5	3	1		2										
Total	15	5	0	6	0	0	0	0	0	0	0	0	0	0
Scaled Value	3	1	0	2	0	0	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 :
Course Code : XCEE17
Course Name : URBAN HYDROLOGY AND HYDRAULICS
Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

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

- Develop intensity duration frequency curves for urban drainage systems.
- Develop design storms to size the various components of drainage systems.
- Apply best management practices to manage urban flooding.
- Prepare master drainage and hydraulics plan for an urbanized 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 short duration rainfall runoff data for urban hydrology studies	Cognitive	Understand
CO2	Understand the importance of short duration rainfall runoff data for urban hydrology studies	Cognitive	Understand
CO3	Understand the importance of short duration rainfall runoff data for urban hydrology studies	Cognitive Affective	Understand Respond
CO4	Learn some of the best management practices in urban drainage.	Cognitive	Understand
CO5	Understand the concepts of preparation master urban drainage system.	Cognitive Affective	Understand Respond

COURSE CONTENT

UNIT I PRECIPITATION ANALYSIS: 9

Urbanization and its effect on water cycle – urban hydrologic cycle – trends in urbanization – Effect of urbanization on hydrology. Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

UNIT II APPROACHES TO URBAN DRAINAGE: 9

Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems.

UNIT III HYDROLOGIC DESIGN: 9

Analysis of Precipitation Data, Construction of IDF curves, Estimation of Evaporation and Evapotranspiration, Determination of Yield from A Catchment, Derivation of Unit Hydrograph, Estimation of Design Flood, Regional Flood Frequency Analysis, Hydrologic and Hydraulic flood routing, Derivation of Synthetic Unit Hydrograph.

UNIT IV	URBAN HYDRAULICS:	9

Sources and distribution of water in urban environment, including surface reservoir requirements, utilization of groundwater, and distribution systems. Analysis of sewer systems and drainage courses for the disposal of both wastewater and storm water. Pumps and lift stations. Urban planning and storm drainage practice.

UNIT V	ANALYSIS AND MANAGEMENT:	9

Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. 'Manual on Drainage in Urbanized area 'by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 – 2 volumes), UNESCO,
2. 'Urban Hydrology' by Hall M J (2015), Elsevier Applied Science Publisher.
3. 'Hydrology – Quantity and Quality Analysis' by Wanielista M P and Eaglin (2016), Wiley and Sons.
4. 'Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modeling' by Akan A.O and R.L. Houghtalen (2016), Wiley International.

REFERENCE BOOKS

1. 'Storm water Detention for Drainage' by Stahre P and Urbonas B (2000), Water Quality and CSO Management, Prentice Hall.
2. 'Urban water cycle processes and interactions' by Marsalek et al (2016), Publication No. 78, UNESCO, Paris (http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)
3. 'Frontiers in Urban Water Management – Deadlock or Hope' by Maksimovic C and J A Tejada-Guibert (2015), IWA Publishing.

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	0	0	1	0	**0**	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 : XCEE18
Course Name : GROUNDWATER ENGINEERING
Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

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

- Water quality criteria and standards, and their relation to public health, environment and urban water cycle;
- Water quality concepts and their effect on treatment process selection;
- The interaction of water quality and the materials being used;
- Hydraulic concepts and their relationship to water transport in treatment plants, pipelines and distribution networks;
- Be able to define and evaluate project alternatives on basis of chosen selection criteria;
- Water quality engineering within a watershed context.

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Relate and Interpret the Development and evolution of ecosystems.	Cognitive	Understand
CO2	Explain and Apply Fluvial Ecosystem Diversity.	Cognitive	Understand
CO3	Classify and Develop the stream water chemistry.	Cognitive Affective	Understand Respond
CO4	Classify and Dissect necessity of Water quality models.	Cognitive	Understand
CO5	List and respond to Formulation of anisotropic and non-homogenous flow of groundwater.	Cognitive Affective	Understand Respond

COURSE CONTENT

UNIT I INTRODUCTION: 9

Development and evolution of ecosystems – Principles and concepts – Energy flow and material cycling – productivity – Classification of Eco technology – ecological engineering- Classification of systems – Structural and functional interactions of environmental systems – Mechanisms of steady-state maintenance in open and closed systems- Modeling and Eco technology – Classification of ecological models – Applications- Ecological economics- Self-organizing design and processes.

UNIT II FLUVIAL ECOSYSTEMS: 9

Fluvial Ecosystem Diversity- The Water Cycle – Stream flow- Flow Variation- The Stream Channel- Sediments and their Transport- Fluvial Processes along the River Continuum.

UNIT III	STREAMWATER CHEMISTRY:	9

Dissolved Gases -Major Dissolved Constituents of River Water-Variability in ionic concentrations -The dissolved load -Chemical classification of river water-The Bicarbonate Buffer System-Influence of Chemical Factors on the Biota-Variation in ionic concentration-Salinization -Effects of acidity on stream ecosystems.

UNIT IV	WATER QUALITY:	9

Water quality models – Historical development – Non point source pollution- Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods legislations for water quality.

UNIT V	GROUNDWATER MODELING:	9

Formulation of anisotropic and non-homogenous flow of groundwater, finite difference methods for solving groundwater flow problems, regional groundwater flow modeling.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Chow, V.T., Maidment, D.R. and Mays, L.W. (2010),"Applied Hydrology", Tata McGraw Hill Edition
2. Warren Viessman, Jr. and G L Lewis, (2018), “Introduction to Hydrology”, Prentice Hall India Pvt. Ltd., New Delhi
3. Davis, S.N. and De Weist, R.J.M. (2012), "Hydrogeology", John Wiley & Sons, N York
4. Watters, G.Z, Analysis and control of pipe flow in pipes, Butter Worth Publishers, 2014.

REFERENCE BOOKS

1. Dandekar, M.M., and Sharma, K.N., (2013), Water Power Engineering, Vikas Publishing Company, New Delhi.
2. Stahre, P., Urbonas, B., (2014), “Stormwater Detention for Drainage, water quality and CSO Management”, Prentice Hall, New Jersey.
3. McCuen R.H., Hydrologic Analysis and Design, Prentice Hall Inc. N York, 2015

Mapping of CO with GA’s

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2	3			2							2
CO 2	2	2			3							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	13	11	3	4	11	0	0	1	0	0	2	10
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 : XCEE19

Course Name : WATER QUALITY ENGINEERING

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 Objectives

- To understand the significance of Physio-chemical treatment for water and wastewater
- To recognize the principles of Physical treatment
- To acquire knowledge on Chemical Treatment
- To apply the principles of treatment methodologies and to design the Municipal water treatment plants

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	*Understand* the significance of Physio-chemical treatment for water and wastewater	Cognitive	Understand
CO2	*Recognize* the principles of Physical treatment	Cognitive	Understand
CO3	*Acquire* knowledge on Chemical Treatment	Cognitive Affective	Understand Respond
CO4	*Apply* the principles of treatment methodologies and to design the Municipal water treatment plants	Cognitive Affective	Create Respond
CO5	*Apply* the principles and to design the Industrial water treatment units	Cognitive Affective	Create Respond

COURSE CONTENT

UNIT I	**POLLUTANTS IN WATER AND WASTE WATER**	**9**
	Characteristics, Standards for performance - Significance of physico-chemical treatment – Selection criteria-types of reactor- reactor selection-batch-continuous type	
UNIT II	**PRINCIPLES OF PHYSICAL TREAMENT**	**9**
	Screening – Mixing, Equalization – Sedimentation – Filtration – Evaporation – Incineration – gas transfer – mass transfer coefficient Adsorption –Membrane separation, Reverse Osmosis, nano filtration, ultra filtration and hyper filtration	
UNIT III	**PRINCIPLES OF CHEMICAL TREATMENT**	**9**
	Coagulation flocculation – Precipitation – flotation solidification and stabilization – Disinfection, Ion exchange, Electrolytic methods, advanced oxidation /reduction – Recent Trends	
UNIT IV	**DESIGN OF MUNICIPAL WATER TREATMENT PLANTS**	**9**
	Selection of Treatment – Design of municipal water treatment plant units – Aerators – chemical feeding – Flocculation-clarifier–O&M aspects – case studies, Residue management – Recent Trends	

UNIT V DESIGN OF INDUSTRIAL WATER TREATMENT PLANTS 9

Design of Industrial Water Treatment Units- Selection of process – Design of softeners – Demineralisers –Reverse osmosis plants –Flow charts – Layouts –O&M aspects – case studies, Residue management – Upgradation of existing plants – Recent Trends.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Rakesh Kumar and R.N. Singh,"Municipal Water and Wastewater Treatment" TERI publishers,2012
2. Gurucharan Singh," Water supply and Sanitary Engineering", Standard Publishers Distributors, 2009
3. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
4. LinvilG.Rich, Unit operations of Sanitary Engineering, Tata Mcgraw Hill, New Delhi, 2007
5. Rangwala, " Water Supply and Sanitary Engineering PB,24/e, Charotar Publishing house Pvt. Ltd.-Anand, 2011

REFERENCE BOOKS

1. Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw Hill, New Delhi, 2003.
2. Qasim, S.R., Motley, E.M. and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2002. 7
3. Lee, C.C. and Shun dar Lin, "Handbook of Environmental Engineering Calculations", McGraw Hill, New York, 1999.
4. F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York (2009).
5. David Hendricks, "Fundamentals of Water Treatment Process", CRC Press New York (2011)

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	
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	1	1		2	1	
Total	2	3	9	7	2	2	2	2	7	2	1	3	7	1
Scaled Value	1	1	2	2	1	1	1	1	2	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 : XCEE20
Course Name : SURFACE HYDROLOGY
Prerequisite : ---

L	T	P	C
3	0	0	3

C	P	A
2.5	0	0.5

L	T	P	H
3	0	0	3

Course Objectives

- To study the hydrologic cycle and evaporation techniques
- To know the infiltration and runoff
- An ability to analyse the various methods of floods frequency analysis

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Calculate the various components of hydrologic cycle	Cognitive	Understand
CO2	Apply the principle of hydrograph to estimate flood characteristics	Cognitive	Understand
CO3	Understand the infiltration processes	Cognitive Affective	Understand Respond
CO4	Able to understand the runoff detailing	Cognitive	Create
CO5	Estimate the flood peak discharge	Cognitive	Create

COURSE CONTENT

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

Introduction: Hydrologic cycle - systems concept - hydrologic system model - hydrologic model classification. Stream flow measurement - measurement of stage – discharge measurements. Stage – discharge relations - selection of a stream gauging site – stream gauge network.

UNIT II	**EVAPORATION**	**9**

Measurement, estimation and control of evapo-transporation (ET) – evapo-transpiration and consumptiveuse – lysimeters and field pots – potential ET and its computation – pan evaporation - Pennman's method – BlaneyCriddle method – reference crop ET and crop coefficient – interception and depression storage.

UNIT III	**INFILTRATION PROCESSES**	**9**

Measurement – Infiltration Capacity And Indices – Model Of Infiltration. Rain Water Harvesting – Advantages - Alterations In Hydrologic Cycle – Methods Of Water Conservation.

UNIT IV	**RUNOFF**	**9**

Components of runoff - Characteristics of runoff – factors affecting runoff – components of hydrograph – base flow separation – rain fall – runoff relations – flow duration curve - flow Mass curve - hydrograph analysis - unit hydrograph theory – derivation of unit hydrograph – applications and limitations of unit hydrograph – 'S' hydrograph – instantaneous unit hydrograph – unit hydrograph for ungauged catchments – synthetic hydrograph – conceptual elements – linear reservoirs – Nash model. Yield from a catchment – flow duration curves – flow mass curve.

UNIT V FLOODS 9

Floods – estimation of peak discharge – rational method - unit hydrograph method. Probabilistic and statistical methods – basic concept of probability and frequency distribution – skewness coefficient – return period discrete distribution – Binomial distribution – continuous distribution – flood frequency analysis – normal, lognormal, Gumbel and Log-Pearson Type III methods. Flood routing – reservoir routing – Modified pulse method – channel routing – Musking hum method.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Garg S.K., Hydrology and Water Resources Engineering
2. Subramanya, K., Engineering Hydrology, Tata McGraw Hill, New Delhi.
3. Raghunath, H.M., Groundwater, 1987, Wiley Eastern Ltd., New Delhi.
4. Modi, P.N., Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi.

REFERENCE BOOKS

1. Todd, D.K., Groundwater Hydrology, 1993 John Wiley & Sons..
2. Raghunath, H.M., Hydrology – Principles, Analysis and Design, 1986, Wiley
3. Dr. P.Jaya Rami Reddy, A Textbook of Hydrology, University Science 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	1	1				2	1			1				2
CO 2	1	1				2	1			2				2
CO 3	1	1				2	1			2				2
CO 4	1	2				3	1			2				3
CO 5	2	1				3	1			3				3
Total	6	6				12	5			10				12
Scaled Value	2	2	0	0	0	3	1	0	0	2	0	0	0	3

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

Semester :
Course Code : XCEE21

Course Name : ENVIRONMENTAL FLUID MECHANICS

Prerequisite : FLUID MECHANICS

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- Understand the effects of diffusion, advection, dispersion, and chemical reactions on concentrations in the environment
- Apply the governing transport equations to solve problems with diverse boundary and initial conditions
- Evaluate the important processes affecting fate and transport in a range of problem situations

Course Outcome*: After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Apply knowledge of basic mathematics, science, and engineering	Cognitive	Understand
CO2	Ability to function on multi-disciplinary teams	Cognitive	Understand
CO3	Ability to identify, formulate and solve engineering problems	Cognitive	Understand
CO4	Ability to understand the impact of engineering solutions in a global and societal context	Cognitive	Understand
CO5	Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Cognitive	Understand

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Introduction to fluid and mass transport in naturally occurring flows; topics include molecular and turbulent diffusion; dispersion; river, estuary, and ocean mixing; dissolution boundary layers; tidal mixing; offshore wastewater outfalls;	
UNIT II	**APPLICATION AND ANALYSIS**	**9**
	Fick's law -Diffusion equation -Integral solutions: CSTR solutions for marina design - Differential analysis: Instantaneous point source solution in 1D - Advective diffusion and solutions in 2D and 3D Initial spatial distributions; fixed concentrations -Other solutions, superposition and image sources	
UNIT III	**POTENTIAL FLOW**	**7**
	Potential flow -porous media flows, surface/internal waves in oceans and lakes.	
UNIT IV	**LAMINAR FLOW**	**11**
	Laminar flow (channel and overland flow, mud flow, transient and oscillatory boundary layer, induced streaming, mass transport)	
UNIT V	**TURBULENT FLOW**	**9**
	Turbulent flow (instability, characteristics, averaging, Reynolds and turbulent kinetic eqns, applications: effluent discharge, boundary layer)	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Chin, David A. (2006). Water Quality Engineering in Natural Systems. Wiley Interscience: Hoboken, New Jersey. (Available free online through the TAMU library)
2. Socolofsky, S. A. and Jirka, G. H. (2005), Special Topics on Mixing and Transport in the Environment
3. Fischer, Hugo B., List, E. John, Koh, Robert C. Y., Imberger, Jörg, and Brooks, Norman H. (1979), Mixing in Inland and Coastal Waters, Academic Press: San Diego, CA.

REFERENCE BOOKS

1. Chapra, Steven C. (1997), Surface Water-Quality Modeling, McGraw-Hill: Boston, MA.
2. Hemond, Harold F. and Fechner-Levy, Elizabeth J. (2000), Chemical Fate and Transport in the Environment, 2nd Edition, Academic Press: San Diego, CA.
3. Wainwright, J. and Mulligan, M., eds. (2004), Environmental Modelling: Finding Simplicity in Complexity, John Wiley &Sons , Ltd.: Hoboken, NJ.

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	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**	**0**	**0**	**8**	**5**	**0**	**0**	**5**	**0**	**0**	**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 :
Course Code : XCEE22

Course Name : Water Resources Field Methods.

Prerequisite :

L	T	P	C
3	0	0	3

C	P	A
2.5	0	0.5

L	T	P	H
3	0	0	3

Course Objectives

- Measure stream velocity and discharge, travel time, stream / hyporheic exchange, bankfull stage, hydrologic return intervals
- Measure stream and land slopes, areas; determine land cover
- Work safely in various field environments
- Develop and implement a quality assurance plan to insure collection of quality data
- Select, install, and operate hydrologic equipment and sensors (samplers, flow measurement systems, meteorological equipment, soil moisture)
- Conduct basic laboratory analytical analyses (total suspended solids, dissolved and particulate nutrients, bacteria, total suspended sediment)
- Identify and deal with statistical outliers
- Plan and conduct a hydrologic and water quality field study

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Understand Site characterization Basic surveying and the measurement technologies	Cognitive	Remember & Understand
CO2	Measure and record the details water-resources	Cognitive	Remember & Analyse
CO3	Understand the methods and sampling of water.	Cognitive	Understand & Apply
CO4	sampling of volatile organic compounds and maintain data quality.	Cognitive Affective	Understand & Analyse Receive
CO5	Understand groundwater monitoring wells and stream flow monitoring stations	Cognitive	Understand & Apply

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Scientific principles of measurement technologies and protocols used for water-resources measurements - Basic Concepts Related to Flowing Water and Measurement, Measurement Accuracy, Selection of Water Measuring Devices,	
UNIT II	**EXPERIMENTAL DESIGN**	**9**
	Experimental design of field-scale water-resources and environmental studies. Inspection of Water Measurement Systems, Measuring and Recording Water Stage or Head, Current Meters.and experimental design of field-scale, water-resources and environmental studies.	

UNIT III	PLANNING FIELD STUDIES	9

Instruments and protocols - for surface-water, ground-water, and water-quality sampling; -Water sampling protocols -Sampling groundwater from boreholes - Preparation to sample monitoring wells- Sampling monitoring wells -Sampling of oily-water separators -Sampling surface water

UNIT IV	WATER SAMPLING	9

For volatile organic compounds- Water sampling for metals-Introduction quality assurance - Sample preparation - Description of data quality

UNIT V	MONITORING STATIONS	9

Stream flow monitoring stations - Groundwater monitoring wells.

L	T	P	Total
45	0	0	45

TEXT BOOKS

4. Li, Y. and K. Migliaccio “Water Quality Concepts, Sampling, and Analyses. Boca Raton”, FL: CRC Press(2011)..

E RESOURCES

1. USGS Techniques of Water-Resources Investigations Reports, available electronically at no cost (http://pubs.usgs.gov/twri/ (http://pubs.usgs.gov/twri/)
2. U.S. Geological Survey (1995). Book 3, Section A: Surface Water Techniques. Techniques of Water Resources Investigations of the United States Geological Survey. Washington, D.C.: USGS.
3. U.S. Geological Survey (2002). Book 4, Section A: Statistical analysis. Techniques of Water Resources Investigations of the United States Geological Survey. Washington, D.C.: USGS.
4. U.S. Geological Survey (1973). Book 4, Section B: Surface Water. Techniques of Water Resources Investigations of the United States Geological Survey. Washington, D.C.: USGS.
5. U.S. Geological Survey (2004). Book 8, Section A: Instruments for measurement of water level. Techniques of Water Resources Investigations of the United States Geological Survey. Washington, D.C.: USGS

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											
CO 2	3													
CO 3	3	2												
CO 4	3	2												
CO 5	3	2												
Total	15	6	1	0	0	0	0	0	0	0	0	0	0	0
Scaled Value	3	2	1	0	0	0	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 :
Course Code : XCEE23
Course Name : REPAIR & REHABILITATION OF STRUCTURES.
Prerequisite : Concrete Technology

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- To gain the knowledge on maintenance and repair strategies
- To perceive the knowledge on quality of concrete
- To recognize various types of materials and its properties
- To assess the damage to structures using various tests
- To learn various repair techniques of damaged structures and corroded structures

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 maintenance and repair	Cognitive	Understand
CO2	Understand the concept of quality assurance of concrete properties	Cognitive	Understand
CO3	Understand the various concrete materials used for repair works	Cognitive	Understand
CO4	Knowledge in the application of repair techniques in concrete construction	Cognitive	Understand
CO5	Understand the repair, rehabilitation and retrofitting of structures	Cognitive	Understand

COURSE CONTENT

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance and Repair Strategies Maintenance, Repair and Rehabilitation, Facts of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration;

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes;

UNIT IV REPAIR TECHNIQUES 9

Techniques for Repair and Protection Methods- Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection;

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Evaluation of root causes; Underpinning & shoring; some simple systems of rehabilitation of structures; Guniting, shotcreting; Non-Destructive testing systems;Use of external plates, carbon fibre wrapping and carbon composites in repairs. Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Demolition Techniques – Engineered demolition methods – Case studies.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures”, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. Norbert Delatte, “Failure, Distress and Repair of Concrete Structures”, Woodhead Publishing, 2009.
3. Shetty.M.S., “Concrete Technology - Theory and Practice”, S.Chand and Company, New Delhi, 2009.

REFERENCES

1. Deterioration, maintenance and repair of structures, Johnson SM McGraw Hill International Publishers, New York.
2. Santhakumar, A.R., “Training Course notes on Damage Assessment and repair in Low Cost Housing”, “RHDC-NBO” Anna University,1992.
3. Raikar, R.N., “Learning from failures - Deficiencies in Design”, Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, 1987.
4. Ravishankar.K., Krishnamoorthy.T.S,"Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures"Allied Publishers, 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	2	1	-	-	1								2	1
CO 2	2	1	-	-	1								2	1
CO 3	2	1	-	-	1								2	1
CO 4	3	2	1	1	1								3	1
CO 5	3	2	1	1	1								3	1
Total	12	7	2	2	5	0	0	0	0	0	0	0	10	5
Scaled Value	3	2	1	1	1	0	0	0	0	0	0	0	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 : XCEE24

Course Name : BUILDING CONSTRUCTION PRACTICE.

Prerequisite : ----

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To make aware of site clearance, marking and earthwork
- To gain the knowledge in masonry and finishes
- To perceive the knowledge on shuttering and scaffolding
- To understand the latest construction techniques for sub structure
- To understand the latest construction techniques for super structure

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Able to understand the construction activities	Cognitive	Understand
CO2	Perceive the knowledge on various masonry and finishes	Cognitive	Understand
CO3	Explain the shuttering and scaffolding methods	Cognitive Affective	Understand Respond
CO4	Identify various techniques adopted in sub structure construction	Cognitive	Understand
CO5	Understand the different techniques used in super-structures	Cognitive	Understand

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork	
UNIT II	**MASONRY AND FINISHES**	**9**
	Masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – laying brick Building foundations – basements – weather and water proof – roof finishes - acoustic and fire protection;	
UNIT III	**SHUTTERING AND SCAFFOLDINS**	**7**
	Temporary shed – centring and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes.	
UNIT IV	**SUB STRUCTURE CONSTRUCTION**	**11**
	Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation;	
UNIT V	**SUPER STRUCTURE CONSTRUCTION**	**9**
	Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks;	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 5th Edition, 2015.
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, DhanpatRai and Sons, New Delhi 2007.

REFERENCES

1. Jha, J and Sinha, S.K., Construction and Foundation Engineering, KhannaPublishers,New Delhi, 2004.
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
4. Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company, New Delhi, 1983

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	2	2				1								1
CO 4	3	3				2								2
CO 5	3	3				2								2
Total	10	12	0	0	0	1	0	0	0	0	0	0	0	1
Scaled Value	3	2	1	1	1	0	0	0	0	0	0	0	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 : XCEE25

Course Name : CONSTRUCTION EQUIPMENT AND AUTOMATION

Prerequisite : ----

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To enable the students familiarize with modern construction equipments.
- To understand the equipment management methods and equipment functional operations.
- To learn the applications of the equipment in construction projects.

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Identify construction equipment appropriate to tasks	Cognitive	Understanding
CO2	Estimate equipment ownership and operating costs	Cognitive	Understanding
		Affective	Responding
CO3	Estimate and schedule activities using equipment productivity and cost data	Cognitive	Understanding
		Affective	Responding
CO4	Understand contemporary issues pertaining to construction methods, equipment usage and management.	Cognitive	Understanding
CO5	Recognize the concept of intelligent buildings	Cognitive	Understanding

COURSE CONTENT

UNIT I EQUIPMENT MANAGEMENT 9

Identification –Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment – Depreciation Analysis, Methods of calculation of depreciation- Safety Management.

UNIT II EARTHWORK EQUIPMENT 9

Fundamentals of Earth Work Operations - Earth Moving operations-Types of Earthwork Equipment - Tractors, Motor Graders, Scrapers, Front end Loaders, Earth Movers – capacity calculations.

UNIT III PUMPS USED IN CONSTRUCTION 9

Equipment for Dredging, Trenching, Tunnelling, Drilling and Blasting. Equipment for compaction - Types of pumps used in Construction - Equipment for Grouting - Pile Driving Equipment- Equipment of Erection and demolition

UNIT IV SCREENING EQUIPMENT 9

Crushers – Feeders - Screening Equipment - Batching and Mixing Equipment – Hauling equipment - Pouring and Pumping Equipment – Ready mixed concrete carriers.

UNIT V INTELLIGENT BUILDINGS & BUILDING MANAGEMENT SYSTEM 9

Concept-Purpose-Control Technologies- Automation Of All The Services And Equipment - Building Management Systems (BMS) -Energy Management Systems And Building controls.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers, Delhi, 2008.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder.C, “Construction Planning Equipment and Methods”, McGraw Hill. Singapore 2005.
3. William T.Mayer, " Energy Economics and Build Design ", McGraw Hill Book Co., 1983

REFERENCES

1. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers Delhi, 2008.
2. Leonhard E.Bernold, “Construction Equipment and Methods”,Wileyindia Pvt. Ltd2005.
3. Mahesh Varma .Dr, “Construction Equipment and its planning and application”, Metropolitan Book Company, New Delhi, 2003.

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				
CO 2	3	2			2	2			2	2	1	3	2	1
CO 3	3	2			2	2					1	3		
CO 4			1								3			
CO 5			1				2		2					2
Total	**6**	**4**	**2**	**1**	**4**	**4**	**2**	**1**	**4**	**3**	**5**	**6**	**2**	**3**
Scaled Value	2	1	1	1	1	1	1	1	1	1	1	2	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 : XCEE26
Course Name : CONTRACTS MANAGEMENT
Prerequisite : ----

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To understand the various types of construction contracts.
- To learn about the tenders, arbitration and labour regulations.
- To Know the various legal implications related to contracts.

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Recognize the various types of construction contracts	Cognitive	Understanding
CO2	Understand the tenders, arbitration and legal requirements	Cognitive	Understanding
		Affective	Responding
CO3	Gain knowledge about various tax laws	Cognitive	Understanding
CO4	Able to analyse, evaluate and design construction contract documents	Cognitive	Understanding
		Affective	Responding
CO5	Gain knowledge in labour regulations.	Cognitive	Understanding

COURSE CONTENT

UNIT I INTRODUCTION TO CONSTRUCTION CONTRACT 9

Definition of Contract Legal issues in contract – Standard forms of contracts- General and special conditions of contracts- Contract pricing by the client, project management consultants and the contractor, Contract correspondence and contract closure. Types of contracts, Documents forming a contract, General conditions of Indian contracts - International contracts - Contract administration.

UNIT II TENDERS 9

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems - World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

UNIT III ARBITRATION 9

Comparison of Actions and Laws – Agreements – Appointment of Arbitrators – Conditions of Arbitration – Arbitration Tribunals - Powers and Duties of Arbitrator – Enforcement of Award – Arbitration and Conciliation Act 1996 - Arbitration case study.

UNIT IV TAX LAWS 9

Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

UNIT V LABOUR REGULATION 9

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Anurag K Agarwal, "Contracts and Arbitration for Managers", SAGE Response, 2015.
2. S. RanagaRao, "Contract Management & Dispute Resolutions", Engineering staff College of India, 2008.
3. C. J. Schexnayder and R. E. Mayo, "Construction Management Fundamentals", McGraw Hill, New Delhi. 2003.

REFERENCES

1. Prof AkhileshwarPathak, "Contract Terms Are Common Sense", Penguin Portfolio, 2018.
2. B. S. Patil "Civil Engineering Contracts and Estimates", Universities Press, 2009.
3. D.S. Berrie and B.c.Paulson, "Professional construction management including C.M.Design construct and general contracting" McGraw Hill International, 1992.

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	
CO 2			2			3		3	2	1	1		1	
CO 3	2	2							2	1	1			
CO 4	2	1		2		3						1		
CO 5					2		3			2				1
Total	**4**	**3**	**2**	**2**	**2**	**6**	**3**	**3**	**4**	**4**	**3**	**1**	**2**	**1**
Scaled Value	1	1	1	1	1	2	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 :
Course Code : XCEE27

Course Name : ENVIRONMENTAL LAW AND POLICY

Prerequisite : Environmental Engineering

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- To recognize statutory goal setting means and approaches
- To gain knowledge in implementing the environmental law statutes to factual situations.
- To analyse the legal opinions and legal principles

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Describe different methods for setting environmental goals and the means to achieve those goals	Cognitive	Knowledge
CO2	Read and understand legal opinions and analyze opinions to find legal principles	Cognitive	Knowledge
CO3	Apply common law environmental remedies and explain how those remedies supplement environmental statutory law	Cognitive	Apply
CO4	Apply major common law environmental causes of action and environmental law statutes to factual situations.	Cognitive	Applly

COURSE CONTENT

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

Concept of laws and policies, Origin of environmental law, Introduction to environmental laws and policies, Environment and Governance, sustainable development and environment.

UNIT II	**ENVIRONMENTAL PROTECTION**	**9**

Duties and responsibilities of citizens for environmental protection – Subjects related to environment in the seventh schedule of the Constitution: Union list, State list and Common or Concurrent list - Scheme of labelling of environmentally friendly products (ecomark) – Significance of Environmental Education – Environmental Information Systems (ENVIS)

UNIT III	**ENVIRONMENTAL LAWS IN INDIA**	**9**

Legal control of Environmental pollution in India with special reference to: Environment (Protection) Act, 1986 - Powers of Central Government under EPA - The Water (Prevention and Control of Pollution) Act 1974 - Air (Prevention and Control of Pollution) Act, 1981 – Forest Conservation Act, 1980 – Wildlife (Protection) Act, 1972 - The National Green Tribunal Act, 2010

UNIT IV	**GUIDELINES AND RULES FOR ENVIRONMENTAL PROTECTION**	**9**

Guidelines for Common Effluent Treatment Plants (CETPs) – Guidelines for environmentally sound management of e-waste 2008 - The Biomedical waste (Management and Handling) Rules 1998 - Hazardous Waste (Management and Handling) Rules, 1989 - The Municipal Solid Wastes (Management and Handling) Rules, 2000 - The Ozone Depleting Substances (Regulation and Control) Rules, 2000

UNIT V MAJOR INITIATIVES/POLICIES FROM MOEF 9

Central and State Pollution Control Boards: Powers and functions of pollution control boards - Penalties and procedure - National Policies for Environmental Protection in India: National River Conservation Plan (NRCP), National Green Tribunal (NGT), Capacity Building for Industrial Pollution Management (CBIPM), National Environmental Protection Authority (NEPA), Green India Mission – Environmental Clearances: National Environmental Assessment and Monitoring Authority (NEAMA)

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.

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1. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.
2. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification.

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5. envfor.nic.in/legis/legis.html
6. edugreen.teri.res.in/explore/laws.htm
7. envfor.nic.in/legis/crz/crznew.html
8. rti.gov.in/
9. www.ngosindia.com/resources/pil.php

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	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
Total	9	10	8	5	0	2	1	0	0	1	0	6	9	11
Scaled Value	2	2	2	1	0	1	1	0	0	1	0	2	2	3

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

Semester :
Course Code : XCEE28

Course Name : SOLID AND HAZARDOUS WASTE MANAGEMENT

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 Objectives

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

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 System	Cognitive	Understand
CO3	Identify the methods of collection, segregation and transport of solid and Hazardous waste	Cognitive	Understand
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	Knowledge

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 generation from nuclear power plants- 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**

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- Hazardous and Nuclear waste disposal options.

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

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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

	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	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
Total	9	10	8	5	0	2	1	0	0	1	0	6	9	11
Scaled Value	2	2	2	1	0	1	1	0	0	1	0	2	2	3

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

Semester :
Course Code : XCEE29
Course Name : AIR AND NOISE POLLUTION AND CONTROL
Prerequisite : Environmental Engineering

L	T	P	C
3	0	0	3

C	P	A
3	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To learn the effects of air pollutants
- To gain the knowledge on various particulate control methods
- To understand the impact of gaseous pollutants and controlling methods
- To perceive knowledge on air sampling and pollutant measurement
- To identify the concepts of noise pollution and control methods

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	*Understand* the effects of air pollutants	Cognitive	Understand
CO2	*Understand* the particulate control methods	Cognitive	Understand
CO3	*Understand* the gaseous pollutants and controlling methods	Cognitive	Understand
CO4	*Acquire* knowledge on air sampling and pollutant measurement	Cognitive	Knowledge
CO5	*Recognise* the concepts of noise pollution and control methods	Cognitive	Knowledge

COURSE CONTENT

UNIT I AIR POLLUTANTS 9

Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, smog and ozone disturbance, Greenhouse effect.

UNIT II PARTICULATE CONTROL 9

Air Pollution control- at source-equipments for control of air pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones Electrostatic precipitators

UNIT III GAS POLLUTANT CONTROL 9

Gaseous pollutants-control by absorption-adsorption scrubbers-secondary combustion after burners, Working principles advantages and disadvantages, design criteria and examples

UNIT IV AIR SAMPLING AND LEGISLATIONS 9

Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles

UNIT V INDOOR AIR QUALITY AND NOISE POLLUTION 9

Indoor air quality .Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, McGraw 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

E REFERENCES

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		3					
CO 2			2	3			3		3					2
CO 3	1		1	3			3		3	1			1	1
CO 4	1			3	2		3	2	3		1		1	1
CO 5				3			3	3	3		1			
Total	2		3	15	2	2	15	5	15	1	2		2	4
Scaled Value	1	0	1	3	1	1	3	1	3	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 : XCEE30
Course Name : Environmental Impact Assessment
Prerequisite : Nil

L	T	P	C
3	0	0	3

C	P	A
3	0	1

L	T	P	H
3	0	0	3

Course Objectives

- To provide a basic understanding of the EIA process as it is used for research, planning, project or program evaluation, monitoring, and regulatory enforcement.
- To perceive the knowledge on Methodologies for assessment
- To understand the concepts of legal, economic, social, administrative and technical process
- To prepare the Environmental audit reports.
- To provide experience and training in environmental planning and related professions

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Understand the EIA process to apply for research, planning, project	Cognitive	Understand
CO2	Acquire the knowledge on Assessment methodologies	Cognitive	Understand
CO3	Understand the concepts of legal, economic, social, administrative and technical process.	Cognitive	Understand
CO4	Create Environmental audit reports	Cognitive	Create
CO5	Experienced and Trained in Environmental Planning and related professions	Cognitive	Knowledge

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
	Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and Comprehensive EIA; General Framework for Environmental Impact Assessment. Characterization and site assessment.	
UNIT II	**METHODOLOGIES AND ASSESSMENT**	**9**
	Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis; Life Cycle Assessment	
UNIT III	**ENVIRONMENTAL MANAGEMENT PLAN**	**9**
	Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit	
UNIT IV	**ECONOMIC ANALYSIS**	**9**
	Cost Benefit Analysis; Resource Balance, Energy Balance & Management Review; Operational Control;	
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 Science London. 2009.

REFERENCES

1. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for Developing Countries", Butterworth Heinemann, London. 2004.
2. The World Bank Group, "Environmental Assessment Source Book Vol. I, II and III. The World Bank, Washington. 2001.
3. John G. Rau and David C Hooten (Ed)., Environmental Impact Analysis Handbook,
4. McGraw-Hill Book Company, New York, 2010.
5. Judith petts, handbook of environmental impact assessment vol. i & ii, blackwell science, 1999

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	2			3	1	1		1				2
CO 2	1	3	1	1		3		1			1	1		1
CO 3	1	2	2			2		1			1	1		1
CO 4	1	2				1	1							2
CO 5	1	2				2	1							3
Total	4	8	5	1	0	9	2	3	0	1	2	2	0	7
Scaled Value	1	2	1	1	0	2	1	1	0	1	1	1	0	2

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

Semester :
Course Code : XCEMO1

Course Name : REAL ESTATE AND VALUATION

Prerequisite : Nil

L	T	P	C
0.5	0	0.5	1

C	P	A
0.2	0.4	0.4

L	T	P	H
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 different methods	Psychomotor Affective	Guided ResponseResponding
CO3	***Perform*** an applied real estate analysis in a business situation	PsychomotorAffective	Guided ResponseResponding

COURSE CONTENT

VALUATION **15**

Principles and Purposes of valuation - Types 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 and agencies. 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, Contract and Arbitration" Lakhani Book Depot, 2016.
2. SyamalesDatta "Valuation of Real Property Principles & Practice", Eastern Law house private 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
0.5	0	0.5	1

C	P	A
0.50	0.25	0.25

L	T	P	H
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 and mapping software.
- The course starts with introduction to land surveying followed by fundamentals of total station and its 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 and mapping 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, digital surveying procedure, working, data reduction etc.	Psychomotor Affective	Guided ResponseResponding
CO5	Understand the concepts of preparation of master demonstration of a digital land surveying and mapping of an area.	Psychomotor Affective	Guided ResponseResponding

COURSE CONTENT

FUNDAMENTALS OF LAND SURVEYING & GPS **10**

Overview -Fundamentals -GPS and Land Surveys- CORS Networks - Practical Application /-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- Maps or Plats.

SURVEY APPLICATIONS	10

Traversing using various instruments, Contouring Characteristics, uses and methods Measurements of areas and volumes using different methods, setting out works buildings, 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 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. John Wiley Inc.
4. Kiser, J.D. Surveying for Forestry and the Natural Resources. 2010. Corvallis, OR: John Bell and Assoc.

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 : XCEMO3

Course Name : GENERAL REPAIRS & REMEDIAL WATERPROOFING

Prerequisite : Nil

L	T	P	C
0.25	0	0.75	0

C	P	A
1	2	0

L	T	P	H
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	Cognitive	Understanding

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 coating **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. John Wiley Inc.
4. Kiser, J.D. Surveying for Forestry and the Natural Resources. 2010. Corvallis, OR: John Bell and Assoc.

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
Prerequisite : Nil

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
CO2	Able to create documents for building approval.	Cognitive Affective	Understanding Respond
CO3	Able to apply approval for building.	Cognitive Affective	UnderstandingRespond

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 plan approval.

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
0.25	0	0.75	0

C	P	A
0.25	0.50	0.25

L	T	P	H
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 numerical techniques.	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 the geotechnical data.	CognitivePsychomotorAffective	UnderstandingGuided ResponseResponding

COURSE CONTENT

	Solution of Non-linear Equations	**3**
	Bisection, False Position, Newton-Raphson, Successive approximation method, Iterative methods	
	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 Models for solving ta engineering problems.	

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 Engineering computations", 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
1	0	0	1

C	P	A
1	0	0

L	T	P	H
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

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, John Wiley & 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
1	0	0	1

C	P	A
0.25	0.75	0

L	T	P	H
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**
	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

Semester :
Course Code : XCEMO8

Course Name : SURVEY CAMP

Prerequisite : Nil

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	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 and plots.

Triangulation - Trilateration - LS and CS Contouring - Radial Contouring

L	T	P	Total
5	0	10	15

REFERENCES

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 :
Course Code : XCEOE1

Course Name : REMOTE SENSING AND GIS

Prerequisite : Nil

L	T	P	C
3	0	0	3

C	P	A
2.5	0.5	0

L	T	P	H
3	0	0	3

Course Objectives

- To give information about overview of Remote Sensing
- To understand basics of consept of Geo - Information System
- To know the application of Remote sensing and GIS in the field of Environmental Engineering

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Apply the concepts of Electro Magnetic energy, spectrum and spectral signature curves in the practical problems	Cognitive	Understand
CO2	Apply the concepts of satellite and sensor parameters and characteristics of different platforms	Cognitive	Understand
CO3	Apply the concepts of DBMS in GIS	Cognitive	Understand
CO4	Analyse raster and vector data and modelling in GIS	Cognitive Psychomotor	Understand Response
CO5	Apply GIS in land use, disaster management, ITS and resource information system	Cognitive	Understand

COURSE CONTENT

UNIT-I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT –II PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors

UNIT-III IMAGE INTERPRETATION AND ANALYSIS 9

Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised.

UNIT -IV	GEOGRAPHIC INFORMATION SYSTEM	9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT - V	DATA ENTRY, STORAGE AND ANALYSIS	9

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Ian Heywood " An Introduction to GIS", Pearson Education, Asia, 2000.
2. Lo.C.P and A.K.W.Yeung, " Concepts and Techniques of Geographic InformationSystems", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

REFERENCES

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical InformationSystems, Oxford Publication, 2004.
2. C.P.Lo and Albert K.W.Yeung, Concepts and Techniques of Geographical InformationSystems, Prentice Hall India, 2006.
3. Thomas. M..Lille sand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	1	2		1	1		1		1			
CO 2		2		2						1	1	1
CO 3	1	1	2			1		1				
CO 4					1				1			1
CO 5		1		1			1				1	
Total	2	6	2	4	2	1	2	1	2	1	2	2
Scaled Value	1	2	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 :
Course Code : XCE OE 2
Course Name : BUILDING SERVICES
Prerequisite : Nil

L	T	P	C
3	0	0	3

C	P	A
2.5	0	0.5

L	T	P	H
3	0	0	3

Course Objectives

- To give information about water supply source, treatment and distribution.
- To inform about the principles of illumination in buildings.
- To know fire protection in building

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Understanding the concepts of various water harvesting systems and water supply facility	Cognitive Affective	Understand Respond
CO2	Identify and understand the elements of electrical systems	Cognitive	Understand
CO3	Have a good understanding of importance of building ventilation and HVAC systems	Cognitive	Understand
CO4	Classify suitable fire safety procedures for different types of buildings	Cognitive	Understand
CO5	Have a keen knowledge on essentials of performance and functioning of intelligent buildings	Cognitive	Understand

COURSE CONTENT

UNIT I WATER SUPPLY SYSTEMS 9

Water quality, Purification and treatment- water supply systems-distribution systems in small towns. Rain Water Harvesting - Sanitation in buildings-arrangement of sewerage systems in housing Storm water drainage from buildings -septic and sewage treatment plant – collection, conveyance and disposal of town refuse systems.

UNIT II PRINCIPLES OF ILLUMINATION AND DESIGN 9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering.

UNIT III VENTILATION AND ITS IMPORTANCE 9

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant –fan coil systems-water piping –cooling load –air conditioning systems for different types of buildings –protection against fire to be caused by A.C.Systems.

UNIT IV SAFETY REGULATIONS 9

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types-heat and smoke detectors-dry and wet risers- Automatic sprinklers.

UNIT V INTELLIGENT BUILDINGS 9

Intelligent buildings-Building automation-Smart buildings- Building services in high rise buildings-Green buildings-Energy efficient buildings for various zones-Case studies of residence, office buildings and other buildings.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Wendell C. Edwards, "Building Systems: Mechanical, Electrical, Plumbing, Fire Safety and Communication Systems", Linus Publications, Incorporated, 2009
2. Carson Dunlop, "Air Conditioning and Heat Pumps - Essentials of Home Inspection", Dearborn Real Estate, 2003.
3. Roger Greeno and Fred Hall, "Building Services Handbook", Routledge, 2015
4. Derek Phillips, "Lighting Modern Buildings", Taylor & Francis, 2013.
5. Ross Montgomery, Robert McDowall, "Fundamentals of HVAC Control Systems", Elsevier, 2008

REFERENCES

1. Nagarajan. K, "Project Management", New age international (P) Ltd, Publishers, 2005
2. William H.Severns and Julian R. Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 2000.
3. National Building Code.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1			1									
CO 2												
CO 3	1			3		1						
CO 4								1				
CO 5	1				2					1	1	1
Total	2	0	1	3	2	1	0	1	0	1	1	1
Scaled Value	1	0	1	1	2	1	0	1	0	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 : XCEOE3
Course Name : METRO SYSTEMS AND ENGINEERING
Prerequisite : Nil

L	T	P	C
3	0	0	3

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Objectives

- To give information about overview of metro systems.ion
- To understand basics of construction planning & management, construction quality & safety systems
- To know the air conditioning, ventilation, electronic signaling systems and Automatic fare collection

Course Outcome: *After the completion of the course, students will be able to*		**Domain C or P or A**	**Level**
CO1	Understanding the concepts of metro systems	Cognitive	Understand
CO2	Have a good understanding of construction methods for various civil engineering structures used in metro systems	Cognitive	Understand
CO3	Knonwledge on application of electronic signaling systems and automatic fare collection	Cognitive	Understand
CO4	Able to understanding of airconditioning for stations and buildings	Cognitive	Understand
CO5	Have a keen knowledge on essentials of performance and functioning of green buildings	Cognitive	Understand

COURSE CONTENT

UNIT I	**GENERAL**	**6**
	Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials	
UNIT II	**CIVIL ENGINEERING**	**12**
	Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management	
UNIT III	**ELECTRONICS AND COMMUNICATION ENGINEERING**	**9**
	Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.	
UNIT IV	**MECHANICAL & TV + AC:**	**9**
	Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators	

UNIT V ELECTRICAL 9

OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Konstadinos G.Goulias,"Transportion Systems Planning; Methods and applications", CRC Press,2003
2. Carson Dunlop, "Air Conditioning and Heat Pumps - Essentials of Home Inspection", Dearborn Real Estate, 2003.
3. Roger Greeno and Fred Hall, "Building Services Handbook", Routledge, 2015

REFERENCES

1. Vukan R. Vuchic, Urban Transist", Operations, Planning and Economics, John Wiley &Sons,2005
2. William H.Severns and Julian R. Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 2000.
3. National Building Code.

Mapping of CO with GA's

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

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