PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
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Criterion 1 – Curricular Aspects

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

DEPARTMENT OF CIVIL ENGINEERING

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

1. List of courses for the programmes in order of

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

2. Syllabus of the courses as per the list.

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

Name of the Course	Course Code	Year of introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
Calculus and Linear Algebra	XMA101	2018-19	Skill Development - Assignment and Seminar
Electrical and Electronic Engineering Systems	XBE102	2018-20	Skill Development - Assignment and Seminar
Physics	XAP103	2018-21	Skill Development - Assignment and Seminar
Engineering Graphics and Design	XEG104	2018-22	Skill Development- Understand the views of the objects, Drawings under various views
Speech Communication	XGS105	2021-22	Skill Development - Assignment and Seminar
Constitution of India	XUM106	2017-18	Skill Development - Assignment and Seminar
Electrical and Electronic Engineering Systems Laboratory	XBE107	2021-22	Skill Development - Assignment and Seminar
Applied Physics for Engineers Laboratory	XAP108	2008-09	Skill Development - Assignment and Seminar
Calculus, Ordinary Differential Equations and Complex Variable	XMA201	2018-19	Skill Development - Assignment and Seminar
Programming for Problem Solving	XCP202	2013-14	Employability- Test,Assignment, Seminar,Poster Presentation
Chemistry	XAC203	2008-09	Skill Development-Assignment, Seminar
Technical Communication	XGS204	2021-22	Skill Development - Assignment and Seminar
Workshop Practices	XWP205	2008-09	Skill Development- Understand the views of the objects, Drawings under various views
Engineering Mechanics	XEM206	2008-09	Skill Development - Assignment and Seminar
Programming for Problem Solving Laboratory	XCP207	2013-14	Employability- Test,Assignment, Seminar,Poster Presentation
Chemistry Laboratory	XAC208	2008-09	Skill Development - Assignment

			and Seminar
Disaster Preparedness & Planning	XCE302	2019-20	Skill Development - Album and Seminar
Computer Aided Civil Engineering Drawing	XCE303	2019-20	Skill Development-Assignment and Tutorial
Engineering Mechanics	XCE304	2014-15	Skill Development-Assignment and Tutorial
Energy Science and Engineering	XCE305	2014-15	Employability-Field work and Assignments
Surveying – I	XCE306	2014-15	Skill development- Assignment
Introduction to Civil Engineering	XCE307	2019-20	Skill Development - Assignment and Seminar
Effective Technical Communication	XGS308	2016-17	Skill Development-Assignment, Seminar, Technical Report
Inplant Training - I	XCE309	2014-15	Skill Development-Assignment, Seminar, Technical Report
Digital Land surveying and mapping	XCEM09	2019-20	**Entrepreneurship**-Case study
Concrete Technology	XCE402	2011-12	Skill development-Literature survey
Engineering Geology	XCE403	2008-09	Employability, Quiz/case study
Mechanics of Fluids	XCE404	2015-16	Skill Development-Assignment and Tutorials
Entrepreneurship Development	XUM405	2016-17	Skill development- Tutorials and Assignment
Mechanics of Solids	XCE406	2013-14	Skill development- Tutorials and Assignment
Geotechnical Engineering	XCE407	2015-16	Employability, Quiz/case study
Surveying II	XCE408	2014-15	Skill development- Tutorials and Assignment
Material Testing and Evaluation	XCE409	2018-19	Skill development- Tutorials and Assignment

Mechanics of Materials	XCE501	2019-20	Employability-Tutorials, solving complex problems
Hydraulic Engineering	XCE502	2019-20	Skill Development-Assignment, Seminar, Technical Report
Structural Analysis	XCE503	2019-20	Employability-Tutorials, solving complex problems
Hydrology & Water Resources Engineering	XCE504	2019-20	Skill Development-Assignment, Seminar, Technical Report
Environmental Engineering	XCE505	2019-20	Employability –Tutorials and Case Study
Constitution of India	XUM506	2019-20	Skill Development-Assignment, Seminar, Technical Report
Transportation Engineering	XCE507	2019-20	Skill Development-Assignment, Seminar, Technical Report
Construction Engineering & Management	XCE508	2019-20	Skill Development-Assignment, Seminar, Technical Report
Professional Practice, Law & Ethics	XCE509	2019-20	Skill Development-Assignment, Seminar, Technical Report
In-plant Training - II	XCE510	2019-20	Skill development-Field work
Survey Camp	XCEM08	2008-09	Skill Development-Assignment, Seminar, Technical Report
Structural Engineering	XCE601	2019-20	Employability –Tutorials and Seminar
Engineering Economics, Estimation & Costing	XCE602	2019-20	Skill Development - Assignment and Seminar
Elective-I	XCEE**	2019-20	Skill Development - Assignment and Seminar
Elective-II	XCEE**	2019-20	Skill Development - Assignment and Seminar
Elective-III	XCEE**	2019-20	Skill Development - Assignment and Seminar
Elective-IV	XCEE**	2019-20	Skill Development - Assignment and Seminar

Elective V	XCEE**	2021-22	Skill Development-Assignment, Seminar, Technical Report
Elective-VI	XCEE**	2021-22	Skill Development-Assignment, Seminar, Technical Report
Elective VII	XCEE**	2021-22	Skill Development-Assignment, Seminar, Technical Report
Project Phase – I	XCE705	2021-22	Employability- Field visit
In--plant Training - III	XCE706	2021-22	Skill development-Field work
Real Estate and Valuation	XCEM01	2019-20	Skill development-Field work
Elective VIII	XCEE**	2021-22	Skill Development - Assignment and Seminar
Project Phase– II	XCE804	2021-22	Skill Development - Assignment and Seminar
Mechanics of Solids-I	PCE102	2012-13	Skill Development-Assignment and Tutorial
Fluid Mechanics and Machinery	PCE103	2012-13	Skill Development-Assignment and Tutorial
Strength of Materials Lab	PCE104	2012-13	Employability-Field work and Assignments
Fluid Mechanics and Machinery Lab	PCE105	2012-13	Skill Development-Assignment and Tutorial
Mechanics of Solids-II	PCE201	2012-13	Employability-Tutorials and Assignments
Geotechnical Engineering - I	PCE202	2012-13	Employability – Tutorials, Seminar and Assignments
Concrete Technology	PCE203	2012-13	Skill development- Drawing Preparation
Disaster Management	P**204	2012-13	Entrepreneurship-Case study
Geotechnical Engineering Lab	PCE205	2012-13	Employability-Field work and Document Preparation

Chemistry and Microbiology for Environmental Engineers	YEN101	2014-15	Skill development-Case study, Assignment
Unit Operation and Processes in Environmental Systems	YEN102	2019-20	Employability- Case study, Problem solving
Air Pollution and Control	YEN103C	2014-15	Employability- Case study, Assignment
Environment Economics	YEN103B	2018-19	Skill development-Report writing
Environmental Policies and Legislation	YEN104C	2018-19	Employability- Case study, Seminar
Environmental Quality Measurements Laboratory - I (Water & Wastewater)	YEN105	2014-15	Skill development-Analysis
Microbiology Laboratory	YEN106	2014-15	Skill development- Analysis
Research Methodology and IPR	YRM107	2014-15	Skill development-Report writing
Transport of Water and Waste water	YEN201	2014-15	Employability-Case study, Assignments
Biological Treatment of Waste water	YEN202	2018-19	Employability- Case Study
Solid and Hazardous Waste Management	YEN203	2014-15	Employability- Case study, field visit
Environmental Geotechnology	YEN204B	2018-19	Skill development- Case study, Assignments
Environmental Quality Measurements Laboratory - II (Air, Noise and Solidwaste)	YEN205	2014-15	Skill development- analysis
Unit Operation Laboratory	YEN206	2014-15	Skill Development- analysis
Mini Project	YEN207	2014-15	Skill development-Experimental work

Ground Water Contamination and Transport Modeling	YEN301A	2014-15	Employability- Case study
Industrial Safety	YMEOE1	2018-19	Employability- Case Study, Report writing
Dissertation Phase - I	YEN303	2014-15	Employability- Design and Analysis
Dissertation Phase - I	YEN401	2014-15	Employability- Design, Analysis Fabrication, Testing , Report preparation
Chemistry and Microbiology for Environmental Engineers	QEN101	2018-19	Skill development-Case study, Assignment
Microbiology Laboratory	QEN103	2018-19	Skill development- Analysis
Unit Operation and Processes in Environmental Systems	QEN201	2018-19	Skill development- Analysis
Environmental Quality Measurements Laboratory - I (Water &Waste water)	QEN203	2018-19	Skill development- Analysis
Transport of Water and Wastewater	QEN301	2012-13	Employability-Case study, Assignments
Environmental Quality Measurements Laboratory - II(Air, Noise and Solid waste)	QEN303	2018-19	Skill development- analysis
Biological Treatment of Waste water	QEN401	2018-19	Employability- Case Study, Report writing
Mini Project	QEN404	2012-13	Employability- Design and Analysis
Project Work - Phase I	QEN501	2012-13	Employability- Design and Analysis
Project Work - Phase II	QEN601	2012-13	Employability - Field work and Lab scale performance

COURSE CODE	**XMA101**	**L**	**T**	**P**	**C**
COURSE NAME	**CALCULUS AND LINEAR ALGEBRA**	**3**	**1**	**0**	**4**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 3:0.5:0.5		**3**	**1**	**0**	**4**

COURSE OBJECTIVES

- Understand the application of calculus and linear algebra in engineering.

COURSE OUTCOMES		**DOMAIN**	**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. Half range Fourier sine and cosine series.	Cognitive Psychomotor	Applying Remembering Guided Response
CO3	***Find***the derivative of composite functions and implicit functions. Euler's theorem and Jacobian.	Cognitive Psychomotor	RememberingGuided Response
CO4	***Explain*** the functions of two variables by Taylor's expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence.	CognitiveAffective	Remembering Understanding Receiving
CO5	***Apply*** Differential and Integral calculus to notions of Curvature and to improper integrals.	Cognitive	Applying

UNIT I MATRICES 12L+3T

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 II SEQUENCES AND SERIES 12L+3T

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 12L+3T

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 12L+3T

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 12L+3T

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.

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)**

REFERENCE BOOKS

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

E –REFERENCES

1. http://nptel.ac.in/faq/110101010/Prof.IndrajitMukherjee,IIT,Bombay and Prof. Tapan P.Bagchi, IIT, Kharagpur.

LECTURE: 60 TUTORIAL: 15 PRACTICAL: 0 TOTAL :75

XMA101 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	3	3	3	15	3
PO_2	2	1	1	2	2	8	2
PO_3	0	0	0	0	0	0	0
PO_4	0	0	0	0	0	0	0
PO_5	2	0	0	0	1	3	1
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	0	0	0	0	0	0	0
PO_9	0	0	0	0	0	0	0
PO_{10}	1	1	1	1	1	5	1

PO_{11}	0	0	0	0	0	0	0
PO_{12}	2	1	1	1	2	7	2
PSO_1	0	0	0	0	0	0	0
PSO_2	1	1	1	1	1	5	1
TOTAL	11	7	7	8	10	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XBE102**	**L**	**T**	**P**	**C**
COURSE NAME	**ELECTRICAL AND ELECTRONIC ENGINEERING SYSTEMS**	**3**	**1**	**0**	**4**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 3:0:0		**3**	**1**	**0**	**4**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Define and Relate*** the fundamentals of electrical parameters and ***build*** and ***explain*** AC, DC circuits by Using measuring devices	Cognitive	Understand
CO2	***Define and Explain*** the operation of DC and AC machines.	Cognitive	Understand
CO3	***Recall and Illustrate*** various semiconductor devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive	Understand
CO4	***Relate and Explain*** thenumber systems and logic gates. **Construc**t the different digital circuit.	Cognitive	Understand
CO5	***Label and Outline*** thedifferent types of microprocessors and their applications.	Cognitive	Understand

UNIT I FUNDAMENTALS OF DC AND AC CIRCUITS, MEASUREMENTS 9+3

Fundamentals of DC– Ohm's Law – Kirchhoff'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 II ELECTRICAL MACHINES 9+3

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 SEMICONDUCTOR DEVICES 9+3

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 DIGITAL ELECTRONICS 9+3

Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subtractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.

UNIT V MICROPROCESSORS 9+3

Architecture, 8085, pin diagram of 8085, ALU timing and control unit, registers, data and address bus, timing and control signals, Instruction types, classification of instructions, addressing modes, Interfacing Basics: Data transfer concepts – Simple Programming concepts.

LECTURE: 45 TUTORIAL: 15 PRACTICAL:0 TOTAL: 60

TEXT BOOK

1. Metha V.K, Rohit Mehta, 2020. Principles of Electronics,12th ed, S Chand Publishing.
2. Albert Malvino, David J.Bates., 2017. Electronics Principles. 7th ed, Tata McGraw-Hill. New Delhi.
3. Rajakamal, 2014. Digital System-Principle & Design. 2nd ed. Pearson education.
4. Morris Mano, 2015. Digital Design. Prentice Hall of India.
5. Ramesh, S. Gaonkar, 2013, Microprocessor Architecture, Programming and its Applications with the 8085, 6th ed , India: Penram International Publications.

REFERENCE BOOKS:

1. Cotton, H.,2005 Electrical Technology. CBS Publishers & Distributors Pvt Ltd.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967, Electronics Devices, New Delhi: Tata McGraw-Hill.
4. Millman, J. and Halkias, 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. Nagendra Krishnapura, IIT Madras.
4. Dr.L.Umanand, http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISC Bangalore.

XBE102- Mapping of COs with GAs

CO/GA	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10	GA 11	GA 12
CO 1	3	3	1	1	1	1			1	1	1	
CO 2	3	3	1	1	1	1			1	1	1	
CO 3	2	2	2	1	2	2	1	1	1	1	1	
CO 4	2	2	1	1	1	1	1	1	1	1	1	
CO 5	2	2	1	1	1	1	1	1	1	1	1	
Total	12	12	6	5	6	6	3	3	5	5	5	
Scaled	3	3	2	1	2	2	1	1	1	1	1	

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XAP103**	**L**	**T**	**P**	**C**
COURSE NAME	**APPLIED PHYSICS FOR ENGINEERS**	**3**	**1**	**0**	**4**
C:P:A	**2.8:0.8:0.4**	**L**	**T**	**P**	**H**
PREREQUISITE	**BASIC PHYSICS IN HSC LEVEL**	**3**	**1**	**0**	**4**

COURSE OUTCOMES

		Domain	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

UNIT - I MECHANICS OF SOLIDS **9+3**

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 -II ELECTROMAGNETIC THEORY **9+3**

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarisation, Dielectric constant, internal field - Clausius Mossotti 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+3**

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+3**

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+3**

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

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
Hours	**45**	**15**		**60**

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai 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 RESOURCES

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

XAP103 Mapping of CO's with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	3	3	3	15	3
PO_2	2	0	2	2	0	6	2
PO_3	2	1	2	2	2	9	2
PO_4	2		2	2	0	6	2
PO_5	1	1	1	1	0	4	1
PO_6	0	0	0	0	0	0	
PO_7	0	0	0	0	0	0	
PO_8	0	0	0	0	0	0	
PO_9	1		1	1	0	3	1
PO_{10}	0	0	0	0	0	0	
PO_{11}	0	0	0	0	0	0	
PO_{12}	1	1	1	1	1	5	1
PSO_1	0	0	0	0	0	0	
PSO_2	0	0	0	0	0	0	
TOTAL	12	6	12	12	6	-	-

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XEG104**	**L**	**T**	**P**	**C**
COURSE NAME	**ENGINEERING GRAPHICS AND DESIGN**	**1**	**0**	**2**	**3**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 3:0:0		**1**	**0**	**2**	**5**

COURSE OBJECTIVES

- To prepare the student to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare the student to communicate effectively
- To prepare the student to use the techniques, skills, and modern engineering tools necessary for engineering practice

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Apply*** the national and international standards, ***construct***and ***practice*** various curves	Cognitive Psychomotor Affective	Apply Guided response Respond
CO2	***Interpret*, *construct*** **and** ***practice*** orthographic projections of points, straight lines and planes.	Cognitive Psychomotor Affective	Understand Mechanism Respond
CO3	***Construct Sketch*** **and** ***Practice*** projection of solids in various positions and true shape of sectioned solids.	Cognitive Psychomotor Affective	Apply overt response Respond
CO4	***Interpret*, *Sketch*** **and** ***Practice*** the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive Psychomotor Affective	Understand Overt response Respond
CO5	***Construct sketch*** **and** ***practice*** isometric and perspective views of simple and truncated solids.	Cognitive Psychomotor Affective	Apply Overt response Respond

UNIT I INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE 6L+12P

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 threedimensional 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. Practice on basic tools of CAD.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 6L+12P

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-CAD practice on points and lines

UNIT III PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS 6L+12P

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-CAD practice on solid models.

UNIT IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS 6L+12P

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-CAD practice on intersection of solids.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6L+12P

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-CAD practice on isometric view.

TEXT BOOKS

1. Natarajan,K.V, " A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
2. 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/e-content
2. Http://nptel.ac.in/courses/112103019/

LECTURE: 15 TUTORIAL: 0 PRACTICAL: 30 TOTAL:45

XEG104 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	3	3	3	15	3
PO_2	3	3	3	3	3	15	3
PO_3	3	3	3	3	3	15	3
PO_4	2	1	1	1	1	6	2

PO_5	3	3	3	3	3	15	3
PO_6	2	1	1	1	1	6	2
PO_7	3	3	3	3	3	15	3
PO_8	1	1	1	1	1	5	1
PO_9	1	1	1	1	1	5	1
PO_{10}	2	1	1	1	1	6	2
PO_{11}	3	2	2	2	2	11	3
PO_{12}	3	3	3	3	3	15	3
PSO_1	0	0	0	0	0	0	0
PSO_2	1	1	1	1	1	5	1
TOTAL	30	26	26	26	26	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XGS105**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**SPEECH COMMUNICATION**	**0**	**1**	**2**	**0**	**3**
PRE-REQUISITES	**NIL**	**L**	**T**	**P**	**SS**	**H**
C:2.6 P:0.4 A:0	**-**	**0**	**1**	**4**	**0**	**5**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Ability*** to recall the types of speeches	Cognitive	Remember
CO2	***Apply*** the techniques in public speaking	Cognitive	Apply
CO3	***Identify***the common patterns in organizing a speech	Cognitive	Remember
CO4	***Construct*** the nature and style of speaking	Cognitive	Create
CO5	***Practicing***thespeaking skills	Psychomotor	Guided Response

UNIT I TYPES OF SPEECHES **9**

1.1 – Four types of speeches

1.2 – Analyzing the audience

1.3 - Developing ideas and supporting materials

UNIT II PUBLIC SPEAKING **9**

2.1 - Introduction to Public Speaking

2.2 - Competencies Needed for successful speech making

2.3 – Speaking about everyday life situations

UNIT III ORGANIZATION OF SPEECH **9**

3.1 – Developing a speech out line

3.2 - Organizing the speech

3.3 – Introduction - development – conclusion

UNIT IV PRESENTATION **9**

4.1 - Tips for preparing the draft speech

4.2 – Presentation techniques using ICT tools

4.3 – Using examples from different sources

UNIT V ACTIVITIES **9**

5.1 – Reading activities

5.2 – Creative presentations

5.3 – Media presentation techniques

SUGGESTED READINGS

1. Sanjay Kumar and Pushp Lata. *Communication Skills*. Oxford University Press. 2011

2. Michael Swan. *Practical English Usage.* OUP. 1995

XGS105 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	0	0	0	0	0	0	0
PO_2	0	0	0	0	0	0	0
PO_3	0	0	0	0	0	0	0
PO_4	0	0	0	0	0	0	0
PO_5	0	0	0	0	0	0	0
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	1	1	1	1	1	5	1
PO_9	3	3	2	2	2	12	2
PO_{10}	3	3	3	3	3	15	3
PO_{11}	0	0	0	0	0	0	0
PO_{12}	2	2	2	2	2	10	2
PSO_1	0	0	0	0	0	0	0

PSO_2	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XUM106**	**L**	**T**	**P**	**C**
COURSE NAME	**CONSTITUTION OF INDIA**	**0**	**0**	**0**	**0**
PREREQUISITE:	**NIL**	**L**	**T**	**P**	**H**
C:P:A	**3:0:0**	**0**	**0**	**0**	**3**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Understand*** the Constitutional History	Cognitive	Understanding
CO2	***Understand*** the Powers and Functions	Cognitive	Understanding
CO3	***Understand*** the Legislature	Affective	Remembering
CO4	***Understand*** the Judiciary	Affective	Remembering
CO5	***Understand*** the Centre State relations	Cognitive	Understanding

UNIT I **08**

Constitutional History- The Constitutional Rights- Preamble- Fundamental Rights- Fundamental Duties- Directive principles of State Policy.

UNIT II **09**

The Union Executive- The President of India (powers and functions)- Vice-President of India-The Council of Ministers-Prime Minister- Powers and Functions.

UNIT III **10**

Union Legislature- Structure and Functions of Lok Sabha- Structure and Functions of Rajya Sabha- Legislative Procedure in India- Important Committes of Lok Sabha- Speaker of the Lok Sabha.

UNIT IV **09**

The Union Judiciary- Powers of the Supreme Court- Original Jurisdiction- Appelete jurisdictions- Advisory Jurisdiction- Judicial review.

UNIT V **09**

Centre State relations- Political Parties- Role of governor, powers and functions of Chief Minister- Legislative Assembly- State Judiciary- Powers and Functions of the High Courts.

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
45	**0**	**0**	**45**

REFERENCES

1. W.H.Morris Shores- Government and politics of India, NewDelhi,B.1.Publishers,1974.
2. M.V.Pylee- Constitutional Government in India, Bombay, Asia Publishing House, 1977.
3. R.Thanker- The Government and politics of India, London:Macmillon, 1995.
4. A.C.Kapur- Select Constitutions S,Chand & Co.,NewDelhi, 1995

5. V.D.Mahajan- Select Modern Governments,S,Chand &Co, NewDelhi,1995.
6. B.C.Rout- Democractic Constitution of India.
7. Gopal K.Puri- Constitution of India, India 2005.

XUM106- Mapping of COs with POs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	2			1					
CO 2	2			1					
CO 3	2			1					1
CO 4	2			1				1	1
CO 5	2	2		1				1	1
Total	10	2		5				2	3
Scaled to 0,1,2,3	2	1		1				1	1

1-5 →1, 6-10 →2, 11-15 →3

0 – No Relation, 1- Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE	**XBE107**	**L**	**T**	**P**	**C**
COURSE NAME	**ELECTRICAL AND ELECTRONIC ENGINEERING SYSTEMS LAB**	**0**	**0**	**1**	**1**
C:P:A	**1.5:1:0.5**	**L**	**T**	**P**	**H**
PREREQUISITE:	**BASIC PHYSICS IN HSC LEVEL**	**0**	**0**	**1**	**2**

COURSE OUTCOMES		**Domain**	**Level**
CO1	***Apply***the fundamental electrical concepts and ***differentiate*** the various electronic components.	Cognitive Psychomotor Affective	Understand Set Valuing
CO2	***Implement*** and ***execute*** the different types of wiring connections.	Cognitive Psychomotor Affective	Understand Set Valuing
CO3	***Demonstrate*** the Fluorescent lamp connection with choke.	Cognitive Psychomotor Affective	Understand Set Valuing
CO4	***Characterize*** and ***display*** the basic knowledge on the working of PN junction and Zener diode.	Cognitive Psychomotor Affective	Understand Set Valuing
CO5	***Implement*** and ***execute***the various digital electronic circuits such	Cognitive	Understand

as Adders and Subtractors. Psychomotor Set

Affective Valuing

OBJECTIVES

The course helpsto

a. Learn the basic concepts of electrical and electronics components.
b. Understand the basic wiring methods and connection.
c. Study the characteristics of diodes, Zener diodes, NPN transistors.
d. Verify the working of simple logic gates, adders and subtractors.

LIST OF EXPERIMENTS

Ex. No	Experiments	COs
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.	Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.	-
4.	Fluorescent lamp connection with choke.	-
5.	Staircase Wiring	-
6.	Forward and Reverse bias characteristics of PN junction diode.	-
7.	Forward and Reverse bias characteristics of zener diode.	-
8.	Input and Output Characteristics of NPN transistor.	-
9.	Construction and verification of simple logic gates.	-
10.	Construction and verification of adders and subtractors.	-

LECURE:0 TUTORIAL: 0 PRACTICAL: 30 TOTAL:30

TEXT BOOKS

1. Laboratory Manual "Electrical and Electronic Engineering SystemsLab", Department of Electrical and Electronics Engineering, PMIST, Thanjavur.

XBE107- Mapping of COs with GAs

CO/GA	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10	GA 11	GA 12
CO 1	3	3	1	1	1	1			1	1	1	
CO 2	3	3	1	1	1	1			1	1	1	
CO 3	2	2	2	1	2	2	1	1	1	1	1	
CO 4	2	2	1	1	1	1	1	1	1	1	1	
CO 5	2	2	1	1	1	1	1	1	1	1	1	
Total	12	12	6	5	6	6	3	3	5	5	5	
Scaled Value	3	3	2	1	2	2	1	1	1	1	1	

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XAP108**	**L**	**T**	**P**	**C**
COURSE NAME	**APPLIED PHYSICS FOR ENGINEERS LAB**	**0**	**0**	**1**	**1**
C:P:A	**0:1.5:0.5**	**L**	**T**	**P**	**H**
PREREQUISITE:	**BASIC PHYSICS IN HSC LEVEL**	**0**	**0**	**1**	**2**

COURSE OUTCOMES

		Domain	**Level**
CO1	***Identify*** the basics of mechanics, and ***determine*** its significance in engineering systems and technological advances.	Psychomotor:	Mechanism
CO2	***use*** and ***locate*** basic applications of electromagnetic induction to technology.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	***describe*** the working principle and application of various lasers and fibre optics.	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***Analyse*** energy bands in solids, ***discuss*** and ***use*** physics principles of latest technology using semiconductor devices.	Psychomotor: Affective:	Analyze Mechanism Receive

LIST OF EXPERIMENTS

Ex. No	**Experiments**	**COs**
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.	

LECURE:0 **TUTORIAL: 0** **PRACTICAL: 30** **TOTAL:30**

TEXT BOOKS

1. Laboratory Manual "PhysicsLab", Department of Physics, PMIST, Thanjavur.

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. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

XAP108 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	3	3	3	15	3
PO_2	2		2	2	0	6	2
PO_3	2	1	2	2	2	9	2
PO_4	2		2	2	0	6	2
PO_5	1	1	1	1	0	4	1
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	0	0	0	0	0	0	0
PO_9	1		1	1	0	3	1
PO_{10}	0	0	0	0	0	0	0
PO_{11}	0	0	0	0	0	0	0
PO_{12}	1	1	1	1	1	5	1
PSO_1	0	0	0	0	0	0	0
PSO_2	0	0	0	0	0	0	0
TOTAL	12	6	12	12	6	-	-

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XMA201	L	T	P	C
COURSE NAME	CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE	3	1	0	4
PREREQUISITES	NIL	L	T	P	H
C:P:A= 3:0.5:0.5		3	1	0	4

COURSE OBJECTIVES

- Understand the application of Calculus, Ordinary Differential Equations and Complex Variable in engineering.

COURSE OUTCOMES		DOMAIN	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	Remember, Apply
CO2	**Solve** first order differential equations of different types which are solvable for p, y, x and Clairaut's type.	Cognitive	Apply
CO3	**Solve** Second order ordinary differential equations with variable coefficients using various methods.	Cognitive	Apply
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	Remember, Apply 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	Apply Receiving

UNIT I MULTIVARIABLE CALCULUS (INTEGRATION) 9L+3T

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 II FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9L+3T

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 9L+3T

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 9L+3T

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 9L+3T

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.

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40thth Edition, 2008.

REFERENCE BOOKS

LECTURE: 45 TUTORIAL: 15 PRACTICAL: 0 TOTAL :60

XMA201 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	3	3	3	15	3
PO_2	2	1	1	2	2	8	2
PO_3	0	0	0	0	0	0	0
PO_4	0	0	0	0	0	0	0
PO_5	2	0	0	0	1	3	1
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	0	0	0	0	0	0	0
PO_9	0	0	0	0	0	0	0
PO_{10}	1	1	1	1	1	5	1
PO_{11}	0	0	0	0	0	0	0
PO_{12}	2	1	1	1	2	7	2
PSO_1	0	0	0	0	0	0	0
PSO_2	0	0	0	0	0	0	0
TOTAL	10	6	6	7	9	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3
0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XCP202**	**L**	**T**	**P**	**C**
COURSE NAME	**PROGRAMMING FOR PROBLEM SOLVING**	**3**	**0**	**0**	**3**
PREREQUISITES	**BASIC UNDERSTANDING SKILLS**	**L**	**T**	**P**	**H**
C:P:A= 3:0:0		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To learn programming language basics and syntax
- To ignite logical thinking
- To understand structured programming approach
- To deal with user defined data types
- To know about data storage in secondary memory

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Define*** programming fundamentals and ***Solve*** simple programs using I/O statements	Cognitive	Remember Understand Apply
CO2	***Define*** syntax and ***write simple programs*** using control structures and arrays	Cognitive	Remember Understand Apply
CO3	***Explain*** and ***write simple programs*** using functions and pointers	Cognitive	Remember Understand Apply
CO4	***Explain*** and ***write simple programs*** using structures and unions	Cognitive	Remember Understand Apply
CO5	***Explain*** and ***write simple programs*** using files and ***Build*** simple projects	Cognitive	Remember Understand Apply

UNIT I PROGRAMMING FUNDAMENTALS AND I/O STATEMENTS 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.

UNIT II CONTROL STRUCTURES AND ARRAYS 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.

UNIT III FUNCTIONS AND POINTERS 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 in self-referential structures-Notion of linked list.

UNIT IV STRUCTURES AND UNIONS 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.

UNIT V FILES **9**

File management in C - File operation functions in C - Defining and opening a file - Closing a file - The getw and putw functions - The fprintf & fscanf functions - fseek function – Files and Structures.

TEXT BOOKS

1. Byron Gottfried, "Programming with C", III Edition, (Indian Adapted Edition), TMH publications, 2010
2. Yeshwant Kanethker, “Let us C”, BPB Publications, 2008

REFERENCE BOOKS

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill, 7th edition 2017.
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. 2005
3. Johnson baugh R. and Kalin M., “Applications Programming in ANSI C”, III Edition, Pearson Education India, 2003

E –REFERENCES

1. https://www.indiabix.com/c-programming/questions-and-answers/
2. https://www.javatpoint.com/c-programming-language-tutorial
3. https://www.w3schools.in/c-tutorial/

LECTURE: 45 TUTORIAL: 0 PRACTICAL: 0 TOTAL :45

XCP202 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	2	2	2	12	3
PO_2	2	2	2	2	2	10	2
PO_3	0	0	1	1	1	3	1
PO_4	0	0	2	2	0	4	1
PO_5	3	2	2	2	2	11	3
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	0	0	0	0	1	1	1
PO_9	0	0	0	0	0	0	0
PO_{10}	0	0	0	0	2	2	1
PO_{11}	2	2	2	2	2	10	2

PO_{12}	3	3	2	2	2	12	3
PSO_1	2	2	2	2	2	10	2
PSO_2	0	0	0	0	0	0	0
TOTAL	15	14	15	15	16	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XAC203**	**L**	**T**	**P**	**C**
COURSE NAME	**APPLIED CHEMISTRY FOR ENGINEERS**	**3**	**1**	**0**	**4**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 2.5:1:0.5		**3**	**1**	**0**	**4**

COURSE OBJECTIVES

- Understand the application of chemistry in engineering.

COURSE OUTCOMES		**DOMAIN**	**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	Remembering Perception
CO2	***Explain*** *and* ***Measure*** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understanding Set
CO3	***Interpret*** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Applying Mechanism Receive
CO4	***Describe, Illustrate*** *and* ***Discuss*** the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remembering Analyzing Perception Responding
CO5	***Apply, Measure*** and ***Distinguish*** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remembering, Applying Mechanism

UNIT I PERIODIC PROPERTIES AND WATER CHEMISTRY 8L+3T

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 12L+3T

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 10L+3T

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 7L+3T

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 8L+3T

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, Shoban Lal Nagin 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 Arun Bahl, 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.

REFERENCES

1. Puri B R Sharma L R and Madan S Pathania, “Principles of Physical Chemistry”, Vishalpublishing 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- REFERENCES

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/

LECTURE:45 TUTORIAL:15 PRACTICAL:0 TOTAL:60

XAC203 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	2	3	3	3	13	3
PO_2	0	0	0	0	0	0	0
PO_3	0	0	0	0	0	0	0
PO_4	0	0	0	0	0	0	0
PO_5	0	0	0	0	0	0	0
PO_6	0	0	0	0	0	0	0
PO_7	2	1	2	3	2	10	2
PO_8	3	2	3	3	2	13	3
PO_9	3	2	3	3	3	14	3
PO_{10}	0	0	0	0	0	0	0
PO_{11}	0	0	0	0	0	0	0
PO_{12}	0	0	0	0	0	0	0
PSO_1	0	0	0	0	0	0	0
PSO_2	0	0	0	0	0	0	0

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	XGS204	L	T	P	SS	C
COURSE NAME	TECHNICAL COMMUNICATION	2	0	0	0	2
PRE-REQUISITES	NIL	L	T	P	SS	H
C:3 P:0 A:0	-	2	0	0	0	2

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Ability*** to understand the basic principles	Cognitive	Remember
CO2	***Apply*** the techniques in writing	Cognitive	Apply
CO3	***Identify***communicative styles	Cognitive	Remember
CO4	***Construct*** the nature of writing	Cognitive	Create

UNIT I – Basic Principles **9**

1.1 – Basic Principles of Technical Writing

1.2 – Styles used in Technical Writing

1.3 – Language and Tone

UNIT II – Techniques **9**

2.1 – Special Techniques used in writing

2.2 – Definition & Description of mechanism

2.3 – Description- Classification-Interpretation

UNIT III – Communication **9**

3.1 – Modern development in style of writing

3.2 - New letter writing formats

UNIT IV – Report Writing **9**

4.1 – Types of Report writing

4.2 – Project writing formats

SUGGESTED READINGS

1. John Sealy, Writing and Speaking Author; Oxford University Press, New Delhi, 2009
2. Williams K.S, Communicating Business. Engage Learning India Pvt Ltd, 2012

XGS204 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	0	0	0	0	0	0	0
PO_2	0	0	0	0	0	0	0
PO_3	0	0	0	0	0	0	0
PO_4	0	0	0	0	0	0	0
PO_5	0	0	0	0	0	0	0
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	1	1	1	1	1	5	1
PO_9	3	3	2	2	2	12	2
PO_{10}	3	3	3	3	3	15	3
PO_{11}	0	0	0	0	0	0	0
PO_{12}	2	2	2	2	2	10	2
PSO_1	0	0	0	0	0	0	0
PSO_2	0	0	0	0	0	0	0
TOTAL							

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XWP205**	**L**	**T**	**P**	**C**
COURSE NAME	**WORKSHOP PRACTICES**	**1**	**0**	**2**	**3**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 1:3:0		**1**	**0**	**2**	**5**

COURSE OBJECTIVES

- To obtain skills in machining methods, casting process, moulding methods and welding etc.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Summarize*** the machining methods and ***Practice*** machining operation.	Cognitive Psychomotor	UnderstandGuided Response
CO2	***Defining***metal casting process, moulding methods and **relates**Casting and Smithy applications.	Cognitive Psychomotor	Remember Perception
CO3	***Plan*** basic carpentry and fitting operation and ***Practice*** carpentry and fitting operations.	Cognitive Psychomotor	Apply Guided Response
CO4	***Summarize*** metal joining operation and ***Practice*** welding operation.	Cognitive Psychomotor	UnderstandGuided Response
CO5	***Illustrate*** the, electrical and electronics basics and ***Makes*** appropriate connections**.**	Cognitive Psychomotor	Understand Origination

COURSE CONTENT

EXP.NO	**TITLE**	**COs**
1	Introduction to machining process	CO1
2	Plain turning 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

THEORY: 15 **TUTORIAL:0** **PRACTICAL:30** **TOTAL: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.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana etal; 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, Dhanpat Rai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES

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

XWP205 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	2	2	2	2	2	10	2
PO_2	1	1	1	1	1	5	1
PO_3	2	2	2	2	2	10	2
PO_4	2	2	2	2	2	10	2
PO_5	1	1	1	1	1	5	1
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	1	1	1	1	1	5	1
PO_9	1	1	1	1	1	5	1
PO_{10}	0	0	0	0	0	0	0
PO_{11}	1	1	1	1	1	5	1
PO_{12}	2	2	2	2	2	10	1
PSO_1	0	0	0	0	0	0	0
PSO_2	0	0	0	0	0	0	0
TOTAL	13	13	13	13	13	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XEM206**	**L**	**T**	**P**	**C**
COURSE NAME	**ENGINEERING MECHANICS**	**0**	**0**	**3**	**3**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 3.5:0.25:0.25		**0**	**0**	**3**	**3**

COURSE OBJECTIVES

Upon successful completion of the course, student will have:

- *Ability to apply mathematics, science, andengineering.*
- Ability to design and conduct experiments, as well as to analyze and interpretdata.
- Ability to identify, formulate, and solve engineeringproblems.
- Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of thelimitations.
- Ability to comprehend the thermodynamics and their corresponding processes that influence the behavior and response of structural components.
- Ability to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) and thermodynamics to model, analyze, design, and realize physical systems, components, orprocesses.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Explain*** the principles forces, laws and theirapplications.	Cognitive	Understanding, Apply
CO2	***Classification***of friction, and ***apply*** the forces in Trusses and beams.	Cognitive	Understanding, Apply
CO3	***Explain*** and ***Apply*** moment of Inertia and Virtual work	Cognitive	Understanding, Apply
CO4	***Outline*** and ***Examine*** Dynamics	Cognitive	Understanding, Apply
CO5	***Explain*** free and forced vibration	Cognitive	Remember, Understanding

UNIT I INTRODUCTION TO ENGINEERING MECHANICS 9L+3T

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static indeterminacy.

UNIT II FRICTION AND BASIC STRUCTURAL ANALYSIS 9L+3T

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.

UNIT III CENTROID , CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD **9L+3T**

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.

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 ofequilibrium.

UNIT IV REVIEW OF PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS OF RIGID BODIES **9L+3T**

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). Types of motion, Instantaneous centre 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 bodyrotation.

UNIT V MECHANICAL VIBRATIONS **9L+3T**

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

TEXT BOOKS

1. Hisrich, 2016, Entrepreneurship, Tata McGraw Hill, New Delhi.
2. S.S.Khanka, 2013, Entrepreneurial Development, S.Chand and Company Limited, New Delhi.

REFERENCE BOOKS

1. Mathew Manimala, 2005, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition.
2. Prasanna Chandra, 2009, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill.
3. P.Saravanavel, 1997, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai.
4. Arya Kumar,2012, Entrepreneurship: Creating and Leading an Entrepreneurial organisation, Pearson Education India.
5. Donald F Kuratko, T.V Rao, 2012, Entrepreneurship: A South Asian perspective, Cengage Learning India.
6. Dinesh Awasthi, Raman Jaggi, V.Padmanand, Suggested Reading / Reference Material for Entrepreneurship Development Programmes (EDP/WEDP/TEDP), EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad.

E-REFERENCES

1. Jeff Hawkins, "Characteristics of a successful entrepreneur", ALISON Online entrepreneurship courses, "https://alison.com/learn/entrepreneurial-skills

2. Jeff Cornwall, "Entrepreneurship -- From Idea to Launch", Udemy online Education, https://www.udemy.com/entrepreneurship-from-idea-to-launch/

LECTURE: 45 TUTORIAL: 15 PRACTICAL: 0 TOTAL:60

XEM206 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	1	1	1	1	1	5	1
PO_2	2	2	2	2	3	11	3
PO_3	3	3	3	3	3	15	3
PO_4	1	1	1	1	1	5	1
PO_5	0	0	0	0	0	0	0
PO_6	3	3	3	3	3	15	3
PO_7	1	1	1	1	1	5	1
PO_8	0	3	0	1	3	7	2
PO_9	3	3	3	3	3	15	3
PO_{10}	1	1	1	3	3	9	2
PO_{11}	2	2	2	3	3	12	3
PO_{12}	2	2	2	3	3	12	3
PSO_1	2	2	2	3	3	12	3
PSO_2	2	2	2	3	3	12	3
TOTAL	23	26	23	30	33	-	-

1-6 → 1, 7-12 → 2, 13-18 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XCP207**	**L**	**T**	**P**	**C**
COURSE NAME	**PROGRAMMING FOR PROBLEM SOLVING LAB**	**0**	**0**	**1**	**1**
PREREQUISITES	**BASIC UNDERSTANDING SKILLS**	**L**	**T**	**P**	**H**
C:P:A	**0.75:0.25:0**	**0**	**0**	**2**	**2**

LEARNING OBJECTIVES

- To learn programming language basics and syntax
- To ignite logical thinking
- To understand structured programming approach
- To deal with user defined data types
- To know about data storage in secondary memory

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Solve*** simple programs using I/O statements	Cognitive Psycomotor	Apply Responding
CO2	***Solve*** programs using control structures and arrays	Cognitive Psycomotor	Apply Responding
CO3	***Solve*** programs using functions and pointers	Cognitive Psycomotor	Apply Responding
CO4	***Solve*** programs using structures	Cognitive Psycomotor	Apply Responding
CO5	***Solve*** programs using files	Cognitive Psycomotor	Apply Responding

LIST OF EXPERIMENTS

Ex. No	**Experiments**	**COs**
1.	Program to display a Leave Letter as per proper format	CO1
2.	i. Program for addition of two numbers ii. Program to solve any mathematical formula.	CO1
3.	Program to find greatest of 3 numbers using Branching Statements	CO2
4.	Program to display divisible numbers between n1 and n2 using looping Statement	CO2
5.	Program to search an array element in an array.	CO2
6.	Program to find largest / smallest element in an array.	CO2
7.	Program to perform string operations.	CO3
8.	Program to find area of a rectangle of a given number use four function types.	CO3
9.	Programs to pass and receive array and pointers using four function types	CO3
10.	Programs using Recursion for finding factorial of a number	CO3
11.	Program to read and display student mark sheet of a student structures with variables	CO4
12.	Program to read and display student marks of a class using structures with arrays	CO4
13.	Program to create linked list using structures with pointers	CO4
14.	Program for copying contents of one file to another file.	CO5
15.	Program using files to store and display student mark list of a class using structures with array	CO5

TUTORIAL:0 **PRACTICAL:30** **TOTAL:30**

XCP207 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	CO4	CO5	Total	Scaled to 0,1,2 and 3
PO_1	3	3	2	2	2	12	3
PO_2	2	2	2	2	2	10	2
PO_3	0	0	1	1	1	3	1
PO_4	0	0	2	2	0	4	1
PO_5	3	2	2	2	2	11	3
PO_6	0	0	0	0	0	0	0
PO_7	0	0	0	0	0	0	0
PO_8	0	0	0	0	1	1	1
PO_9	0	0	0	0	0	0	0
PO_{10}	0	0	0	0	2	2	1
PO_{11}	2	2	2	2	2	10	2
PO_{12}	3	3	2	2	2	12	3
PSO_1	2	2	2	2	2	10	2
PSO_2	0	0	0	0	0	0	0
TOTAL	15	14	15	15	16	-	-

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE	**XAC208**	**L**	**T**	**P**	**C**
COURSE NAME	**APPLIED CHEMISTRY FOR ENGINEERS LAB**	**0**	**0**	**1**	**1**
PREREQUISITES	**NIL**	**L**	**T**	**P**	**H**
C:P:A= 0:2:0		**0**	**0**	**1**	**2**

COURSE OBJECTIVES

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Ability*** to Identify the principles of chemistryrelevant to the study of science and engineering	Cognitive Psychomotor	Remember Perception
CO2	***Analyze***and ***Measure*** molecular/system propertiessuch as surface tension, viscosity, conductance ofsolutions, redox potentials, extent of hardness, chloride content ofwater, etc.	Cognitive Psychomotor Affective	Understand Analyze Perception Receive
CO3	***Analyze*** the synthetic procedure and rate constants of reactions from concentration of reactants/products as afunction of time	Cognitive	Apply

LIST OF EXPERIMENTS

Ex. No	**Experiments**	**COs**
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.	CO3
8.	Estimation of iron by colorimetric method.	CO3
9.	Synthesis of a polymer/drug.	CO3
10.	Saponification/acid value of oil.	CO3

LECURE:0 **TUTORIAL: 0** **PRACTICAL: 30** **TOTAL:30**

TEXT BOOKS

1. Laboratory Manual "ChemistryLab", Department of Chemistry, PMIST, Thanjavur.

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://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques
3. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011

XAC208 - Mapping of CO with PO

CO Vs PO	CO1	CO2	CO3	Total	Scaled to 0,1,2 and 3
PO_1	3	2	2	7	2
PO_2	3	2	2	7	2
PO_3	3	2	2	7	2
PO_4	3	2	2	7	2
PO_5	2	1	1	4	1
PO_6	3	2	2	7	2
PO_7	3	2	2	7	2
PO_8	0	1	0	1	0
PO_9	1	1	1	3	1
PO_{10}	1	1	1	3	1
PO_{11}	1	1	0	2	1
PO_{12}	0	1	0	1	0
PSO_1	0	1	0	1	0
PSO_2	0	1	0	1	0

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

Semester	**III**
Subject Name	**FLUID MECHANICS**
Subject Code	**XCE 302**

L	T	P	C
3	1	0	4

C	P	A
3	1	0

L	T	P	H
3	2	0	5

	Course Outcome: *After the completion of the course, students will be able to*	***Domain C or P or A***	***Level***
CO1	Acquiring knowledge of fluid mechanics fundamentals, including concepts of mass and momentum conservation	Cognitive	Knowledge
CO2	Application of Bernoulli equation to solve problems in fluid mechanics	Cognitive	Application
CO3	Identify the losses in pipes and field applications	Cognitive Psychomotor	Knowledge Measure
CO4	Perform dimensional analysis for problems in fluid mechanics.	Cognitive	Analyse
CO5	Acquiring knowledge of fluid mechanics fundamentals, including concepts of mass and momentum conservation	Cognitive	Knowledge

COURSE CONTENT

UNIT I **FLUID PROPERTIES AND FLUID STATICS12 hrs** **15**

Fundamental definitions dimensions and units – fluid properties – classification of fluids. Concepts of fluid pressure and its measurement (manometer) – forces on solid surfaces buoyancy and floatation – fluid mass under relative equilibrium.

UNIT II **FLUID KINEMATICS12 hrs** **15**

Lagrangian and Eulerian methods – Classification of flow – Streamlines, path lines and streak lines – Continuity equation – Velocity potential and Stream function – Flow nets.

UNIT III **FLUID DYNAMICS** **15**

Euler's and Bernoulli's equations – Application of Bernoulli's equation – orifice meter, Venturimeter, Pitot tube, flow through orifice, mouthpiece, weir and notch, momentum principle. Flow through pipes: Loss of energy in pipes – pipes in series and parallel – moody diagram.

UNIT IV **DIMENSIONAL ANALYSIS AND SIMILITUDE** **15**

Dimensional homogeneity - Non Dimensional parameter - Π theorem - dimensional analysis - choice of variables - Rayleigh methods. Model analysis - similitude, types of similarities, force ratio, similarity laws - model classification, scale effects.

UNIT V **BOUNDARY LAYER** **15**

Definition of boundary layer – Displacement, momentum and energy thickness – laminar and turbulent boundary layers – Total drag on flat plate due laminar and turbulent boundary layer - Separation of boundary layers and its control.

L	T	P	Total
45	15	0	60

TEXT BOOKS

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

2011.

2. Kumar K.L., Engineering Fluid Mechanics, S.Chand (p) Ltd., New Delhi, 2008.
3. Natarajan, M.K., Principles of Fluid Mechanics, Oxford and IBH publishing Co. New Delhi, 2008.
4. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi, 2010

REFERENCES

1. Prof. S. Nagarathinam , Fluid Mechanics , Khanna Publishers, New Delhi
2. K. R. Arora,Fluid Mechanics, Hydraulics and Hydraulics Machines, Standard Publishers, New Delhi,2011
3. P. N. Modi & S. M. Sethi "Hydraulics, Fluid Mechanics and Hydraulics Mechanics" Standard Publishers, New Delhi, 2009

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	3	3	--	--	--	--	--	--	--	--	--	--	--	--
CO 2	3	3	1	--	--	--	--	--	--	--	--	--	2	1
CO 3	3	3	--	--	--	--	--	--	--	--	--	--	--	--
CO 4	2	2	--	--	--	--	--	--	--	--	--	--	2	--
CO 5	1	1	--	--	--	--	--	--	--	--	--	--	--	--
	12	12	1	--	--	--	--	--	--	--	--	--	4	1

1 - Low, 2 – Medium, 3 – High

Semester **III**

Subject Name **SURVEYING**

Subject Code **XCE 303**

L	T	P	C
3	0	1	4

C	P	A
1.5	1.0	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	***Identify*** the Principles and function of various surveying methods	Cognitive Psychomotor	Understanding Manipulation
CO2	***Identify*** the types of Levelling and ***determine*** the reduced levels using Dumpy Level	Cognitive Psychomotor Affective	Applying Manipulation Responding
CO3	***Classify*** the methods of Contouring and measure the capacity of Reservoir	Cognitive Psychomotor	Understanding Manipulation
CO4	***Describe*** the methods and ***measure*** the angles and distances using Theodolite and Tacheometric Surveying	Cognitive Psychomotor Affective	Understanding Manipulation Responding

CO5	***Identify*** the Principles and function of various surveying methods	Cognitive Psychomotor	Understanding Manipulation

COURSE CONTENT

UNIT I	**BASIC SURVEYING**	**9**

Introduction to Plane and Geodetic Surveying –Scales- Chain surveying- Distance Measurement –offsets- Field Book- Compass Instrument - Measurement of angles and directions - Magnetic declination and its variation- Local attraction - traverse-Plane Table Surveying – Principle-Equipment -Two point and three point problem.

UNIT II	**LEVELLING**	**9**

Leveling - terms and definitions - Instruments and its parts -Temporary and permanent adjustments - Reduction of level - Height of collimation and Rise and fall methods - Reciprocal leveling -Longitudinal and cross sectioning - Contouring -Capacity of reservoirs.

UNIT III	**THEODOLITE AND TACHEOMETRY**	**9**

Description of theodolite - Measurement of horizontal angles and vertical angles - Methods of repetition and reiteration –Tachometry - Tachometric systems - Determination of Instrument constants-Problems in tachometry survey.

UNIT IV	**TRIANGULATION**	**9**

Triangulation system, Requirements for selection of triangulation stations - Satellite station, signals, Phase of signal -Trignometrical leveling Both base of object accessible and inaccessible, problems.

UNIT V	**MODERN SURVEYING**	**9**

Introduction to advance surveying - Total Station and Global positioning system - Geographic information system (GIS)- Photogrammetry - Stereoscopy – Principle of Electromagnetic distance measurement

PRACTICAL	**30**

1. Chain surveying- Distance Measurements.
2. - Magnetic declination and its variation.
3. Two point and three point problem.
4. Height of collimation and Rise and fall methods.
5. Longitudinal and cross sectioning – Contouring.
6. Single plane method and double plane method.
7. Determination of Instrument constants.
8. Determination of reduce level using theodalite by Angle of elevation and depression method.
9. Area calculation and contouring using Total Station.
10. Co ordinate measurement using Global positioning.

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Punmia B.C. Surveying, Vols. I, II and III, Laxmi Publications, 2014
2. Bannister A. and Raymond S., Surveying, ELBS, Sixth Edition, 2014
3. Kanitkar T.P., Surveying and Levelling, Vols. I and II, United Book Corporation, Pune, 2014.
4. S.C.Rangwala and P. S. Rangwala, Charotar Surveying and leveling, Publishing House

Pvt. Ltd, 2014.

REFERENCES

1. Agor ,"A Text Book of Surveying and Levelling" Khanna Publishers, 11th Edition, 2014
2. Basak.N. "Surveying and Leveling" McGraw Hill Education (India) Private Limited, 2nd Edition,2014
3. Subramanian.R Surveying and Leveling by Oxford University Press, 2007

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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	3	3	3	3	3	3	1	3	3	1	3	3	3	3
	13	**10**	**13**	**15**	**15**	**12**	**7**	**15**	**11**	**11**	**13**	**15**	**15**	**14**

Semester **III**
Subject Name **SOLID MECHANICS**
Subject Code **XCE 304**

L	T	P	C
3	1	1	5

C	P	A
1.5	1.0	0.5

L	T	P	H
3	2	2	7

Course Outcome: After the completion of the course, students will be able to		***Domain C or P or A***	***Level***
CO1	Analyse stresses and strains in members subjected to axial, bending and torsional loads.	Cognitive Psychomotor	Analyse Measure
CO2	Examine the stability of structural members by studying the reactions and internal forces.	Cognitive	Analyse
CO3	Find out the critical point in structural members where maximum shear force and bending moment occur at various loading conditions.	Cognitive Affective	Analyse Response
CO4	Evaluate the deflection and shear stress distribution for beams of varioussections.	Cognitive Psychomotor	Analysis Measure
CO5	Assess the output of springs and shafts for its maximum energy.	Cognitive Psychomotor	Knowledge Response

COURSE CONTENT

UNIT I **STRESS, STRAIN AND DEFORMATION OF SOLIDS** **15**

Stress, Strain, Hooke's Law, Elastic Constants, Thermal stress, deformation of simple and compound bars – shear modulus, bulk modulus, relationship between elastic constants, biaxial state of stress – stress at a point – stress on inclined plane – Principal stresses and Principal planes.

UNIT II	ANALYSIS OF PLANE TRUSS, THIN CYLINDERS/SHELLS	15

Stability and equilibrium of plane frames – types of truss – analysis of forces in truss members method of joints, method of sections– Graphical Method - Thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells.

UNIT III	TRANSVERSE LOADING AND STRESSES OF BEAMS	15

Beams–Types of Supports, Types of Load –Relationship between Bending Moment and Shear Force–Shear Force and Bending Moment Diagrams for Statically Determinate Beam with Concentrated Load, Uniformly Distributed Load, Uniformly Varying Load. Theory of Simple Bending – Analysis of Stresses.

UNIT IV	DEFLECTION AND SHEAR STRESSES OF BEAMS	15

Double Integration Method - Macaulay's Methods - Area Moment Method - Conjugate Beam Method for computation of Slopes and Deflections of determinant beams-Variation of Shear Stress– Shear Stress distribution in Rectangular and I Sections, Solid and Hollow Circular Sections, Angle and Channel Sections.

UNIT V	TORSION AND SPRINGS	15

Stresses and deformation in circular (solid and hollow shafts) – stepped shafts – shafts fixed at both ends – leaf springs – stresses in helical springs – deflection of springs

PRACTICAL	30

1.Tension test on HYSD bar / MS rod

2. Impact Test(Izod and Charpy)

3. Hardness Test(Brinells and Rockwell)

4. Test on timber

   i) Compressive strength test

   ii)Tensile strength test

   iii)Shear Strength test

   iv) Static bending test

5. Deflection Test

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Bansal.R.K. “A Text Book of Strength of materials”, Laxmi Publications, Sixth Edition,2015
2. Bhavikatti.S. “Strength of Materials”, Vikas Publishing House Pvt Limited, Fourth Edition, 2013
3. Khurmi. R.S “Strength of Materials “, S.Chand Limited, Revised edition, 2013
4. Rajput. R.K. “Strength of Materials “, 2012, S.Chand Limited, Revised Edition,2012.

REFERENCES

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.

Mapping of CO with PO'S														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 0**	**PO11**	**PO 2**	**PSO1**	**PSO2**
CO 1	2	3	--	1	3	--	--	--	**--**	--	2	--	2	--
CO 2	1	2	--	--	--	--	--	--	**--**	**--**	1	--	1	--
CO 3	1	3	--	--	--	2	--	--	**--**	**--**	2	--	2	--
CO 4	1	2	2	1	--	--	1	1	**--**	**--**	2	--	1	--
CO 5	1	1	1	--	3	--	1	1	**--**	**--**	--	--	1	--
	6	11	3	2	6	2	2	2	--	--	7	--	7	**--**

Semester **III**

Subject Name **ENGINEERING MATERIALS**

Subject Code **XCE305**

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 and characterize building materials	Cognitive	Understand
CO2	Understand the manufacturing process of bricks and cement	Cognitive	Remember
CO3	Identify the methods for preservation of timber and metals	Cognitive	Understand
CO4	Understand the use of non-conventional Civil Engineering materials	Cognitive	Understand

COURSE CONTENT

UNIT I **BUILDING STONES, BRICK & OTHER CLAY PRODUCTS** **9**

Classification of stones- Characteristics of good building stones, important types of building atones, their properties and stones and uses. Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, classification and testing of bricks, special types of bricks and their uses. Types of tiles and their use in buildings. Terracotta, stoneware.

UNIT II **LIME & CEMENT** **9**

IS classification of lime and uses, flow diagram of manufacturing process of cements, chemical composition of cement, IS specifications and tests on Portland cement, different types of cements and their uses.

UNIT III **MORTAR & CONCRETE** **9**

Preparation of cement mortar and concrete, proportion of mortars and concrete for different types of works, properties of concrete in plastic and hardened stages, factors affecting strength of concrete, types of concrete and their specific use.

UNIT IV **TIMBER & WOOD BASED PRODUCTS** **9**

Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses.

UNIT V **CONSTRUCTION MATERIALS** **9**

Types of steel-mild steel, high carbon steel, high strength steel- properties and uses, commercial forms of steel and their uses. Introduction to some new materials: Ferro cement, super plasticizers, FAL-G brick, fly ash, plastics, paints, and geotextiles.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Civil Engineering Materials and Construction Practices by R.K. GUPTA, Jain Brothers, New Delhi, 5th Edition , 2014
2. Civil Engineering Materials by S.C. Rangwala, Charotar Publishing House 41 edition, 2014
3. B.C Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction 10th Edition, Laxmi Publications Pvt., Ltd., 2010.

REFERENCES

1. S. K. Sharma, B. K. Kaul, Textbook Of Building Construction , Indiawise, 1980-05
2. Bujang B. K. Huat, Faisal Haji Ali, Husaini Omar, Foundation Engineering: Design and Construction in Tropical Soils, Taylor & Francis Group, 2006
3. National Building Code of India, Part I –X 2010

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	--	--	1	1	1	--	--	--	--	--	2	--	--
CO 2	1	--	--	2	2	1	2	--	--	--	--	1	--	--
CO 3	1	--	--	2	1	--	1	--	--	--	--	1	--	--
CO 4	2	--	--	2	2	--	--	--	--	--	--	2	--	--
	6	--	--	7	6	2	3	--	--	--	--	6	**--**	**--**

Semester **III**
Subject Name **ENTREPRENEURSHIP DEVELOPMENT**
Subject Code **XEP 306**

L	T	P	C
2	0	0	2

C	P	A
3	0	1

L	S	T	P	H
2	1	0	0	3

Course Outcome: After the completion of the course, students will be able to		***Domain C or P or A***	***Level***
CO1	Recognise and describe the personal traits of an entrepreneur.	Cognitive Affective	Understand Receive
CO2	Determine the new venture ideas and analyse the feasibility report.	Cognitive	Understand & Analyse
CO3	Develop the business plan and analyse the plan as an individual or in team.	Cognitive Affective	Analyse Receive
CO4	Describe various parameters to be taken into consideration for launching and managing small business.	Cognitive	Understand
CO5	Describe Technological management and Intellectual Property Rights.	Cognitive Psychomotor	Understand

COURSE CONTENT

UNIT I	**ENTREPRENEURIAL TRAITS AND FUNCTIONS**	**9**

Definition of Entrepreneurship; competencies and traits of an entrepreneur; factors affecting Entrepreneurship Development; Role of Family and Society ; Achievement Motivation; Entrepreneurship as a career and national development.

UNIT II	**NEW PRODUCT DEVELOPMENT AND VENTURE CREATION**	**9**

Ideation to Concept development; Sources and Criteria for Selection of Product; market assessment ; Feasibility Report ;Project Profile; processes involved in starting a new venture; legal formalities; Ownership; Case Study.

UNIT III	**ENTREPRENEURIAL FINANCE**	**9**

Financial forecasting for a new venture; Finance mobilization; Business plan preparation; Sources of Financing, Angel Investors and Venture Capital; Government support in startup promotion.

UNIT IV	**LAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT**	**9**

Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.

UNIT V	**TECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE**	**9**

Technology management; Impact of technology on society and business; Role of Government in supporting Technology Development and IPR protection; Entrepreneurship Development Training and Other Support Services.

L	S	T	P	Total
30	15	0	0	45

TEXT BOOKS

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2016.
2. S.S.Khanka,, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2013.

REFERENCES

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition2005,.
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 2009.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai, 1997,.
4. Arya Kumar, Entrepreneurship: Creating and Leading an Entrepreneurial Organisation, Pearson Education India,2012
5. Donald F Kuratko, T.V Rao, Entrepreneurship: A South Asian perspective, Cengage Learning India,2012.
6. Dinesh Awasthi, Raman Jaggi, V.Padmanand, Suggested Reading / Reference Material for Entrepreneurship Development Programmes (EDP/WEDP/TEDP), EDI Publication.

E-REFERENCES

1. Jeff Hawkins, " Characteristics of a successful entrepreneur", ALISON Online entrepreneurship courses, "https://alison.com/learn/entrepreneurial-skills
2. Jeff Cornwall, "Entrepreneurship -- From Idea to Launch", Udemy online Education, https://www.udemy.com/entrepreneurship-from-idea-to-launch/
3. Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf

Mapping of CO with GA's

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

Semester **III**

Subject Name **IN-PLANT TRAINING-I**

Subject Code **XCE 308**

L	T	P	C
0	**0**	**0**	**1**

C	P	A
2	**2**	**2**

L	T	P	H
0	**0**	**0**	**0**

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

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

Mapping of CO with GA's

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

1-Low , 2- Medium ,3-High

Semester	**IV**
Subject Name	**CONCRETE TECHNOLOGY**
Subject Code	**XCE 402**

L	T	P	C
2	0	1	3

C	P	A
2	0.75	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	***Identify*** and ***test*** the properties of ingredients of Concrete	Cognitive Psychomotor Affective	Understand Manipulation Responding
CO2	***Identify*** and ***test*** the properties of Concrete	Cognitive Psychomotor Affective	Understand Manipulation Responding
CO3	***Carry out*** the mix design of M20 and M35 as per IS456	Cognitive Psychomotor	Understand Manipulation
CO4	***Ensure***quality during Transporting, Laying, Compacting and finishing of concrete	Cognitive	Understand
CO5	***Adopt*** special concreting technologies to meet out the modern construction requirements.	Cognitive	Understand

COURSE CONTENT

UNIT I	**CONSTITUENT MATERIALS**	**6**

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

UNIT II	**FRESH CONCRETE**	**6**

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

UNIT III	**CONCRETE MIX DESIGN**	**6**

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

UNIT IV	**HARDENED CONCRETE**	**6**

Concepts of mix design - Factors influencing mix design – ACI and IS code recommended mix design methods; Non-pump able concrete; Pump able concrete.

UNIT V	**SPECIALCONCRETES**	**6**

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

PRACTICAL 15

S.No.	List of Experiments	Cos
1.	Determination of Specific gravity of Cement	1
2.	Work out the fineness of Cement	1
3.	Find out the Consistency of Cement	1
4	Compute the Setting time of Cement	1
5	Determine the Fineness modulus of fine aggregate	1
6	Calculate the Specific gravity of fine aggregate	1
7	Find out the Bulking of fine aggregate	1
8	Estimate the Fineness modulus of coarse aggregate	1
9	Compute the Specific Gravity of Coarse aggregate	1
10	Find out the Bulking of coarse aggregate	1
11	Carry out the Aggregate Impact test	1
12	Determine the workability of Concrete through Slump Cone Test	2
13	Compute the Compaction Factor for the given mix ratio of concrete	2
14	Carry outthe mix design of M20 and M35 as per IS 456	3
15	Determine the Compressive Strength of Concrete Cube	3

L	T	P	Total
30	0	15	45

TEXT BOOKS

1. Shetty,M.S. “Concrete Technology: Theory and Practice”,7th edition, S.Chand& Company, New Delhi,2014.

REFERENCES

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

E-REFERENCES

1. http://nptel.ac.in/courses/105102012
2. http://nptel.ac.in/courses/105104030
3. http://freevideolectures.com/Course/3357/Concrete-Technology
4. http://engineeringvideolectures.com/course/289

Mapping of CO with PO'S

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

Semester **IV**

Subject Name **GEOTECHNICAL ENGINEERING**

Subject Code **XCE 403**

L	T	P	C
3	0	1	4

C	P	A
1.25	0.75	0.25

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	***Identify*** and ***test*** various types and properties of soils for engineering utilization.	Cognitive Psychomotor	Understanding Observation
CO2	***Recognise*** the deformation behaviour of soil	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO3	***Determine*** and ***analyse*** the Strength parameters of soil.	Cognitive, Psychomotor Affective	Applying Manipulation Valuing
CO4	***Compute*** the load carrying capacity of Shallow foundation for different soils.	Cognitive	Analysing
CO5	***Compute*** the load carrying capacity of Deep foundation for different soils.	Cognitive	Analysing

COURSE CONTENT

UNIT I **SOIL PROPERTIES** **9**

Index properties including consistency limits and grain size distribution – Identification and classification of soil – Textural HRB and BIS specification –Soil water – Concept effective and neutral stresses – Darcy's law, Permeability –Seepage flow, seepage pressure, exit gradient – significance of Laplace equation – quick sand condition, Soil sensors applied in field, Modern advancements , Trenchless Technology.

UNIT II **COMPACTION AND CONSOLIDATION** **9**

Compaction – Factors affecting compaction – Field compaction – Field compaction controls, CBR value. Consolidation of soils – Terzaghi's one dimensional consolidation theory – pressure void ratio relationship – prediction of pre

consolidation pressure – Total settlement and time rate settlement – secondary compression – coefficient of consolidation – Curve fitting methods, consolidation models.

UNIT III STRESS DISTRIBUTION AND SHEAR STRENGTH 9

Vertical stress distribution in soil - Boussinesq's and Westerguard's equations – New mark's influence chart – Principle, Construction and use - Equivalent point load and other approximate procedures, stress isobars & pressure bulbs Shear Strength; Mohr – Coulomb failure criterion and models – shear properties of cohesion less and cohesive soils - Shear Strength. Parameters for under consolidated, normally consolidated and over consolidated clays

UNIT IV BEARING CAPACITY AND SUB SOIL INVESTIGATION 9

Bearing capacity - Ultimate and allowable theories of bearing capacity - Terzaghi, Balla, Skempton, Mayerhof & Hansan. I.S.Code on B.C., Determination of BC, factors affecting BC, limits of total and differential settlement, Methods of exploration, geophysical and conventional methods; Sounding drilling and boring technique; Field tests – penetration tests

UNIT V FOUNDATIONS 9

Foundations - types & selection, footing, rafts and floating foundation, -Philosophy of deep foundation, piles, estimation of individual and group capacity of piles in cohesive and non-cohesive soils, static and dynamic approaches, pile load test, settlement of pile groups, negative skin friction.

PRACTICAL 30

S.No.	List of Experiments
1.	Moisture content of Soil
2.	Atterberg Limits Test
3.	Grain Size Distribution-Sieve Analysis and Hydrometer Analysis
4	Field Density of soil by Sand Replacement method and Core Cutter method
5	Relative Density of Soil and Free Swell index of soil
6	Specific Gravity by Pycnometer and density bottle
7	Moisture- Density relationship using standard Proctor test.
8	Permeability determination(constant head and falling head methods)
9	Direct shear test on cohesionless soil.
10	Unconfined compression test on cohesive soil
11	Triaxial compression test
12	One dimensional consolidation test(co-efficient)

L	T	P	Total
45	0	30	75

TEXT BOOKS

1. Punmia. B.C., Asok Kumar Jain and Arun Kumar Jain, "Soil Mechanics and Foundations" Laxmi Publications Pvt. Ltd., New Delhi, Sixteenth edition, 2006.
2. Murthy, V.N.S. Soil Mechanics and Foundation Engineering, CBS Publishers and Distributors, Reprint, 2009.
3. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 4th edition, 2012.

REFERENCES

1. Braja.M.Das, "Principles of Geotechnical Engineering", Cengage Engineering published by Global Engineering, 8th Edition ,2014
2. IS 1080:1985, Code of practice for design and construction of foundations in soils (other than raft, ring and shell) (second revision) Re affirm date Dec 2011
3. IS 1498:1970, Classification and identification of soils for general Engineering purposes (first revision) Reaffirm Dec 20113

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	3	3			3				1			1	1	1
CO 2	3				3				1			1	1	1
CO 3	2	3			3				1			2	1	1
CO 4	2		3	3		3		1	1	2	2		2	1
CO 5	2		3	3		3		1	1	1	2		2	1
	12	**6**	**6**	**6**	**9**	**6**		**2**	**5**	**3**	**4**	**4**	**7**	**5**

Semester	**IV**
Subject Name	**OPEN CHANNEL FLOW AND HYDRAULIC MACHINES**
Subject Code	**XCE 404**

L	T	P	C
3	**1**	**1**	**5**

C	P	A
1.25	**0.75**	**0.25**

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	***Illustrate*** the various theories dealing with the flow phenomenon of fluids and ***Design*** the open channels	Cognitive Affective Psychomotor	Applying Responding Observation
CO2	***Identify***the impact of jet on different shapes of plate.	Cognitive Affective	Understanding Valuing
CO3	***Classify*** and ***design*** of the hydro-machinery and the components, function and use of different types of turbines.	Cognitive Affective Psychomotor	Applying Evaluating Manipulation
CO4	***Describe*** and ***Discuss*** the working principles of pumps	Cognitive	Remembering
CO5	***Choice*** the type of pump for a practical situation	Cognitive Affective Psychomotor	Remembering Valuing Observation

COURSE CONTENT

UNIT I	**OPEN CHANNEL FLOW**	**15**

Open channel flow - Classification – Terminology - velocity distribution in open channels - Chezy, Manning and other formulae – Best hydraulic section - specific energy - specific force - hydraulic jump and its characteristics – Gradually varied flow surface profiles – notches, weirs and venturiflumes – discharge through notches.

UNIT II	**IMPACT OF JET**	**15**

Principles of impingement of jets – Impact of jet on a stationary vertical plate, stationary inclined plate, stationary curved plate, hinged plate, moving vertical and inclined plates, moving curved plate, series of moving flat and curved vanes.

UNIT III	**TURBINES**	**15**

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

UNIT IV	**CENRIFUGAL PUMP**	**15**

Centrifugal pump – description and working – head, discharge and efficiency of a Centrifugal pump - pressure rise in the pump – minimum starting speed of a pump – cavitation – characteristics curves – priming – multistage pumps

UNIT V	**OTHER PUMPS**	**15**

Reciprocating pump - description and working – types – discharge and slip – power required to drive the pump – indicator diagram- air vessel – work done against friction with and without air vessels – working principle and use of- deep well pumps – submersible and jet pumps, special pumps – gear pump – screw pump, sewage pump.- Characteristics test on jet pump, gear pump, vane pump, reciprocating pump.

PRACTICAL		**30**

S.No.	**List of Experiments**
1.	Notches
2.	Venturimeter
3.	Friction factor of the pipe
4	Centrifugal Pump
5	Reciprocating Pump
6	Jet Pump
7	Submersible Pump
8	Pelton Turbine
9	Francis Turbine

L	**T**	**P**	**Total**
45	**15**	**15**	**75**

TEXT BOOKS

1. Subramanya, “Flow in Open channels”, McGraw Hill Education (I), New Delhi, 2015.
2. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 2011.
3. R.K.Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand & Company Ltd., New Delhi, 2002.

REFERENCES

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 Mc Graw Hill Education (P) Ltd., New Delhi, 2011

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	3	3	2	0	3	2	1	1	1	1	1	1	2	1
CO 2	3	3	2	0	1	1	1	1	0	1	0	1	1	1
CO 3	3	3	2	1	2	2	1	1	1	1	1	1	1	1
CO 4	2	3	2	1	2	1	0	1	0	1	0	1	2	1
CO 5	2	3	2	1	1	1	1	0	1	1	1	1	1	1
	13	**15**	**10**	**3**	**2**	**7**	**4**	**5**	**3**	**5**	**3**	**5**	**7**	**5**

Semester **IV**

Subject Name **STRUCTURAL MECHANICS**

Subject Code **XCE 405**

L	T	P	C
3	1	0	4

C	P	A
2.00	0.50	0.50

L	T	P	H
3	2	0	5

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

		Domain C or P or A	***Level***
CO1	***Identify*** the behavior of structural element and ***Discuss*** the failure theories.	Cognitive & Affective	Remembering & Respond
CO2	***Analyse*** indeterminate structures and ***Reports*** the results	Cognitive& Affective	Analyzing & Respond
CO3	***Infer***the end conditions&***Discuss*** the failure criteria of the column and cylinder.	Cognitive & Affective	Understanding & Respond
CO4	***Compute and Locate*** the deflection of beams by energy principles.	Cognitive& Affective	Application & Receive
CO5	***Analyse***bending stresses and ***Follows*** basic principles to check the stability of structural elements	Cognitive & Psychomotor	Analyzing & Guided Response

COURSE CONTENT

UNIT I **STATE OF STRESS IN THREE DIMENSIONS** **12**

Stress and strain tensor - Principal stresses and principal planes –Theories of failure - Application of strain gauges for stress analysis.

UNIT II	INDETERMINATE BEAMS	12

Propped cantilever beams and fixed beams - Fixed end moments and support reactions – Analysis of continuous beam - Theorem of Three Moments

UNIT III	COLUMNS AND THICK CYLINDERS	12

Short and Long Columns, Euler's Theory , Eccentrically loaded column - Rankine-Gordon formula - Thick cylinders – Compound cylinders

UNIT IV	ENERGY PRINCIPLES	12

Unit load method for deflection – Castigliano's theorem – Principle of virtual work – Application of energy theorems for computing deflections in beams.

UNIT V	ADVANCED TOPICS	12

Unsymmetrical bending - Curved Beams –Stability of dams and Retaining walls.

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Bansal R.K. "A Text Book of Strength of materials", 2010, Laxmi Publications, Fourth Edition.
2. Bhavikatti.S. S. "Strength of Materials", 2010, Vikas Publishing House Pvt Limited.
3. Rajput. R.K. "Strength of materials", 2011, S.Chand Limited.

REFERENCES

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. Timoshenko.S.B.andGere.J.M,"MechanicsofMaterials",VanNosReinbhold,NewDelhi, 2010.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	1					1			1					
CO 2	2	1				1		1			1		3	1
CO 3	1				1		1				1			
CO 4	3	1		3			1						1	
CO 5	3	3											1	
	10	**5**		**3**	**1**	**2**	**2**	**1**	**1**		**2**		**5**	**1**

Semester	**IV**
Subject Name	**ECONOMICS FOR ENGINEERS**
Subject Code	**XEE 406**

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	***Explain*** the concepts of economics in engineering and ***identify*** element of cost to prepare cost sheet	Cognitive Psychomotor	Understand Perception
CO2	***Calculate and Explain*** the Break-even point and marginal costing	Cognitive Psychomotor	Understand & Apply Perception
CO3	***Summarize*** and ***Use*** value engineering procedure for cost analysis	Cognitive Affective	Understand Receive
CO4	***Estimate*** replacement problem	Cognitive	Understand
CO5	***Compute, Explain*** and ***make Use of*** different methods ofdepreciation	Cognitive	Understand & Apply

COURSE CONTENT

UNIT I	**INTRODUCTION TO ECONOMICS**	**8**

Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost

UNIT II	**BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS**	**12**

Margin of Safety, Profit, Cost & Quantity analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations

Social Cost Benefit Analysis: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis.

UNIT III	**VALUE ENGINEERING &COST ACCOUNTING**	**10**

Value engineering – Function, aims, Value engineering procedure - Make or buy decision.Business operating costs, Business overhead costs, Equipment operating costs

UNIT IV	**REPLACEMENT ANALYSIS**	**7**

Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset.

UNIT V	**DEPRECIATION**	**8**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. S.P Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K Global Publications, Faridabad, Haryana, 2012
2. S.P.Jain & Narang, "Cost accounting – Principles and Practice", Kalyani Publishers, Calcutta, 2012
3. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
4. William G.Sullivan, James A.Bontadelli & Elin M.Wicks, "Engineering Economy",Prentice Hall International, New York, 2001.

REFERENCES

1. Luke M Froeb / Brian T Mccann, " Managerial Economics – A problem solving approach" Thomson learning 2007
2. Truett & Truett, "Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
3. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	1	2	0	1	0	0	1	1	1	2	2	3	--	--
CO 2	2	2	1	2	0	0	2	1	1	2	3	3	--	--
CO 3	2	2	1	3	0	0	2	2	1	2	2	3	--	--
CO 4	1	2	1	2	0	0	0	1	1	1	2	3	--	--
CO 5	1	2	0	1	0	0	1	1	0	1	2	3	--	--
	7	**10**	**3**	**9**	**0**	**0**	**6**	**6**	**4**	**8**	**11**	**15**	**--**	**--**

Semester **IV**

Subject Name **TECHNICAL COMMUNICATION**

Subject Code **XGS 407**

L	T	P	C
1	0	0	1

C	P	A
3	0	0

L	S	T	P	H
1	2	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	Confidence to ***present*** a project in 10 to 15 minutes	Affective	Response
CO4	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

CO5	***Enables*** the speaker speaks clearly and fluently with confidence and it trains the learner to listen actively and critically	Psychomotor	Perception

COURSE CONTENT

UNIT I	**BASIC PRINCIPLES OF GOOD TECHNICAL WRITING**	**9**

Style in technical writing, out lines and abstracts, language used in technical writing: technical words, jargons etc.,

UNIT II	**SPECIAL TECHNIQUES**	**9**

Technical writing: Definition, description of mechanism, Description of a process, Classifications, division and interpretation.

UNIT III	**REPORT/ PROJECT**	**9**

Layout the formats: chapters, conclusion, bibliography, annexure and glossary, Graphics aids etc - Presentation of the written project 10 – 15 minutes

UNIT IV	**SOUNDS OF ENGLISH LANGUAGE**	**9**

Vowels, consonants, diphthongs , word stress, sentence stress, intonation patterns, connected speech etc. - Vocabulary building – grammar, synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, idioms and phrases.

UNIT V	**READING COMPREHENSION**	**9**

Reading for facts, meanings from context, scanning, skimming, inferring meaning, critical reading, active listening, listening for comprehension etc.

L	S	T	P	Total
15	**30**	**0**	**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

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	--	--	--	--	--	1	3	--	--	--	--	--	--	--
CO 2	--	--	--	--	--	1	1	--	--	--	--	--	--	--
CO 3	--	--	--	--	--	1	2	--	--	--	--	--	--	--
CO 4	--	--	--	--	--	1	1	--	--	--	--	--	--	--
CO 5	--	--	--	--	--	1	1	--	--	--	--	--	--	--
	--	**--**	**--**	**--**	**--**	**5**	**8**	**--**	**--**	**--**	**--**	**--**	**--**	**--**

Semester	**V**
Subject Name	**STRUCTURAL ANALYSIS**
Subject Code	**XCE 502**

L	T	P	C
2	1	0	3

C	P	A
2.5	0	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	Identify the behavior of structural element under various loading condition.	Cognitive Affective	Analysis Response
CO2	Understand the advantage of statically indeterminate structure and the statically determinate structure.	Cognitive	Analysis
CO3	Superimpose the effects of settlement and rotation of the supports over the regular analysis.	Cognitive	Analysis
CO4	Apply knowledgeonadvanced methods of analysis of structuresincludingarches and cables.	Cognitive	Analysis
CO5	Recognize the failure mechanism of structural elements.	Cognitive	Analysis

COURSE CONTENT

UNIT I SLOPE DEFLECTION METHOD 12

Continuous beams and Rigid frames (with And without sway) – Symmetry and Asymmetry– Simplification for hinged end – Support Displacements-Introduction to matrix methods

UNIT II 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 III MOVING LOADS AND INFLUENCE LINES 12

Influence Lines for Reactions, Shear Forces and Bending Moments in Determinate Structures – Muller Breslau's principle for indeterminate structures(Reactions, Shear Forces and Bending Moments)

UNIT IV 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

UNIT V PLASTIC ANALYSIS OF STRUCTURES 12

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

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.

REFERENCES

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. Devdas Menon, "Structural Analysis", Narosa Publishers, 2010.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	3	--	--	--	1	2	--	--	--	--	--	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
	10	**10**	**6**	**--**	**2**	**3**	**2**	**1**	**1**	**--**	**2**	**--**	**3**	**1**

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **ENVIRONMENTAL ENGINEERING**

Subject Code **XCE 503**

L	T	P	C
3	**1**	**0**	**4**

C	P	A
2.0	**0.5**	**0.5**

L	T	P	H
3	**2**	**0**	**5**

***Course Outcome**: After the completion of the course, students will be able to*		***Domain C or P or A***	***Level***
CO1	An insight into the structure of drinking water supply systems, including water transport, treatment and distribution	Cognitive	Knowledge
CO2	Able to design the various water and waste water treatment units.	Cognitive	Comprehension
CO3	An understanding of water quality criteria and standards and their relation to public health	Cognitive	Analysis
CO4	The student will be able to identify the characteristics of sewage, distinguish and classify the different sewerage systems.	Cognitive Psychomotor	Analysis Measure
CO5	The student will have the knowledge on operation and maintenance of treatment units	Cognitive Affective	Analysis Response

COURSE CONTENT

UNIT I	**WATER AND ENVIRONMENT**	**12**

Public water supply schemes, Forms and properties of water –per capita demand - population forecasts - variation in demand pattern – Water Quality standards – water borne diseases – planning of public water supplies.

UNIT II	**SOURCES AND TRANSMISSION OF WATER**	**12**

Types of water sources- Intake structures -wells, infiltration galleries – Transmission of water through pipes and channel - Hydraulics of pipe flow - use of charts and nomograms for computations – pipe materials - laying, jointing and testing of pipes- Distribution networks.

UNIT III	**WATER TREATMENT**	**12**

Layout of Treatment plants for conventional water treatment plant. Principles and Functions of Screen, Flash Mixer, Flocculator, Sedimentation Tank, Slow and Rapid Sand Filters, and Disinfection Process- advanced water treatment techniques.

UNIT IV	**WASTE WATERTREATMENT**	**12**

Characteristics and composition of sewage - cycles of decomposition of organic wastes - D.O, BOD and COD and their significance. Treatment methods - Layout of waste water treatment plant - Activated sludge process and its modifications; Tricking filters and Rotating biological contactors - oxidation pond- Operational problems –planning organizing and controlling of plant operations and Trouble shooting.

UNIT V	**DISPOSAL OPTIONS**	**12**

Land disposal - sewage farming practice - dilution - discharge into rivers, estuaries and ocean - river pollution - oxygen sag - self-purification - eutrophication. - sludge treatment - properties and characteristics of sludge - sludge digestion and drying beds – Recycle and reuse.

PRACTICAL	**30**

1. Determination of pH, turbidity and conductivity.
2. Determination of the available chlorine in bleaching powder and estimation of the residual chlorine.
3. Determination of optimum dosage of coagulant
4. Determination of Iron and Fluoride.
5. Determination of Phosphorous
6. Determination of Potassium
7. Determination of Total Solids and Suspended solids.
8. Determination of Biochemical Oxygen Demand.
9. Determination of Chemical Oxygen Demand.
10. Determination of Ammonia Nitrogen.
11. Demonstration of Bacteriological analysis of water.

L	T	P	Total
30	0	30	60

TEXT BOOKS

1. Gurucharan Singh," Water supply and Sanitary Engineering", Standard Publishers Distributors, 2009
2. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007

3. S.K. Garg, Wastewater Engineering, Khanna Publishers, New Delhi, 2007
4. CPHEEO Manual on Water Supply And Treatment,1999
5. CPHEEO Manual on Sewerage And Sewage Treatment,1993

REFERENCES

1. Karia G L & Christian R A, "Wastewater Treatment", Prentice Hall of India, New Delhi, 2013.
2. Rangwala, " Water Supply and Sanitary Engineering PB,24/e, Charotar Publishing house Pvt. Ltd.-Anand, 2011
3. B.C. Punmia, Wastewater Engineering, Volume – II, Laxmi Publication 2008
4. LinvilG.Rich, Unit operations of Sanitary Engineering, Tata Mcgraw Hill, New Delhi, 2007
5. Standard methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA,USA,1989.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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	--
	2	**3**	**12**	**7**	**2**	**2**	**2**	**2**	**10**	**2**	**1**	**3**	**11**	**1**

Semester **V**
Subject Name **BUILDING PLANNING AND DRAWING**
Subject Code **XCE 504**

L	T	P	C
3	1	1	5

C	P	A
2.0	0.5	0.5

L	T	P	H
3	2	2	7

	Course Outcome: *After the completion of the course, students will be able to*	***Domain C or P or A***	***Level***
CO1	Prepare the building plans satisfying the principles of planning and byelaws.	Psychomotor	Guided response
CO2	Draw plan, elevation, section for residential building.	Cognitive	Analysis
CO3	Impart knowledge on constructional details of different building components	Cognitive	Analysis
CO4	Draw plan, elevation, section for public building.	Cognitive	Analysis
CO5	Knowledge on the development of 2D building drawings using computer aided tools	Affective	Develop

COURSE CONTENT

UNIT I **INTRODUCTION** **15**

BIS conventions and specifications- Symbols of the buildings- Size, Layout, Lettering and Dimensioning- Principles of isometric projections - Isometric scales Classification of buildings- Perspective projection -Building bye-laws - floor area ratio, open spaces- orientation of buildings.

UNIT II	PRINCIPLES OF PLANNING	15

Functional design of residential buildings and circulation principles- Positioning of various components of buildings - Development of plan, elevation, section and openings.

UNIT III	COMPONENTS OF BUILDINGS	18

Isolated and Combined footings –Raft and Spread footings-Columns – Beams-Slabs-Staircases-Doors , Windows and Ventilators-Building services.

UNIT IV	PUBLIC BUILDINGS AND TRUSSES	18

Planning of educational buildings-Hospitals- Offices - Factory buildings –Roof trusses.

UNIT V	COMPUTER AIDED DRAFTING	9

Introduction to Coordinates, Units, Dimension, Line, Ray, Polyline, Arc, Hatch, Offset, Scale, Layer, Colour, etc., using CAD

PRACTICAL **30**

1. Bonds in masonry-Walls and quoins
2. Drawing of footings
3. Drawing of doors and windows
4. Drawing of staircase
5. Drawing of Steel truss
6. Plan, elevation and section of two bed room single storeyed building
7. Plan, elevation and section of two bed room two storeyed building
8. Plan, elevation and section of school building
9. Practising CAD

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Gurcharn Singh, Building Planning, Designing & Scheduling, Standard Publishers, New Delhi, 2005
2. National Building Codeof India,2005.
3. Specifications of building planning and scheduling - Gurcharn Singh, Jagdish Singh -2012

REFERENCES

1. Verma B.P., Civil Engg. Drawing & House Planning –Khanna publishers, New Delhi, 2003
2. Shah.M.G., Building drawing –Tata McGraw-Hill,2006
3. Kumaraswamy N., KameswaraRaoA.,Building Planning & Drawing , CharotarPublishing, Second revised edition, 2007

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	1	1	1	--	--	1	--	1	--	--	--	1	1
CO 2	--	1	--	1	--	--	1	--	1	1	1	1	--	1
CO 3	1	1	2	1	1	1	--	1	1	1	--	1	--	1
CO 4	1	2	--	1	--	1	--	1	--	--	--	1	--	1
CO 5	3	2	3	--	1	--	--	--	--	--	--	--	--	--
	7	**7**	**6**	**4**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**3**	**2**	**4**

Semester	**V**
Subject Name	**BASICS OF EARTHQUAKE ENGINEERING AND SEISMIC DESIGN**
Subject Code	**XCE505A**
Prerequisite	**Nil**

L	T	P	C
2	1	0	3

C	P	A
2.5	0	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	Differentiate the static and dynamic analysis.	Cognitive	Understand
CO2	Analyse SDOF and MDOF systems with distributed mass for continuous system.	Cognitive	Analyse
CO3	Quantify the effect of seismic waves.	Cognitive Affective	Analyse Response
CO4	Understand the concept of response spectrum and application of structural dynamics.	Cognitive	Understand
CO5	Design Earthquake resistant structures with codal recommendations.	Cognitive	Evaluation

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

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

L	T	P	Total
30	15	0	45

TEXT BOOKS

1. Biggs, J.M., “Introduction to Structural Dynamics”, McGraw– Hill Education India Pvt.Ltd - New Delhi
2. Dowrik., “Earthquake Resistant Design”Willey,2012
3. Paz,M.,“Structural Dynamics-Theory & Computattions’’Shahdara,Delhi,2010
4. Anil k chopra “ Dynamics of structures ’’ Theory and application to Earthquake Engineering,2014

REFERENCES

1. George G.Penelis and AndreasJ.Kappos,Earthquake Resistant Concrete Structures,E& FN Spon.London,UK
2. Kavitha S., Damodarasamy S. R. “Basic of Structural Dynamics and Aseismic Design” PHI Learning Private Limited publishers, 2009.
3. Shashikant k. Duggal “Earthquke resistant design of structures”India, 2013

Mapping of CO with PO’S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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
	10	**8**	**6**	**--**	**2**	**3**	**2**	**2**	**1**	**3**	**1**	**2**	**6**	**2**

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **TOTAL QUALITY MANAGEMENT**

Subject Code **XTQ 506**

L	T	P	C
3	0	0	0

C	P	A
3	0	0

L	T	P	H
3	0	0	3

Course Outcome: *After the completion of the course, students will be able to*		***Domain C or P or A***	***Level***
CO1	List and explain the basic concepts of total quality concepts and its limitations.	Cognitive	Remembering, Understanding
CO2	Analyze and explain the customer satisfaction, employee involvement, supplier selection and appraise the performance by TQM principle.	Cognitive	Comprehension
CO3	Explain and apply the statistical process control tools.	Cognitive	Understanding, Appling
CO4	Select and explain the different TQM tools and their significance.	Cognitive	Remembering, Understanding
CO5	Explain the importance aspects of different quality systems.	Cognitive	Understanding

COURSE CONTENT

UNIT I	INTRODUCTION	9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review –Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council –Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation.

UNIT II	TQM PRINCIPLES	9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality –Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

UNIT III	STATISTICAL PROCESS CONTROL (SPC)	9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV	TQM TOOLS	9

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

UNIT V	QUALITY SYSTEMS	9

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements –Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 –Concept, requirements and benefits.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Dale H. Besterfiled, et. Al. “Total Quality Management”, New Delhi, Pearson Education, Inc,2007.
2. James R. Evans and William M. Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western, 2002.

REFERENCES

1. Feigenbaum, A.V., “Total Quality Management”, McGraw Hill, 1991.
2. Oakland, J.S., “Total Quality Management”, Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
4. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

Mapping of CO with PO's

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

Semester **V**

Subject Name **BUSINESS COMMUNICATION**

Subject Code **XGS 507**

L	T	P	C
1	0	0	1

C	P	A
3	0	0

L	S	T	P	H
1	2	0	0	3

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

		Domain C or P or A	***Level***
CO1	To choose and apply different styles to various forms of business communication.	Cognitive	Knowledge
CO2	Identify the proper tone of language required in writing and speaking in business communication.	Cognitive	Understand
CO3	Display knowledge on grammar and other linguistic features in writing various forms of business communication.	Cognitive	Understand
CO4	To distinguish between letters and memos and various forms of Business Communication.	Cognitive	Grasp
CO5	Learn how to write business reports, minutes, proposals.	Psychomotor	Apply

COURSE CONTENT

UNIT I **9**

Introduction to business communication; modern developments in the style of writing letters memos and reports: block letters, semi block letters, full block letters, simplified letters etc.,

UNIT II **9**

The language used in memos/minutes/telephone memos/ letters/ assignments art of writing E-mail etc. Advantages of written and spoken communication.

UNIT III **9**

The use of active and passive voice; the use of grammar, propriety, accuracy , exactness , the tone & other elements of language used in these writings.

UNIT IV **9**

The format of various types of Reports/ projects etc.,

UNIT V **9**

Writing Business reports, proposals and minutes.

L	S	T	P	Total
15	30	0	0	45

TEXT BOOKS&REFERENCES

1. John Sealy, Writing and Speaking Author:, Oxford University Press, New Delhi Third Edition 2009.
2. Williams K S, Communicating in Business (8th Edition) Engage Learning India Pvt. Ltd.; 2012
3. John Sealy, Writing and Speaking, Oxford University Press, New Delhi Third Edition 2009.

Mapping of CO with GA's

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

Semester V

Subject Name IN-PLANT TRAINING-II

Subject Code XCE 508

L	T	P	C
0	0	0	1

C	P	A
2	2	2

L	T	P	H
0	0	0	0

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

Mapping of CO with GA's

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

1 - Low, 2 – Medium, 3 – High

Semester	**VI**
Subject Name	**IRRIGATION ENGINEERING**
Subject Code	**XCE 602**

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 Outcome: *After the completion of the course, students will be able to*		***Domain C or P or A***	***Level***
CO1	Understand the knowledge on methods of irrigation including canal irrigation.	Cognitive	Understand
CO2	Find the crop water requirement for various crops in the commanded area.	Psychomotor	Measure
CO3	Understand the design aspects of dams and channel systems.	Cognitive	Comprehension
CO4	Understand the concept of various hydraulic structures such as dam, energy dissipaters, head and cross regulators and structures involved in cross drainage works.	Cognitive	Knowledge
CO5	Know the water resources available and management system.	Cognitive	Knowledge

COURSE CONTENT

UNIT I **IRRIGATION ENGINEERING** **9**

Catchment area – Ayacut- Duty, delta and base period- relationship - Irrigation efficiencies – Crop water requirement –Estimation of consumptive use of water.

UNIT II **METHODS OF IRRIGATION** **9**

Surface and subsurface irrigation-Sprinkler and Drip irrigation- Lift irrigation- Tank irrigation- Well irrigation - Flooding methods.

UNIT III **HYDRAULIC STRUCTURES** **9**

Weir and Barrage – Site selection for dam construction- Gravity dam –Earthen dam- Arch dam – Buttress dam- Diversion head works with drawings- Canal drop-Canal regulators-Canal outlets- Forces acting on dam – Spillway.

UNIT IV **CANAL IRRIGATION** **9**

Classifications of canals- Canal alignment- Canal lining -Cross drainage works including drawing -River training works.

UNIT V **WATER RESOURCES AND MANAGEMENT** **9**

Water resources survey – water resources of India and Tamilnadu –Estimation of water requirements for irrigation and drinking-Single and multipurpose reservoir-Storage of reservoir –National water policy- Water prizing-Water losses – Participatory irrigation management-Irrigation scheduling-water distribution.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Linsley R.K and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000.
2. Punmia B.C., et.al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009.
3. GargS.K.,"Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delgi. 2009.
4. Sharma, S.K., Principles and Practice of Irrigation Engg, S.Chand Co, 1984.

REFERENCES

1. Duggal, K.N. and Soni, J.P., "Elements of water Resources Engineering", New Age International Publishers. 2005.
2. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata Mcgraw-Hill Inc., New Delhi, 1997.
3. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	3	2	--	--	2	--	--	--	--	--	--	--	1	1
CO 2	--	3	--	--	--	--	--	--	1	--	--	--	1	2
CO 3	2	--	2	1	--	--	--	1	1	--	--	--	1	
CO 4	2	2	--	--	--	1	1	1	--	--	--	--	1	1
CO 5	2	2	1	--	2	1	--	--	--	--	--	--	2	2
	9	**9**	**3**	**1**	**4**	**2**	**1**	**2**	**2**	**--**	**--**	**--**	**6**	**6**

1 - Low, 2 – Medium, 3 – High

Semester **VI**
Subject Name **TRANSPORTATION ENGINEERING**
Subject Code **XCE 603**

L	T	P	C
3	0	1	4

C	P	A
2.0	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	Understand the importance of transportation infrastructure planning and design.	Cognitive	Understand
CO2	Apply basic science principles in estimating stopping and passing sight distance requirements.	Cognitive Psychomotor	Measure
CO3	Design and analyse the highway system and railway track system.	Cognitive Affective	Comprehension
CO4	Make use of computer technology in the development of transportation infrastructure.	Cognitive Affective	Knowledge
CO5	Insight on the basics of Airport and Harbour Engineering	Cognitive	Knowledge

COURSE CONTENT

UNIT I	**INTRODUCTION TO TRANSPORTATION ENGINEERING**	**9**

Types, characteristics and components of transportation systems - Transportation capacity – Concept – Level of service- transportation planning and evaluation –Environmental issues- Transportation safety – Introduction to intelligent transportation and application of information technology in transportation development.

UNIT II	**HIGHWAY ENGINEERING**	**9**

Functional Classification of Highway System - History of road development - pioneer works of Romans, Tresaguat, Telford, Metcalf and Macadam –Highway Alignment and Geometric Design; Alignment factors – Engineering surveys; Cross–section elements – Superelevation – pavement widening - sight distances – Horizontal Alignment – Vertical Alignment – Grade compensation – Geometric design of Hill roads.

UNIT III	**HIGHWAY PAVEMENT DESIGN**	**9**

Pavement Design - Flexible pavement - CBR Method, IRC: 37-2001 - Rigid pavement: Westergaard's analysis of wheel load stress, temperature stresses IRC: 58-2002 method of design. Types of joints and their functions,; Highway materials, construction procedure of WMM roads, bituminous roads, concrete roads and soil stabilized road - MOST specifications. Highway Drainage: Maintenance and repairs. Intersections - Miscellaneous Elements (Pedestrian facilities on Urban Roads,CycleTracks,,Bus bays, Parking facilities, Traffic Signs and Markings).

UNIT IV	**RAILWAY ENGINEERING**	**9**

Railway Engineering - Location surveys and alignment - Permanent way - Gauges - Components - Functions and requirements - Geometric design 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	**DOCK, HARBOUR AND AIRPORT**	**9**

Airport Engineering-Aircraft characteristics - Airport obstructions and zoning - Runway - taxiways and aprons- Terminal area planning.

Docks and Harbours - Types - Layout and planning principles- Breakwaters - Docks- Wharves and Quays - Transit sheds- Warehouses- Navigation aids. Urban transportation systems - Bus transit - Mass Rapid Transit System - Light Rail Transit. Transport economics and Financing - Intelligent Transportation Systems (ITS).

PRACTICAL	**30**

I. Tests on Aggregates

a. Specific Gravity
b. Water absorption
c. Impact Strength
d. Crushing strength
e. Abrasion
f. Grading
g. Flakiness and Elongation Index
h. Stripping Value

II. Tests on Bitumen

a. Penetration
b. Softening point
c. Flash and fire point
d. Ductility
e. Viscosity

L	T	P	Total
45	0	30	75

TEXT BOOKS

1. Khanna S.K.,HighwayEngineering, Nem Chand & Bros.,2011.
2. L.R.Kadiyali and N.B.Lal: Principles and Practice of Highway Engineering, Khanna publishers, 2007.
3. Ministry of Road Transport and Highways. Specifications for Road and Bridge Works, 5th Revision , Indian Roads Congress, 2014.
4. Rangwala, S.C., Railway Engineering, Charotar Publishing House, Pvt. Limited,2008.
5. Saxena, S.C. Railway Engineering, DhanpatRai, 2015

REFERENCES

1. Papacostas C.S. and PD Prevedouros. Transportation Engineering and Planning, Third Edition. Prentice Hall of India Pvt. Ltd, New Delhi, India, 2002.
2. JotinKhisty C. and B. Kent Lall.Transportation Engineering, Third Edition,Phi Learningpublishers, 2009
3. IRC: 37-2001 – Guidelines for the Design of flexible Pavements for Highways, IRC, New Delhi, 2012.
4. IRC: 58-2002(Second Revision) – Guidelines for the Design of Rigid Pavements for Highways, IRC, New Delhi, 2002.
5. Horonjeff Robert: The Planning and Design of Airports, McGraw Hill Co., New York, 2010.
6. Chandra S. and M.M. Agarwal, Railway Engineering,Second Edition, Oxford University Press, New Delhi, 2013.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	--	--	1	1	--	--	--	--	--	--	--	--	1	1
CO 2	--	1	1	1	1	--	--	1	1	--	1	--	1	**--**
CO 3	2	--	3	2	1	1	--	1	1	--	--	--	3	**--**
CO 4	--	--	1	1	2	1	1	--	--	3	--	3	1	**--**
CO 5	1	2	--	1	--	--	1	--	--	--	--	--	1	**--**
	3	3	6	6	4	2	2	2	2	3	1	3	7	1

Semester **VI**

Subject Name **DESIGN OF CONCRETE STRUCTURES**

Subject Code **XCE 604**

L	T	P	C
3	1	1	5

C	P	A
1.5	0.5	1

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	Acquaint knowledge on design processes for idealising RC structures and construct their load paths.	Cognitive	Understand
CO2	Interpret ultimate and serviceability limit state approaches in current structural design philosophy	Cognitive Affective	Applying Receiving
CO3	Estimate primary design loads on structural elements to find the critical load combination that governs design.	Cognitive Affective	Analysing Valuing
CO4	Model building structure and analyse structural elements for design actions	Cognitive Psychomotor	Evaluation Manipulation

COURSE CONTENT

UNIT I	**METHODS OF DESIGN OF CONCRETE STRUCTURES**	**15**

Methods and principles of Design-Properties of Concrete and Steel –Code specifications for structural members –Working stress method- Yield line theory- Design of beams and slabs.

UNIT II	**LIMIT STATE DESIGN FOR FLEXURE**	**15**

Design of one way and two way slab - singly anddoubly reinforced beams- continuous beams –Flanged beams – Staircase.

UNIT III	**LIMIT STATE DESIGN FOR SHEAR, BOND AND TORSION**	**15**

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 AND FOOTINGS**	**15**

Types of columns-Design of shortcolumns and long columns-Footings- Square, rectangular and circular footing –Raft and pile foundations.

UNIT V	**DESIGN OF MISCELLANEOUS STRUCTURES**	**15**

Liquid retaining structures-Bridge deck slabs-Retaining walls-Culverts

PRACTICAL	**30**

Design and drafting of slabs, beams and columns using software.

L	T	P	Total
45	30	30	105

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 – Design Aids for Reinforced Concrete to IS:456-1978

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	3	--	1	--	--	--	--	--	--	--	--	--	2	--
CO 2	2	3	--	1	--	1	1	--	--	**--**	--	--	3	1
CO 3	1	1	3	1	--	1	1	1	--	**--**	1	--	1	--
CO 4	1	--	2	1	--	--	--	1	1	**--**	1	--	3	--
CO 5	7	4	6	3	1	2	2	2	1	**--**	2	--	9	1
	13	11	12	14	14	8	13	12	5	10	2	5	11	8

1 – Low, 2 – Medium, 3 – High

Semester	**VI**
Subject Name	**STRUCTURAL STEEL DESIGN**
Subject Code	**XCE 605**

L	T	P	C
3	1	0	4

C	P	A
2	1	0

L	T	P	H
3	2	0	5

	Course Outcome: *After the completion of the course, students will be able to*	***Domain C or P or A***	***Level***
CO1	Design of structural connections	Cognitive Psychomotor	Understand Manipulation
CO2	Design of tension and compression members	Cognitive	Applying
CO3	Understand fabrication of plate girders and gantry girders	Cognitive Psychomotor	Understand Manipulation
CO4	Design of structural elements of Industrial Structures.	Cognitive	Evaluation
CO5			

COURSE CONTENT

UNIT I	**INTRODUCTION**	**12**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using welding, bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints – High Tension bolts.

UNIT II	**TENSION MEMBERS**	**12**

Types of sections – Net area – Net effective sections for Angles and Tee – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT III	**COMPRESSION MEMBERS**	**12**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base.

UNIT IV	BEAMS	12

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders– Intermediate and bearing stiffeners – Web splices – Design of beam columns.

UNIT V	TRUSSES AND INDUSTRIAL STRUCTURES	12

Roof trusses – Roof and side coverings – Design loads - Design of purlin and elements of truss- Design of gantry girder.

L	T	P	Total
45	15	0	75

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

REFERENCES

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.
1. SP6 – 1 : ISI Hand Book of Structural Engineers, Part –I

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	1	3	2			1	1	1				2	
CO 2	2	1	3	2			1		1				2	
CO 3	1	1	3	1		1							1	
CO 4	3	1	3	3	1	1							2	
CO 5	8	4	12	8	1	2	2	1	2				7	
	13	11	12	14	14	8	13	12	5	10	2	5	11	8

1 - Low, 2 – Medium, 3 – High

Semester	**VI**
Subject Name	**CONSTRUCTION TECHNIQUES, EQUIPMENTS AND PRACTICES**
Subject Code	**XCE 606A**
Prerequisite	**CONCRETE TECHNOLOGY**

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

	Course Outcome: *After the completion of the course, students will be able to*	***Domain C or P or A***	***Level***
CO1	Understand the properties of fresh and hardened concrete.	Cognitive Affective	Understand Response
CO2	Implement modular construction practices related to substructure and superstructure construction	Cognitive	Understand Response
CO3	Analyze productivity and economics in construction techniques	Cognitive	Evaluate
CO4	Select appropriate construction equipment and can estimate ownership and operating costs.	Cognitive Affective	Understand Response

COURSE CONTENT

UNIT I **CONCRETE TECHNOLOGY** **9**

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete - manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete – curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

UNIT II **CONSTRUCTION PRACTICES** **9**

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick – – weather and water proof – roof finishes – acoustic and fire protection.

UNIT III **SUB STRUCTURE CONSTRUCTION** **9**

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling 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 IV **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.

UNIT V **CONSTRUCTION EQUIPMENT** **9**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for

dredging, trenching, tunnelling.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. A.M. Neville, J.J.Brooks “Concrete Technology”,Prentice Hall; 2nd edition, 2010.
2. B.C. Punmia, Ashok Kumar Jain,Arun Kumar Jain, "Building Construction”, Laxmi publications; 10 th edition,2008.
3. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.
4. Douglas D. Gransberg, Calin M. Popescu, Richard Ryan, “Construction equipment management for engineers estimators and owners”, CRC Press, 2006.

REFERENCES

1. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.
2. Robert L Peurifoy,Clifford J. Schexnayder, Aviadshapira, andRobertSchmitt"Construction Planning, Equipment and Methods", 8th Edition,McGraw-Hill Higher Education, 2010.
3. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 2009
4. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.

Mapping of CO with PO’S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	1	1	3	1	--	--	--	--	--	--	--	--	--	--
CO 2	1	--	--	--	1	--	--	1	--	--	--	2	--	--
CO 3	1	2	--	--	2	1	1	1	1	--	--	--	1	1
CO 4	2	2	--	1	--	1	1	1	--	--	1	--	1	--
	5	5	3	2	3	2	2	3	1	-	1	2	2	1

1 - Low, 2 – Medium, 3 – High

Semester **VI**

Subject Name **ENVIRONMENTAL STUDIES**

Subject Code **XCE 607**

L	T	P	C
0	0	0	0

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	Describe the significance of natural resources and explain anthropogenic impacts	Cognitive	Remember & Understand
CO2	Illustrate the significance of ecosystem and biodiversity for maintaining ecological balance	Cognitive	Understand
CO3	Identify the facts , consequences , preventive measures of major pollution and Recognize the disaster phenomenon	Cognitive Affective	Remember Receive

CO4	Explain the socio- economics, policy dynamics and practice the control measures of global issues for sustainable development.	Cognitive	Understand & Analyse
CO5	Recognize the impact of population and apply the concept to develop various welfare programs.	Cognitive	Understand & Apply

COURSE CONTENT

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY 9

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (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 12

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 – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education - HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
5. Introduction to International disaster management, Butterworth Heinemann, 2006.
6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.

REFERENCES

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publications House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup& Sons, New Delhi, 2007.
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006
7. Benny Joseph, Environmental Studies,Tata McGraw Hill Publications, 2005

E- RESOURCES

1. Bharat Raj Singh **,** 2015,Global Warming: Causes, Impacts and Remedies , InTech.
2. Richard C. J. Somerville , The Forgiving Air: Understanding Environmental Change , 1998, University of California Press

Mapping of CO with GA's

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

1 - Low, 2 – Medium, 3 – High

Semester VI

Subject Name ACADEMIC WRITING

Subject Code XGS 608

L	T	P	C	
0	0	0	0	

C	P	A
2	0.5	0.5

L	T	P	H
0	0	2	2

	Course Outcome: *After the completion of the course, students will be able to*	***Domain C or P or A***	***Level***
CO1	Ability to identify the features of a technical project report and knowledge on the linguistic competence to write a technical report	Cognitive	Comprehension
CO2	Ability to integrate both technical subject skill and language skill to write a project.	Cognitive	Synthesis
CO3	Confidence to present a project in 10 to 15 minutes	Affective	Response
CO4	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	Comprehension
CO5	The program enables the speaker speaks clearly and fluently with confidence and it trains the learner to listen actively and critically	Psychomotor	Palpate

COURSE CONTENT

UNIT I **10**

Basic principles of good technical writing, Style in technical writing, out lines and abstracts, language used in technical writing: technical words, jargons etc.,

UNIT II **10**

Special techniques used in technical writing: Definition, description of mechanism, Description of a process, Classifications, division and interpretation.,

UNIT III **25**

Report/ project layout the formats: chapters, conclusion, bibliography, annexure and glossary, Graphics aids etc - Presentation of the written project 10 – 15 minutes.

UNIT IV **15**

Sounds of English Language; vowels, consonants, diphthongs , word stress, sentence stress, intonation patterns, connected speech etc. - Vocabulary building – grammar, synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, idioms and phrases.

UNIT V **15**

Reading comprehension – reading for facts, meanings from context, scanning, skimming, inferring meaning, critical reading, active listening, listening for comprehension etc.

L	T	P	Total
45	0	30	75

TEXT BOOKS

1. Gordon H. Mills, Technical Writing – April, 1978, Oxford University Press
2. Barun K. Mitra, Effective Technical Communication: A Guide for Scientists and Engineers. Author, Publication: Oxford University press. 2007

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO 2	1	1	--	--	--	--	--	--	1	2	--	--	--	--
CO 3	--	--	--	2	--	--	--	--	--	2		2	--	--
CO 4	--	--	--	2	--	--	--	--	--	2	1	2	--	--
CO 5	--	--	--	--	--	--	--	--	--	2	1	2	--	--
	1	1	--	4	--	--	--	--	1	8	2	6	--	--

1 - Low, 2 – Medium, 3 – High

Semester	**VII**
Subject Name	**CONSTRUCTION PROJECT MANAGEMENT**
Subject Code	**XCE702**

L	T	P	C
3	0	1	4

C	P	A
2	0.5	0.5

L	T	P	H
3	0	2	5

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

COURSE CONTENT

UNIT I	**CONSTRUCTION PROJECT FORMULATION**	**9**

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

UNIT II	**CONSTRUCTION PLANNING AND SCHEDULING**	**9**

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

UNIT III	**RESOURCE PLANNING**	**9**

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

UNIT IV	**TENDERING AND CONTRACT ADMINISTRATION**	**9**

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

UNIT V QUALITY CONTROL AND SAFETY MANAGEMENT 9

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

PRACTICAL 30

Introduction to Microsoft Projects and Primavera

L	T	P	Total
45	0	30	75

TEXT BOOKS

1. Kumar NeerajJha, "Construction Project management", Dorling Kindersley, Publishers, New Delhi.2013
2. Sengupta .B, Guha .H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 2001.
3. Sharma.S.C, "Construction Engineering and Management",Khanna Publishers,Delhi,2008.
4. Chitkara.K.K, Construction Project Management planning, Scheduling and control, Tata McGraw Hill Publishing Company, New Delhi, 2010.

REFERENCES

1. Joy.P.K, Total Project Management - The Indian context, Macmillan India Ltd, New Delhi, 2000
2. Vohra.N.D., Quantitative Techniques in Management, Tata McGraw Hill Publishing Company, New Delhi, 2010
3. Billy E.Gillett., Introduction to Operations Research - Computer Oriented Algorithmic Approach, Tata McGraw Hill, 2005.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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	--	--	--	--	--	--	--
	4	2	2	3	3	5	4	5	5	2	1	1	3	2

1 - Low, 2 – Medium, 3 – High

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

L	T	P	C
3	1	1	5

C	P	A
2	0.5	0.5

L	T	P	H
3	2	2	7

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

COURSE CONTENT

UNIT I	**ESTIMATION OF BUILDINGS**	**20**

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

UNIT II	**ESTIMATION OF OTHER STRUCTURES**	**20**

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

UNIT III	**SPECIFICATION**	**10**

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

UNIT IV	**RATE ANALYSIS**	**15**

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

UNIT V	**VALUATION**	**10**

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

PRACTICAL	**30**

1. Building marking
2. Estimation using Spread Sheet

L	T	P	Total
45	30	30	105

TEXT BOOKS

1. Dutta, B.N., "Estimating and Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Pvt. Ltd.,New Delhi, 2010.
2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand& Company Ltd., New Delhi, 2004
3. M.Chakraborty,"Estimating,Costing, Specification and Valuation in Civil Engineering",Kolkata,1997.

REFERENCES

1. Birdie.G.S., "A Text Book on Estimating and Costing", DhanpatRai and Sons, New Delhi, 2000
2. Rangwala. S.C., "Elements of Estimating and Costing", Charotar Publishing House,Anand,2011
3. IS 1200-1974, Parts 1-25, Methods of Measurements of Building and Civil Engineering works – Bureau of Indian Standards, New Delhi.
4. Standard Data Books and Schedule of rates of Central and State Public Works Departments.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	--	--	--	1	2	**--**	**--**	**--**	2	--	--	--	--
CO 2	2	--	--	--	2	3	**--**	**--**	**--**	3	--	--	--	--
CO 3	2	--	--	--	3	--	**--**	**1**	**--**	**--**	3	3	1	--
CO 4	2	--	--	2	3	--	**--**	**1**	3	**--**	--	--	1	--
CO 5	2	--	--	2	--	--	2	**1**	**--**	2	3	3	1	3
	10	**--**	**--**	**4**	**9**	**5**	**2**	**3**	**3**	**7**	**6**	**6**	**3**	**3**

1 - Low, 2 – Medium, 3 – High

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

L	T	P	C
3	0	0	3

C	P	A
2.0	0.5	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	Identify and apply the applicable industry design codes relevant for the design of prestressed concrete members	Cognitive	Knowledge
CO2	Discuss and appraise the recent advances in the prestressed concrete technology including the use of advanced materials and application of new technologies	Cognitive Psychomotor	Analysis Precision
CO3	Accomplish design calculations to predict service behavior of prestressed concrete structures	Affective	Response

COURSE CONTENT

UNIT I	**INTRODUCTION – THEORY AND BEHAVIOUR**	**9**

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

UNIT II	**DESIGN CONCEPTS**	**9**

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

UNIT III	**CIRCULAR PRESTRESSING**	**9**

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

UNIT IV	**COMPOSITE CONSTRUCTION**	**9**

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

UNIT V	**PRE-STRESSED CONCRETE BRIDGES**	**9**

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

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

REFERENCES

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

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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**					2	1
	4	4	6	2	3	4	**2**	**3**		**3**	1	3	5	8

1 - Low, 2 – Medium, 3 – High

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

L	T	P	C
3	**0**	**0**	**3**

C	P	A
2	**0**	**1**

L	T	P	H
3	**0**	**0**	**3**

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

COURSE CONTENT

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK 9

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

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 9

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

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer

stations Optimizing waste allocation –compatibility, storage, labeling and handling and Transport of hazardous wastes.

UNIT IV WASTE PROCESSING TECHNOLOGIES 9

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

UNIT V WASTE DISPOSAL 9

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001

REFERENCES

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.
2. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	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
	9	**10**	**8**	**5**	**--**	**2**	**1**	**--**	**--**	**1**	**--**	**6**	**9**	**11**

1 - Low, 2 – Medium, 3 – High

Semester	**VII**
Subject Name	**CYBER SECURITY**
Subject Code	**XUM 706**

L	T	P	C
0	0	0	0

C	P	A
3	0	0

L	T	P	H
3	0	0	3

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

COURSE CONTENT

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

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

UNIT II	**SYSTEMS VULNERABILITY SCANNING**	**9**

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

UNIT III	**NETWORK DEFENCE TOOLS**	**9**

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

UNIT IV	**TOOLS FOR SCANNING**	**9**

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

UNIT V	**INTRODUCTION TO CYBER CRIME AND LAW**	**9**

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Nina Godbole, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, w/cd", Wiley Publications, 2008, ISBN 10: 8126516925, ISBN 13 :9788126516926
2. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing and Investigating Intrusions", Wiley Publications, 2013, Kindle Edition,ISBN 10: 812654919X, ISBN 13 :9788126549191
3. D.S. Yadav, "Foundations of Information Technology", New Age International publishers, 3rd Edition, 2006, ISBN-10: 8122417620, ISBN-13: 978-8122417623

REFERENCES

1. Mike Shema, "Anti-Hacker Tool Kit", McGraw Hill Education, 4th edition, 2014,
2. Nina Godbole, SunitBelapure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wileypublilcations, 2013, ISBN 10 : 8126521791, ISBN 13:9788126521791.
3. Corey Schou, Daniel Shoemaker, "Information Assurance for the Enterprise: A Roadmap to Information Security (McGraw-Hill Information Assurance & Security)",
4. Tata McGraw Hill, 2013, ISBN-10: 0072255242, ISBN-13: 978-0072255249.
5. VivekSood, "Cyber Laws Simplified", McGraw Hill Education (INDIA) Private Limited in 2001, ISBN-10: 0070435065, ISBN-13: 978-0070435063.Steven M.Furnell, "Computer Insecurity", Springer Publisher, 2005 Edition.

E- RESOURCES

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

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	3	3	2	1	1	1	1	1	--	--	1
CO 2	2	1	1	1	1	1	1	1	1	--	--	1
CO 3	2	2	2	1	1	1	1	1	1	--	--	1
CO 4	1	1	1	1	--	--	--	--	--	--	--	1
CO 5	1	1	1	2	2	1	1	2	2	--	--	1
	9	**8**	**8**	**7**	**5**	**4**	**4**	**5**	**5**	**0**	**0**	**5**

1 - Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **PROJECT PHASE I**

Subject Code **XCE 707**

L	T	P	C
0	**0**	**2**	**2**

C	P	A
1.5	**0.5**	**1.0**

L	T	P	H
0	**0**	**2**	**4**

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

Mapping of CO with GA's

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

1 – Low, 2 – Medium, 3 – High

Semester VII
Subject Name CAREER DEVELOPMENT SKILLS
Subject Code XGS 708

L	T	P	C
0	0	0	0

C	P	A
1.8	0.8	0.4

L	T	P	H
0	0	0	1

	Course Outcome: After the completion of the course, students will be able to	Domain C or P or A	Level
CO1	Knowledge on a career related communication and learning the different formats of CV	Cognitive	Apply
CO2	Prepare how to face an interview and to learn how to prepare for an interview	Psychomotor	Set
CO3	Communicates with the group of people in discussion	Affective	Response

COURSE CONTENT

UNIT I **CV WRITING** **10**

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

UNIT II **TECHNICAL SKILLS** **10**

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

UNIT III **WORKSHOP** **10**

Mock interviews - workshop on CV writing – Group Discussion.

L	T	P	Total
20	0	10	30

TEXT BOOKS

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

E- RESOURCES

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

Mapping of CO with GA's

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

Semester VII

Subject Name IN-PLANT TRAINING-III

Subject Code XCE 708

L	T	P	C
0	0	0	1

C	P	A
2	2	2

L	T	P	H
0	0	0	0

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

Mapping of CO with GA's

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

Semester VIII

Subject Name PREFABRICATED STRUCTURES

Subject Code XCE802 A

Prerequisite Structural Analysis

L	T	P	C
3	0	0	3

C	P	A
2	0	1

L	T	P	H
3	0	0	3

Course Outcome: *After the completion of the course, students will be able to*		***Domain C or P or A***	***Level***
CO1	Gain knowledge on prefabrication of structures.	Cognitive	Understand
CO2	Identify the components of prefabricated structures.	Cognitive Affective	Understand Respond
CO3	Design the structures based on prefabrication elements.	Cognitive	Remembering
CO4	Handle the prefabricated structures in the field.	Cognitive	Understand

COURSE CONTENT

UNIT I INTRODUCTION – PREFABRICATED STRUCTURES **9**

General Civil Engineering requirements in the prefabrication techniques – material used in prefabrication - Modular co-ordination, standardization, Disuniting, of Prefabricates, production, transportation, erection.

UNIT II PREFABRICATED COMPONENTS 9

Prefabricated structures - Long wall and cross-wall large panel buildings - one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, - columns – shear wall.

UNIT III DESIGN PRINCIPLES 9

Loading criteria - Disuniting of structures- Design of cross section based on efficiency of material used –Problems in design because of joint flexibility – Allowance for joint deformation – Code books used in practice.

UNIT IV DESIGN OF JOINTS 9

Joints for different structural connections – Dimensions and detailing – Design of expansionjoints.

UNIT V DESIGN OF INDUSTRIAL BUILDINGS 9

Components of single-storey industrial sheds with crane gantry systems, Design of R.C. Roof Trusses, Roof Panels, Design of R.C. crane - gantry girders, corbels and columns, wind bracing design-case study of industries. Case study in prefabrication industries.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Hubert Bachmann, Alfred Steinle, "Precast Concrete Construction", Wiley-vchVerlag Gmbh, 2011.
2. WaiKwong Lau, Building Construction with Precast Concrete Structural Elements, Lap Lambert Academic Publishing, 2011.

REFERENCES

1. B.Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, New York, 2009.
2. Kim Elliott,"Precast Concrete Structures", Spons Architecture Price Book, April, 2012.
3. Benjamin Pavlich, "Evaluation of Prefabricated Composite Steel Box Girder Systems for Rapid Bridge Construction", Proquest, Umi Dissertation Publishing, 2011.

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	2	2	3	1	--	--	--	--	--	--	2	--	1	3
CO 2	--	3	1	1	1	1	--	--	--	--	1	1	2	1
CO 3	--	--	3	2	1	--	--	--	1	1	1	1	2	3
CO 4	2	2	--	1	1	2	--	--	1	1	1	1	2	2
CO 5														
	4	7	7	5	3	3	--	--	2	2	5	3	7	9

1 - Low, 2 – Medium, 3 – High

Semester	**VIII**
Subject Name	**URBAN AND REGIONAL PLANNING – FUTURE TRENDS**
Subject Code	**XCE803B**
Prerequisite	**NIL**

L	T	P	C
3	0	0	3

C	P	A
2	1	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	Explain the serviceable fundamentals for urban and regional planning – future trends.	Cognitive	Understand
CO2	Distinguish the rural and urban concepts and developments.	Psychomotor	Apply
CO3	Make out the methods of gathering and generating new modern transportation.	Cognitive	Understand
CO4	Appreciate the techniques and methods used in Modern Planning Concepts and Role of Information Technology In Regional Planning.	Cognitive	Knowledge

COURSE CONTENT

UNIT I	**INTRODUCTION TO LAND USE PLANNING AND PRINCIPLES**	**9**

Basics and Importance of land use planning-zoning principles-zoning laws-Infrastructure parameters: population, size of the city, road, water supply and sanitation-growing trends.

UNIT II	**MODERN PLANNING CONCEPTS**	**9**

Urban growth-migration and population explosion-need of modern planning-garden city, radiant city and linear city concepts-development of new towns and cities-organizational structure of municipalities, corporation and urban development.

UNIT III	**FUTURE TRANSPORTATION AND SOCIAL LIFE IN CITIES**	**9**

Redevelopment strategy of city, transport in future city-new transport technology-Integrated transport-Future communities-Gated communities.

UNIT IV	**ROLE OF INFORMATION TECHNOLOGY IN REGIONAL PLANNING**	**9**

Telemetrically concepts and its impacts on city land use-suitability of software for urban analysis-Modelling with software-simulated city-decision support systems for urban regional analysis- change detection and mapping through software.

UNIT V	**URBAN UTOPIA**	**9**

Global cities-Underground cities- Floating cities- Under Water cities- Visionary cities-clean air Parks- Skyscraper world.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Clements D, Donald A , Earnshaw M and Williams A The Future of Community, Pluto Press, London, 2013
2. Boeri S, BiswasRK . Future City, Routledge, New York, 2012
3. Richards B, Future Transport in Cities, Spon Press, London, 2013

REFERENCES

1. Read S, Rosemann J and Dldijk J V Future City, Spon Press New York,2012
2. Wagner CG, Seeing through Future New Eyes, 2012
3. Gallian.B. Arthur and Simon Eisner, the urban pattern-City Planning and Design,Affiliated Press PvtLtd,New Delhi,2010

Mapping of CO with PO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 0	PO11	PO 2	PSO1	PSO2
CO 1	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO 2	1	2	--	--	2	--	--	--	--	--	--	1	1	1
CO 3	2	--	3	--	--	--	2	--	--	1	1	1	1	1
CO 4	2	1	--	--	1	--	1	--	--	1	1	1	1	1
	6	3	3	--	3	2	3	--	--	2	2	3	3	3

1 - Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **PROJECT PHASE II**

Subject Code **XCE 804**

L	T	P	C
0	0	12	12

C	P	A
6	3	3

L	T	P	H
0	0	12	24

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

Mapping of CO with GA's

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

1 - Low, 2 – Medium, 3 – High

Semester : II
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 : II
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 : **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**

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

COURSE CONTENT

UNIT I HISTORY AND PHIOLOSOPHY 9

History of Making of the Indian Constitution: History-Drafting Committee, (Composition& Working) Philosophy of the Indian Constitution: Preamble-Salient Features

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	9

Fundamental Rights -Right to Equality-Right to Freedom-Right against Exploitation-Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies-Directive Principles of State Policy-Fundamental Duties.

UNIT III	ORGANS OF GOVERNANCE	7

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive-President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications-Powers and Functions

UNIT IV	LOCAL ADMINISTRATION	11

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

UNIT V	ELECTION COMMISSION	9

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

L	T	P	Total
30	0	0	30

TEXT BOOKS

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

REFERENCE BOOKS

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

Mapping of CO with PO's

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

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

Semester :
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 : **I**

Course Code : **PCE102**

Course Name : **MECHANICS OF SOLIDS-I**

Prerequisite : **ENGINEERING MECHANICS**

L	T	P	C
2	1	0	3

C	P	A
2.5	0	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	Analyse stresses and strains in members when subjected to loads.	Cognitive	Analyse
CO2	Evaluate the strain energy under various forces	Cognitive	Analyse
CO3	Calculate the shear force and bending moment due to various	Cognitive	Analyse

loading conditions.

CO4	Examine the stability of structural members by studying the reactions and internal forces.	Cognitive	Analyse
CO5	Assess the output of shafts and springs for its maximum energy.	Cognitive	Knowledge

COURSE CONTENT

UNIT I	**SIMPLE STRESSES & STRAINS**	**9**

Concept and types of Stress and Strain, Hooke's Law, Elastic moduli and the relationship between them, Thermal stress, deformation of simple and compound bars.

UNIT II	**STRAIN ENERGY**	**9**

Strain energy and strain energy density – strain energy in traction, shear in flexure and torsion – Strain Energy due to axial force - Resilience - stresses due to impact and suddenly applied load - Principal stress and principal planes - Mohr's circle

UNIT III	**TRANSVERSE LOADING AND STRESSES OF BEAMS**	**9**

Beams – types of supports and loads – shear force and bending moment for simply supported, cantilever and over hanging beams. Theory of simple bending – analysis of stresses.

UNIT IV	**ANALYSIS OF PLANE TRUSS, THIN CYLINDERS / SHELLS**	**9**

Types of truss – analysis of forces in truss members -method of joints- method of sections. - Thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells

UNIT V	**TORSION AND SPRINGS**	**9**

Stresses and deformation in solid and hollow circular shaft– stepped shafts – shafts fixed at both ends. Spring – leaf springs – stresses in helical springs – deflection of springs.

L	T	P	Total
30	15	0	45

TEXT BOOKS

1.Dr. R.K.Bansal," Strength of Materials", Laxmi Publications Pvt Ltd, New Delhi, 8th Edition

2. R.K. Rajput, " Strength of Materials", S.Chand and Company Ltd, New Delhi, 8th Edition

3. R.S. Khurmi, "Strength of Materials", S. Chand & Company Ltd, New Delhi, 2013.

REFERENCE BOOKS

1. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition.

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

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

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**			**2**		**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 : PCE 103

Course Name : FLUID MECHANICS AND MACHINERY

Prerequisite : NIL

L	T	P	C
2	**1**	**0**	**3**

C	P	A
2.5	**0**	**0.5**

L	T	P	H
2	**2**	**0**	**4**

Course Objectives

- To understand about properties of fluids
- To Analyse the flow of fluid under various conditions
- To understand about various hydraulic Machines

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	Understand the basic terms used in fluid mechanics, under static condition	Cognitive	Understand and Apply
CO2	Apply the principles of fluids under kinematics and dynamic conditions	Cognitive	Apply and Analyse
CO3	Perform the dimensional analysis for problems in fluid mechanics	Cognitive Affective	Analyse
CO4	Apply and analyze distribution of water through pipe and pipes	Cognitive	Apply and Analyse

CO5	Understand the components, the hydro-machines	Cognitive Affective	Understand

COURSE CONTENT

UNIT I	**PROPERTIES OF FLUID AND FLUID STATICS**	**9**

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, Hydrostatic Law, Pressure measuring devices-manometers and its types- Pressure gauges and its types

UNIT II	**FLUID KINEMATICS AND DYNAMICS**	**9**

Classification of fluid flow - Types of Flow lines-stream function, velocity potential function, flow net- Continuity equation along stream lines and Cartesian coordinates. 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

UNIT III	**FLOW THROUGH PIPES AND OPEN CHANNEL FLOW**	**9**

Laminar flow through: circular pipes,-Hegen Poisullis Equation a Laminar flow through parallel plates. Loss of head through pipes, Darcy-Wisbech equation, minor losses, total energy equation- hydraulic gradient line- Pipes in series, equivalent pipes- pipes in parallel, power transmission through pipes., Syphon and Water hammer.

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	**DIMENSIONAL ANALYSIS AND HYDRAULIC SIMILITUDE**	**9**

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 V	**HYDRAULIC MACHINES**	**9**

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

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

L	T	P	Total
30	15	0	45

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	2	1	0	0	0	1	0	1	1	1	0	0	0	1
CO 2	3	2	2	1	1	2	0	1	1	1	0	0	2	1
CO 3	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**0**	**1**	**2**	**1**
CO 4	3	3	3	2	1	2	1	1	2	2	0	1	2	**1**
CO 5	**2**	**1**	**0**	**0**	**1**	**0**	**1**	**2**	**2**	**1**	**0**	**1**	**0**	**1**
Total	13	9	7	4	4	7	3	6	6	7	0	3	6	5
Scaled Value	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**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 : PCE 104

Course Name : STRENGTH OF MATERIALS LAB

Prerequisite : MECHANICS OF SOLIDS-I

L	**T**	**P**	**C**
0	**0**	**2**	**2**

C	**P**	**A**
0	**3**	**0**

L	**T**	**P**	**H**
0	**0**	**2**	**2**

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

		Domain C or P or A	**Level**
CO1	Perception about the behavior of solids under stress and strain.	Psychomotor	Respond
CO2	Calculate the forces and moments.	Psychomotor	Measure
CO3	Predict the properties of surfaces of solids.	Psychomotor	Measure
CO4	Behaviour of beams under different loading systems.	Psychomotor	Measure
CO5	Calculate the deflection of springs.	Psychomotor	Respond

COURSE CONTENT

1.Tension test on HYSD bar / MS rod

2. Impact Test (Izod and Charpy)

3. Hardness Test (Brinell and Rockwell)

4. Test on timber

i) Compressive strength test

ii)Tensile strength test

iii)Shear Strength test

iv) Static bending test

5. Deflection Test

6. Young's modulus of the given material (steel or wood)

7. Tests on springs.

L	T	P	Total
0	0	30	30

TEXT 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.

REFERENCE 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. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, Pearson Prentice Hall, 2004

Mapping of CO with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	3		1	3						2		2	
CO2	1	3				2					2		2	
CO3	1	2	2	1			1	1			2		1	
CO4	1	2	2	1			1	1			2		1	
CO5	1	2												
Total	**6**	**12**	**4**	**3**	**3**	**2**	**2**	**2**			**8**		**6**	
Scaled Value	**2**	**3**	**1**	**1**	**1**	**1**	**1**	**1**			**2**		**2**	

1 – Low, 2 – Medium, 3 – High

Semester : **I**

Course Code : **PCE 105**

Course Name : **FLUID MECHANICS AND MACHINERY LAB**

Prerequisite : **NIL**

L	T	P	C
0	0	2	2

C	P	A
0	3	0

L	T	P	H
0	0	2	2

Course Objectives

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

Course Outcome:	**Domain C or P or A**	**Level**
Determine the coefficient of discharge through pipe and notch	Psychomotor	Respond
Verify the principle of Bernoullis Equation.	Psychomotor	Measure
Determine the minor losses for various fittings.	Psychomotor	Measure
Perform test on Efficiency of the Pumps	Psychomotor	Measure
Perform test on Efficiency of the Turbines	Psychomotor	Respond

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Verification of Bernoullis Equation.
4. Determination of friction factor for a given set of pipes.
5. Determination of minor losses for various fitting.
6. Determination of rate of flow through notches
7. Conducting performance test on centrifugal pump and draw their characteristic curves
8. Conducting performance test on Reciprocating pump and draw their characteristic curves
9. Conducting performance test submersible pump and draw their characteristic curves
10. Conducting load test on Pelton Turbine and draw their characteristic curves
11. Conducting load test on Francis Turbine and draw their characteristic curves
12. Study about Axial flow turbine- Kaplan turbine.

L	T	P	Total
0	0	15	15

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.

	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	2	1				1		1	1	1	
CO 2	1		1	1	1				1		1	1		
CO 3	1			1					1				1	
CO 4	1		1						1					
CO 5	2			1	1						1		1	1
Total	7		4	5	3				4		3	2	3	1
Scaled Value	**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 : **II**

Course Code : **PCE 201**

Course Name : **MECHANICS OF SOLIDS-II**

Prerequisite : **MECHANICS OF SOLIDS-I**

L	T	P	C
2	1	0	3

C	P	A
2.5	0	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	Determine the deflection of Simple and Curved members	Cognitive	Analyse
CO2	Analyse indeterminate structures for shear force and bending moment.	Cognitive& Affective	Analyzing & Respond
CO3	Discuss the failure criteria of the column and cylinder based on end condition	Cognitive& Affective	Understanding & Respond
CO4	Compute the deflection of beams by energy principles	Cognitive& Affective	Application & Receive
CO5	Analyse the degrees of freedom for static and kinematic frames.	Cognitive	Analyse

COURSE CONTENT

UNIT I	**DEFLECTIONS OF BEAMS**	**9**

Introduction, Equation of Elastic Curve, Methods for Determining Deflections (Double Integration, Macaulay's Method, Moment-Area Method). Strain energy and dummy unit load approaches to deflection of Simple and Curved members.

UNIT II	**INDETERMINATE BEAMS**	**9**

Propped cantilever and fixed beams-fixed end moments and reactions– Theorem of Three Moments – Shear force and Bending moment diagrams for continuous beams.

UNIT III	**COLUMNS AND THICK CYLINDERS**	**9**

Introduction – Short and Long Columns, Euler's Theory, Rankine-Gordon Formula, Eccentrically Loaded Columns - Thick cylinders – compound cylinders.

UNIT IV	**ENERGY PRINCIPLES**	**9**

Castigliano's theorems – principle of virtual work – Maxwell's reciprocal theorems.- application of energy theorems for computing deflections in beams and trusses.

UNIT V	**INDETERMINATE BEAMS AND FRAMES**	**9**

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1 .Dr. R.K.Bansal,“ Strength of Materials”, Laxmi Publications Pvt Ltd, New Delhi, 8th Edition

2. R.K. Rajput, “ Strength of Materials”, S.Chand and Company Ltd, New Delhi, 8th Edition

3. R.S. Khurmi, “Strength of Materials”, S. Chand & Company Ltd, New Delhi, 2013

REFERENCE BOOKS

1. William Nash, Theory and Problems of Strength of Materials, Schaum’s Outline Series, McGraw-Hill International Edition.

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

5. Egor P Popov, “Engineering Mechanics of Solids”, Prentice Hall of India, New Delhi, 2012, Second Edition.

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	2	1				1		1			1		3	
CO 3	1				1		1				1			
CO 4	3	1		3			1						1	
CO 5	3	3											1	
Total	10	5	0	3	1	2	2	1	1	0	2	0	5	0
Scaled Value	**2**	**1**	**0**	**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 : **II**

Course Code : **PCE 202**

Course Name : **GEOTECHNICAL ENGINEERING – I**

Prerequisite : **NIL**

L	T	P	C
2	1	0	3

C	P	A
2	0.5	0.5

L	T	P	H
2	2	0	4

Course Objectives

- To understand the soil properties, composition and structure
- To Familiarize the students an understanding of permeability and seepage of soils
- To learn the stress-strain relationship
- To know about the strength of soil and its analysis

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	***Identify*** and ***analyze*** various types of soils for engineering utilization.	Cognitive & Psychomotor	Remembering & Observation
CO2	***Determine*** the necessary index and engineering properties of soils.	Cognitive Affective Psychomotor	Analyzing Respond to Phenomena Observation
CO3	***Predicts*** the stress distribution pattern of soil	Cognitive, Affective & Psychomotor	Application Respond to Phenomena Manipulation
CO4	***Illustrate*** the failure modes of Soil	Cognitive & Psychomotor	Understanding Manipulation
CO5	***Investigate*** the soil using appropriate methods and equipments.	Cognitive & Psychomotor	Remembering Observation

COURSE CONTENT

UNIT I SOIL PROPERTIES AND SUB SOIL INVESTIGATION 9

Origin of Soils and Rocks; Rock cycle; Soil minarology; Index properties including consistency limits and grain size distribution – Identification and classification of soil – Textural HRB and BIS specification

Methods of exploration, geophysical and conventional methods; Sounding drilling and boring

technique; Field tests – penetration tests

UNIT II	SOIL - WATER STATICS	7

Concept effective and neutral stresses – Darcy's law, Permeability – Field and Laboratory permeability tests –Seepage flow, seepage pressure, exit gradient - Flownet – significance of Laplace equation – quick sand condition, Liquefaction

UNIT III	COMPRESSIBILITY AND CONSOLIDATION OF SOIL	12

Compaction – Factors affecting compaction – proctor test – Field compaction – Field compaction controls, CBR value and CBR test

Consolidation of soils – Terzaghi's one dimensional consolidation theory – pressure void ratio relationship – prediction of pre consolidation pressure – Total settlement and time rate settlement – secondary compression – coefficient of consolidation – Curve fitting methods, consolidation models.

UNIT IV	STRESSES IN SOIL FROM SURFACE LOADS	8

Vertical stress distribution in soil - Boussinesq's and Westerguard's equations – Newmark's influence chart – Principle, Construction and use - Equivalent point load and other approximate procedures, stress isobars & pressure bulbs

UNIT V	SHEAR STRENGTH OF SOIL	9

Shear Strength; Mohr – Coulomb failure criterion and models – laboratory and field tests – shear properties of cohesion less and cohesive soils - Shear Strength. Parameters for under consolidated, normally consolidated and over consolidated clays; Soil sensors applied in field, Modern advancements; Trenchless Technology

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Murthy, V. N. S. "Geotechnical Engineering: Principles and Practices ofSoil Mechanics and Foundation Engineering", CRC Press, 2002
2. Ranjan, Gopal & Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Int. Pvt. Ltd., 2004.
3. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 3rd edition, 2005, Reprint 2011.
4. Punmia. B.C.,Asok Kumar Jain and Arun Kumar Jain, "Soil Mechanics and Foundations" Laxmi Publications Pvt. Ltd., New Delhi, Sixteenth edi.tion,2005

REFERENCE BOOKS

1. Terzaghi, K., Peck, R. B. &Mesri, G., "Soil Mechanics in Engineering Practice", Wiley, 1996.
2. Craig, R.F. "Craig's Soil Mechanics", 7th Ed., Spon Press, 2004.
3. Holtz, R.D. & Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall, 1981.
4. Lambe, T.W. & Whitman, R.V., "Soil Mechanics", John Wiley & Sons, 1979.
5. Mitchell, J.K. & Soga, K., "Fundamentals of Soil Behaviour", John Wiley & Sons, 2005.
6. Coduto, D.P. "Geotechnical Engineering: Principles and Practices", Pearson Education, Prentice Hall, 2007.

7. Bolton, M.D. “A Guide to Soil Mechanics”, Universities Press, 2003.
8. Das, B.M. “Principles of Geotechnical Engineering”, Thomson Books, 2013.

E-REFERENCES

1. https://nptel.ac.in
2. https://nptel.ac.in/courses/105/101/105101201/
3. http://www.nitttrchd.ac.in/sitenew1/civil/civil.php#page=page-1

IS Codes

1. IS 1498:1970, Classification and identification of soils for general Engineering purposes (first revision) Reaffirm Dec 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	2	1		1		1		2		1		1	2	2
CO 2	1	2	1	1		2		2		1		1	2	2
CO 3	2	1	1	1		1		3		1	1	1	2	2
CO 4	1	2	1	1	1	1		2		1	1	1	2	2
CO 5	1	3	1	1	1	1	2	2	3	1	1	1	2	2
Total	7	9	4	5	2	6	2	11	3	5	3	5	10	10
Scaled Value	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**1**	**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 : **II**

Course Code : **PCE 203**

Course Name : **CONCRETE TECHNOLOGY**

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

- Acquire knowledge on construction materials
- Study the properties of fresh and hardened concrete.
- Learn the mix design procedure

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

COURSE CONTENT

UNIT I **CONSTITUENT MATERIALS** **9**

Cement: - Properties - Testing – modern methods of analysis - Blended Cements; Aggregates: Classification- Properties - Testing - Artificial aggregates; Water: Various sources - Quality Testing; Admixtures and Chemicals: Properties – Uses - Use of eco-friendly recyclable and sustainable materials

UNIT II **FRESH CONCRETE** **9**

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

UNIT III **HARDENED CONCRETE** **9**

Strength: Compressive - Tensile - Flexure - Strength relationships - Testing as per IS codes – Factors influencing strength – NDT techniques; Thermal properties: Durability of concrete: Shrinkage - Creep - Cracks - Acid, Sulphate and Chloride attack.

UNIT IV	CONCRETE MIX DESIGN	9

Concepts of mix design - Factors influencing mix design – ACI and IS code recommended mix design methods; Non-pumpable concrete; Pumpable concrete:.

UNIT V	SPECIAL CONCRETES	9

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Shetty M S. Concrete Technology: Theory and Practice, 7th Edition, S. Chand & Company Ltd-New Delhi, 2014.
2. Varghese PC. Building Materials (English), 2nd Edition, PHI Learning, 2014.
3. Neville AM. Properties of Concrete, Pearson India, 2012.
4. Zongjin Li. Advanced Concrete Technology, John Wiley & Sons. 2011.

REFERENCE BOOKS

1. Santhakumar AR. Concrete Technology, 1st Edition , Oxford University Press-New Delhi, 2006.
2. Ghambir ML. Concrete Technology, 5th Edition , McGraw Hill Education, 2013.
3. Sandor Popovic. Concrete Materials, 2nd Ed.: Properties, Specifications, and Testing, William Andrew, 2012.
4. John Newman. Advanced Concrete Technology 3: Processes 1st Edition, Elsevier Science, 2003.

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http://nptel.ac.in/courses/105104030

http://freevideolectures.com/Course/3357/Concrete-Technology

http://engineeringvideolectures.com/course/289

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					1	3	1	3	1	
CO 2					1				2	2				
CO 3	1	3	3	3					1				3	
CO 4	1					1	1		1			1		1
CO 5					1					3				
Total	3	6	4	4	2	1	1		5	8	1	4	4	1
Scaled Value	1	2	1	1	1	1	1		1	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 : II

Course Code : P204**

Course Name : DISASTER MANAGEMENT

Prerequisite : NIL

L	T	P	C
0	0	0	0

C	P	A
3	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 concepts of disasters, their significance and types	Cognitive	Understand
CO2	Understand the relationship between vulnerability, disasters, disaster prevention and risk reduction	Cognitive	Understand
CO3	Able to understanding of preliminary approaches of Disaster Risk Reduction (DRR)	Cognitive	Understand
CO4	Develop awareness of institutional processes in the country	Cognitive	Application

CO5	Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity	Cognitive	Application

COURSE CONTENT

UNIT I	**INTRODUCTION TO DISASTERS**	**6**
	Importance &Significance, Types of Disasters, Climate Change, DM cycle	
UNIT II	**RISK ASSESSMENT**	**12**
	Risk, Vulnerability, Types of Risk, Risk identification, Emerging Risks, Risk Assessment, Damage Assessment, Risk modeling.	
UNIT III	**DISASTER MANAGEMENT**	**10**
	Phases, Cycle of Disaster Management, Institutional Framework, Incident Command System, DM Plan, Community Based DM, Community health and safety, Early Warning and Disaster Monitoring, Disaster Communication, Role of GIS and Remote Sensing, Do's and Don'ts in various disasters.	
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**10**
	Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness), Disaster Management Act and Policy – Other related policies, plans, programmes and legislation	
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES**	**7**
	Landslide Hazard Zonation, Earthquake Vulnerability Assessment of Buildings and Infrastructure, Drought Assessment, Coastal Flooding, Forest Fire, Man Made disasters, Space Based Inputs for Disaster Mitigation and Management, Cast Study	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361)
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010

REFERENCE BOOKS

1. Siddhartha Gautam and K Leelakrisha Rao, “Disaster Management Programmes and Policies”, Vista International Pub House, 2012
2. Arun Kumar, “Global Disaster Management”, SBS Publishers, 2008

3. Pardeep Sahni, Alka Dhameja and Uma medury, “Disaster mitigation: Experiences and reflections”, PHI, 2000
4. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
5. Government of India, National Disaster Management Policy, 2009

E-REFERENCES

- NIDM Publications at http://nidm.gov.in- Official Website of National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India
- http://cwc.gov.in , http://ekdrm.net , http://www.emdat.be , http://www.nws.noaa.gov , http://pubs.usgs.gov , http://nidm.gov.ini http://www.imd.gov.ini

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		1	1		
CO 2	1	1	3	2	3		1	1						
CO 3					2		1		1					
CO 4	1	1	2	2	2		1				1	1		
CO 5	2	3		2	3		1	2	1			2		
Total	4	5	7	7	11		5	3	3		2	4		
Scaled Value	1	1	2	2	3		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 : **II**

Course Code : **PCE205**

Course Name : **GEOTECHNICAL ENGINEERING LAB**

Prerequisite : **GEOTECHNICAL ENGINEERING**

L	T	P	C
0	0	2	2

C	P	A
2	0.5	0.5

L	T	P	H
0	0	2	2

Course Objectives

- To understand the handling of equipments
- To provide the hands on training in determination of Engineering and index properties of soils, applied in field problems.
- To provide the knowledge on the use of experimental results pertaining to foundation problems

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**	**Level**
CO1	***Identify*** and ***analyze*** various types of soils for engineering utilization.	Psychomotor	Remembering & Observation
CO2	***Determine*** the necessary index and engineering properties of soils.	Psychomotor	Analyzing Respond to Phenomena Observation
CO3	***Investigate*** the soil using appropriate methods and equipments.	Psychomotor	Remembering Observation

COURSE CONTENT

Experiments in Geotechnical Engineering	**30**

- Water content determination (Oven drying method)
- Grain size distribution - Sieve analysis and Hydrometer analysis
- Determination of Specific gravity by Pycnometer and density bottle method
- Determination of Liquid and Plastic limit (Casagrande method)
- Determination of Shrinkage limit of soil
- Determination of moisture-density relationship (Standard Proctor's)
- Determination of Permeability by Constant and Variable head method
- Determination of in-situ density by sand replacement and core cutter method
- Determination of Relative density - Sand
- Unconfined compression test for fine grained soils
- Triaxial Compression Test
- Direct shear test for coarse grained soils
- California Bearing Ratio (CBR) Test

- Plate load test, SPT and SCPT – study experiments

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Murthy, V. N. S. "Geotechnical Engineering: Principles and Practices ofSoil Mechanics and Foundation Engineering", CRC Press, 2002
2. Ranjan, Gopal & Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Int. Pvt. Ltd., 2004.

REFERENCE BOOKS

1. K.H. Head and R. J. Epps, "Manual of Soil Laboratory Testing vol II", 3rd Edition, Whittles Publishing, 2011.
2. B.M. Das, "Soil Mechanics Laboratory Manual", 6th Ed., London, University Press, 2001.
3. 2. J.E. Bowles, "Physical Properties of Soils", 2nd Ed., McGraw Hill International, Singapore, 1990.

E-REFERENCES

1. https://nptel.ac.in
2. https://nptel.ac.in/courses/105/101/105101201/
3. http://www.nitttrchd.ac.in/sitenew1/civil/civil.php#page=page-1

IS Codes

1. IS 1498:1970, Classification and identification of soils for general Engineering purposes (first revision) Reaffirm Dec 2011
2. IS 1888: 1982 Method of Load Test on Soils. • IS 1892: 1979 Code of Practice for Subsurface Investigation for Foundations
3. IS 2131: 1981 Method for Standard Penetration Test for Soils.
4. IS 2720: Part 31: 1990 Methods of Test for Soils - Part 1 to 31:
5. IS 4968: Part III: 1976 Method for Subsurface Sounding for Soils - Part II: Static Cone Penetration Test.

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
CO 2	2				3			1				1	1	1
CO 3	2				3			1	1	1		1	1	1
Total	6				9			3	1	1		3	3	3
Scaled Value	**2**				**2**			**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	**:**	**I**
Subject Name	**:**	**CHEMISTRY FOR ENVIRONMENTAL ENGINEERS**
Subject Code	**:**	**YEN 102**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Engineering Chemistry**

L	T	P	C
3	1	0	4

L	T	P	H
3	2	0	5

COURSE CONTENT

UNIT I FUNDAMENTALS ON ANALYTICAL CHEMISTRY 12

Oxidation and reduction reactions, balancing equation by electron method -Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV–visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2& H_2S by spectrophotometry

UNIT II DEGRADATION OF CHEMICALS 12

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons

UNIT III AQUATIC CHEMISTRY 12

Metals- Removal of heavy metals- complex formation, oxidation and reduction and sorption – E^h – p^H diagrams - chemical speciation – QSAR – Risk evaluation of chemicals.

UNIT IV ATMOSPHERIC CHEMISTRY 12

Regions of atmosphere - Chemical and photochemical reactions – photochemical smog, ozone layer depletion – Greenhouse gases and global warming – Acid rain.

UNIT V SOIL CHEMISTRY 12

Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.
2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.
3. Manahan, S.E., Environmental Chemistry, Eighth Edition, CRC press, 2009.

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005
2. Finar, I.L. "Organic Chemistry" Vol-I, Pearson, 6thEdition, 2002
3. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	**:**	**I**
Subject Name	**:**	**MICROBIOLOGY FOR ENVIRONMENTAL ENGINEERS**
Subject Code	**:**	**YEN 103**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Microbiology**

L	T	P	C
3	0	1	4

L	T	P	H
3	0	2	5

COURSE CONTENT

UNIT I **INTRODUCTION TO MICROORGANISMS** **12**

Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways- Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae.

UNIT II **MICROBIAL NUTRITIONAL REQUIREMENTS** **12**

Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection

UNIT III **AQUATIC MICROBIOLOGY** **12**

Ecotoxicology - toxicants and toxicity - factors influencing toxicity, effects, acute, chronic, concentration response relationships, test organismns, toxicity testing bioconcentration - bioaccumulation - bio-magnification - bioassay - biomonitoring

UNIT IV **MICROBIOLOGY IN WASTE WATER** **12**

Biological methods to treat waste water-Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

UNIT V **APPLICATION** **12**

Application:- Recycling of waste biomass- Biofertilizer, Biopesticides, bioremediation. Biofuels: - Role of microorganism role in algal biofuel, consortia of anaerobic digester Agriculture and Health, Vermi - composting.

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition., Tata McGraw Hill Publishing Company Limited, New Delhi-2001
2. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008
3. Stainer, R.Y., Ingrahum, J.L., Wheelis, M.C and Painter, P.R. " General Microbiology", Mac Millan Edn., Ltd., London, 2007

REFERENCES

1. Reddy S. Ram Reddy S. M. "Microbial Physiology" by Scitech publishersa, 2005
2. Talaro K and Talaro A Cassida Pelzar and Reid, Foundations in Microbiology, by W.C.Brown Publishers, 2008.
3. Gerard J. Tortora, Microbiology : An Introduction, byPearson 9th Edition, 2008

Semester	**:**	**I**
Subject Name	**:**	**TRANSPORT OF WATER AND WASTEWATER**
Subject Code	**:**	**YEN 104**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Environmental Engineering – I & II**

L	T	P	C
3	0	1	4

L	T	P	H
3	0	2	5

COURSE CONTENT

UNIT I TRANSPORT OF WATER 20

Water Storage and Transmission, Storage- requirements, impounding reservoirs- intakes, pressure conduits, hydraulics - pumps and pumping units, capacity - selection of water pumps -economic design of pumps and economic design of gravity and pumping mains- Analysis of physical and Chemical characteristics of Water

UNIT II MATERIALS FOR PIPES 9

Specification for pipes, merits and demerits, pipe appurtenances, types of loads and stresses, water hammer, causes and prevention, control devices, laying, jointing and Testing of pipes.

UNIT III DISTRIBUTION SYSTEM 10

Principles of design, analysis of distribution networks, Hardy Cross, equivalent pipe and Newton Raphson methods, computer applications in distributions network analysis, optimal design of networks, maintenance of distribution systems, methods of control and prevention of corrosion, storage, distribution and balancing reservoirs – EPANET- LOOP

UNIT IV SANITARY SEWERAGE 12

Storm Drainage: Basic philosophy in storm drainage - drainage layouts - storm runoff estimation - Rainfall data analysis - hydraulics of flow in storm water drains - storm water drain materials and sections - design of storm drains - storm water inlets - Sanitation technology selection - sanitary sewage flow estimation - sewer materials - hydraulics of flow in sanitary sewers - partial flows - sewer design - sewer layouts. - Analysis of physical and Chemical characteristics of Waste water.

UNIT V OPERATION & MAINTENANCE 9

Maintenance requirements of sanitary sewerage - storm drainage systems - manpower requirement - Equipment requirement - preventive maintenance - monitoring safety requirements- corrosion in sewers - prevention and control - Specific problems related to waste water pumping - pumping - pump selection - wastewater pumping networks

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. G.S.Bridie & J.S. Bridie, Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi, 2010.
2. Hammer, M.J. Water & Waste water Technology, John Wiley & Sons, New York, 7TH edition, 2012.
3. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2000
5. Manual on Sewage and Sewerage system, CPHEEO, Government of India, New Delhi, 2000

REFERENCES

1. 'Water supply and wastewater removal' Vol.I. John Wiley and Sons Manual on Water Treatment, CPHEEO, Government of India, New Delhi, 2010
2. Hussain S.K. A Text book of water supply and sanitary Engineering, Oxford and IBH Publishing Co., New, 2010.

4. Larry W. Mays, Mays Larry." Water Distribution System Handbook, "McGraw-Hill Professional Publishing, 1999.

Semester : **I**

Subject Name : **UNIT OPERATION IN ENVIRONMENTAL SYSTEMS**

Subject Code : **YEN 105**

Designed by : **Department of Civil Engineering**

Prerequisite : **Environmental Engineering – I & II**

L	T	P	C
3	1	0	4

L	T	P	H
3	2	0	5

COURSE CONTENT

UNIT I **PRIMARY TREATMENT METHODS** **12**

Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation

UNIT II **SEDIMENTATION AND FILTRATION** **12**

Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters

UNIT III **AERATION** **12**

Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays

UNIT IV **ADSORPTION** **12**

Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics

UNIT V **BIOLOGICAL TREATMENT** **12**

Fundamentals of microbiology of wastewater – kinetics of aerobic and anaerobic, anoxic process – suspended growth and attached growth – Biological reactors – Batch, plug flow – completely mixed.

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002
2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.
3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.
2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011
3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester	**:**	**II**
Subject Name	**:**	**THEORY AND PRACTICE OF WATER AND WASTE WATER TREATMENT**
Subject Code	**:**	**YEN201**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Transport of water and waste water , Unit operation in Environmental Systems**

L	T	P	C
3	1	0	4

L	T	P	H
3	2	0	5

COURSE CONTENT

UNIT I PHYSICAL TREATMENT 12

Principles and Design of Screening – Grit Chamber, Skimming Tank

UNIT II CHEMICAL TREATMENT 12

Principles and Design of Equalisation, chemical dosing tanks, Flash mixers, Flocculators, Sedimentation tanks, Clariflocculators.

UNIT III ADVANCED WATER TREATMENT 12

Principles and Design of filter units - Nano filtration, ultra filtration and hyper filtration - Disinfection units - Reverse Osmosis, Electro dialysis and distillation

UNIT IV BIOLOGICAL TREATMENT 12

Design of Aerobic and anaerobic treatment : Trickling filters, Rotating Biological contactor, activated sludge process, Septic tank, aerated lagoons, waste stabilization ponds and oxidation pond – UASB Reactor and Fluidized Bed Reactor

UNIT V SLUDGE TREATMENT AND DISPOSAL 12

Sludge Processing and management - Effluent Disposal in natural water - Operational problems – Trouble shooting, Planning, Organising and Controlling of plant operations

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. David Hendricks," Fundamentals of Water Treatment Unit Processes: Physical, Chemical, and Biological",CRC Press, 2010.
2. Manual on " Water Supply and Treatment ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999
3. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002.
4. Arceivala.J, Shyam, Asolekar R," Wastewater Treatment For Pollution Control", Tata Mcgraw Hill Education Private Limited, 3rd Edition,2006.

REFERENCES

1. Casey, T.J. Unit treatment processes in water and wastewater Engineering, John Wiley and Sons, London 1997.
2. Edward M. Motley, Guang Zhu, Syed R. Qasim," Water Works Engineering: Planning, Design and Operation", Prentice Hall, 2000.
3. Ronald L. Droste," Theory And Practice of Water And Wastewater Treatment," Wiley India Pvt Ltd, 2011

Semester : **II**

Subject Name : **ENVIRONMENTAL IMPACT ASSESSMENT**

Subject Code : **YEN202**

Designed by : **Department of Civil Engineering**

Prerequisite : **None**

L	T	P	C
3	1	0	4

L	T	P	H
3	2	0	5

COURSE CONTENT

UNIT I INTRODUCTION TO EIA **12**

Environmental Impact Assessment (EIA)- Environmental Impact Statement - Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural.

UNIT II METHODOLOGIES **12**

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case Studies.

UNIT III PREDICTION AND ASSESSMENT **12**

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN **12**

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000

UNIT V CASE STUDIES **12**

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

L	T	P	Total
45	15	0	60

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.

Semester : **II**
Subject Name : **SOLID AND HAZARDOUS WASTE MANAGEMENT**
Subject Code : **YEN203**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
3	0	1	4

L	T	P	H
3	0	2	5

COURSE CONTENT

UNIT I **SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK** **9**

Types and Sources of solid and hazardous wastes - Need for solid and hazardous 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, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management.

UNIT II **WASTE CHARACTERIZATION AND SOURCE REDUCTION** **20**

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

Practical: Composition of MSW, Determination of Physical and Chemical Properties of MSW

UNIT III **STORAGE, COLLECTION AND TRANSPORT OF WASTES** **9**

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

UNIT IV **WASTE PROCESSING TECHNOLOGIES** **12**

Objectives of waste processing – material separation and processing technologies – biological &chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

UNIT V **WASTE DISPOSAL** **10**

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

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. George Techobanoglous et al,"Integrated Solid Waste Management", McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.

REFERENCES

1. R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions" ,Lewis, 1997.
2. Blide A.D.& Sundaresan, B.B,"Solid Waste Management in Developing Countries", INSDOC, 1993.
3. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000.
4. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.

Semester : **II**
Subject Name : **AIR POLLUTION AND CONTROL**
Subject Code : **YEN204**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
3	0	0	3

L	T	P	H
3	0	0	3

COURSE CONTENT

UNIT I **INTRODUCTION TO AIR POLLUTANTS** **9**

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models - Ambient air quality and emission standards – Air pollution indices – Air Quality Sampling and Monitoring.

UNIT II **CONTROL OF PARTICULATE CONTAMINANTS** **9**

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III **CONTROL OF GASEOUS CONTAMINANTS** **9**

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV **EMERGING TRENDS** **9**

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility of selected emerging technologies for Air pollution control

UNIT V **INDOOR AIR QUALITY** **9**

Sources and Causes of Indoor Air Quality Problems- Risk due to Indoor Air pollutants- sources of indoor Air pollutants- Indoor Air Quality Regulations- Indoor Air Quality Models- Indoor Air Quality Control- Case Studies

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 2010.
2. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
3. Anjaneyulu. Y, 'Air Pollution and Control Technologies', Allied Publishers (P) Ltd., India, 2002.

REFERENCES

1. David H.F. Liu, Bela G. Liptak 'Air Pollution', Lweis Publishers, 2000.
2. Arthur C.Stern, ' Air Pollution (Vol.I – Vol.VIII)', Academic Press, 2006.
3. Wayne T.Davis, 'Air Pollution Engineering Manual', John Wiley & Sons, Inc., 2000

Semester : **II**
Subject Name : **SPEECH COMMUNICATION**
Subject Code : **YEN207**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
1	0	1	2

L	T	P	H
1	0	2	3

COURSE CONTENT

UNIT I **9**

Introduction to public speaking; functions of oral communication; skills and competencies needed for successful speech making; importance of public speaking skills in everyday life and in the area of business, social, political and all other places of group work

UNIT II **9**

Various types of Speeches**:** manuscript, impromptu, rememorized and extemporaneous speeches; analyzing the audience and occasion; Developing ideas; finding and using supporting materials

UNIT III **9**

Developing speech out line; Organization of Speech; introduction, development and conclusion; language used in various types of speeches; Adapting the speech structures to the Audience; paralinguistic features

UNIT IV **9**

Delivery of speeches, basic tips; how to present a paper/assignment etc; using visual aids to the speeches; using body language to communicate

UNIT V **9**

Public speaking and speech anxiety, public speaking and critical listening Speech practice (4-6 speeches per student)

L	T	P	Total
15	0	30	45

TEXT BOOKS & REFERENCES

1. Principles and Types of Public Speaking - 2002 by Raymie E. McKerrow (Author), Bruce E. Gronbeck ,Douglas Ehninger , Alan H. Monroe
2. Communication : Principles for a lifetime, portable Edition- volume 2 Interpersonal Communication, Stevan A. Beebe, Texas State Universtiy- San Marcos, 2008.
3. Indian's Great Speeches, Compiled by Nitin Agarwal,Grapevine India Publishers Pvt, Ltd., New Delhi.
4. Speech Change of the World, Alan J. Whiticker, Jaico Publishing House, Mumbai.
5. A Course in Phonetics and Spoken English, J. Sethi , P.V Dhamija, PHI Learning Private Limited, Delhi

Semester : **III**
Subject Name : **PROJECT WORK -- PHASE I**
Subject Code : **YEN301**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
0	0	8	8

L	T	P	H
0	0	16	16

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester : **IV**
Subject Name : **PROJECT WORK -- PHASE II**
Subject Code : **YEN401**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
0	0	15	15

L	T	P	H
0	0	30	30

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.

Semester	**:**	**I**
Subject Name	**:**	**ENERGY AND ENVIRONMENT**
Subject Code	**:**	**YEN 106 A**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Environmental science and Engineering**

L	T	P	C
3	0	0	3

L	T	P	H
3	0	0	3

COURSE CONTENT

UNIT I GENERAL **9**

Trends in waste generation-Processing Philosophy- Typical waste composition and its uses-Waste recovery methods-Waste recycling methods-Energy recovery methods

UNIT II RECOVERY OF WASTE MATERIAL **9**

Recovery of waste materials-Plastic recovery –Energy recovery-Metal recovery-Glass recovery-Non ferrous metals recovery-Composting-Check list

UNIT III RECYCLING OF WASTE MATERIAL **9**

Separation and recycling of waste – Principles - separation-Air classifier –Screening-Hammer mill-Products of recycling-Recycling applications-Case histories-House hold waste recycling –Scrap fragmentation Process

UNIT IV WASTE HANDLING SYSTEMS **9**

Waste handling and storage-Supply and demand-Compacting and storage-Storage hoppers-Waste handling systems-Access and safety –Compactors

UNIT V DISOPAL OF WASTE **9**

Waste disposal-Management- Conveyance – Specific examples- Refractories-Development-Chimneys-Control and instrumentation-Operation and safety.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Vaish Troloki,Enery, Environment and Ecology, Vayu Education of India, New Delhi, 2001
2. Salvato, “Environmental Sanitation”, John Wiley & Sons, NewYork, 1982
3. David Kut and Gerard Hare**,”**Waste recycling for energy recovery”, Architectural Press, 1981.

REFERENCES

1. Metcalf & Eddy, “Wastewater Engineering Treatment Disposal Reuse”, Tata McGraw-Hill, New York, 2003.
2. Arcievala S.J., Wastewater treatment and Disposal – Engineering and Ecology in pollution control, Marcel Dekker. Inc., New York, 1981.
3. Chandra and Adab,”Rubber and plastic Waste”,CBS publishers,2004.

Semester : **II**

Subject Name : **GROUNDWATER CONTAMINATION AND TRANSPORT MODELING**

Subject Code : **YEN 205 B**

Designed by : **Department of Civil Engineering**

Prerequisite : **Transport of Water and Waste Water**

L	T	P	C
3	0	0	3

L	T	P	H
3	0	0	3

COURSE CONTENT

UNIT I **INTRODUCTION TO TRANSPORT PHENOMENA** **9**

Transport phenomenon, diffusion, dispersion, advection, adsorption, conservative and non-conservative pollutants, sources and sinks- point and nonpoint.

UNIT II **FLOW AND TRANSPORT EQUATIONS** **9**

Governing Equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for lakes, streams, and estuaries.

UNIT III **MODEL COMPLEXITY** **9**

Selection and development, model resolution, coupled and uncoupled models, Linear and nonlinear models, solution techniques, data requirements for calibration, application and evaluation of environmental control.

UNIT IV **NUMERICAL MODELS** **9**

FDM, FEM and Finite volume techniques, explicit vs. implicit methods, numerical errors, and stability, High resolution techniques.

UNIT V **SOFTWARE MODELLING** **9**

Stream quality modeling and Groundwater transport modeling using software.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Alexander H.-d Cheng, Jacob Bear, "Modeling Groundwater Flow and Contaminant Transport", springer 02, 2011.
2. PascualHoracio Benito," Approaches to Modeling Contaminant Transport in Porous Media: Pore-Scale to Regional Scale Investigations,"Proquest, Umi Dissertation Publishing, 09-2011.
3. Mark Goltz, Junqi Huang," Analytical Modeling of Solute Transport in Groundwater: Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport I",John Wiley & Sons, Aug 2010.

REFERENCES

1. Rafael Antonio PrietoPiedrahita," Treatment of Contaminated Sediments Using Reactive Cap Technology: Characterization and Modeling of Geotechnical, Hydraulic and Contaminant Transport",Proquest, Umi Dissertation Publishing, Sep 2011.
2. ChunmiaoZheng, Gordon D. Bennett," Applied Contaminant Transport Modeling", Wiley-Interscience, February 2002.
3. ShaharShlomi,"Combining Geostatistical Analysis and Flow-And-Transport Models to Improve Groundwater Contaminant Plume Estimation,"Proquest, Umi Dissertation Publishing,2011.

Semester : **II**

Subject Name : **REMOTE SENSING AND GIS**

Subject Code : **YEN206 A**

Designed by : **Department of Civil Engineering**

Prerequisite : **None**

L	T	P	C
3	0	0	3

L	T	P	H
3	0	0	3

COURSE CONTENT

UNIT I **FUNDAMENTALS OF REMOTE SENSING** **9**

Definition, Physics of Remote Sensing, Electromagnetic Radiation and its interactions with atmosphere, Spectral reflectance of earth materials and vegetation

UNIT II **PLATFORMS AND SENSORS** **9**

Aerial Photographs, Active and passive sensors, Data products, Various satellite in orbit and their sensors.

UNIT III **DATA PROCESSING** **9**

Data analysis - Visual Interpretation and Digital Image Processing – classification

UNIT IV **GIS** **9**

Introduction to GIS, concepts and Data base structure, various GIS software.

UNIT V **REMOTE SENSING AND GIS APPLICATIONS** **9**

Management and monitoring of land, air, water and pollution studies, conservation of resources, Identification of site for waste disposal – optimization of Route for collection of MSW

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Anji Reddy.M," Textbook of Remote Sensing and GIS", BPB Publications,2006
2. T. M. Lillesand and R.W.Kiefer," Remote Sensing and Image Interpretation ",Wiley,2011
3. E. T. Engman and R. J. Curney," Remote Sensing in Hydrology,"Chapman&Hall,1990

REFERENCES

1. Lillies and T.M. and Kiefer, R.W., "Remote Sensing and Image Interpretation ", John Wiley and Sons, 1994.
2. Burrough,P.A. and McDonnell, R.A.,"Principles of Geographical Information Systems", Oxford University Press, 1998.
3. Lintz, J. and Simonet, " Remote Sensing of Environment ", Addison Wesley Publishing Company, 1994.
4. David Martin," Geographic Information Systems", Routledge,1995.

Semester	**:**	**I**
Subject Name	**:**	**CHEMISTRY FOR ENVIRONMENTAL ENGINEERS**
Subject Code	**:**	**QEN 102**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Engineering Chemistry**

L	T	P	C
3	1	0	4

L	T	P
3	2	0

COURSE CONTENT

UNIT I FUNDAMENTALS ON ANALYTICAL CHEMISTRY 12

Oxidation and reduction reactions, balancing equation by electron method -Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV– visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2& H_2S by spectrophotometry

UNIT II DEGRADATION OF CHEMICALS 12

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons

UNIT III AQUATIC CHEMISTRY 12

Metals- Removal of heavy metals- complex formation, oxidation and reduction and sorption – E^h – p^H diagrams - chemical speciation – QSAR – Risk evaluation of chemicals.

UNIT IV ATMOSPHERIC CHEMISTRY 12

Regions of atmosphere - Chemical and photochemical reactions – photochemical smog, ozone layer depletion – Greenhouse gases and global warming – Acid rain.

UNIT V SOIL CHEMISTRY 12

Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.
2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.
3. Manahan, S.E., Environmental Chemistry, Eighth Edition, CRC press, 2009.

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005
2. Finar, I.L. "Organic Chemistry" Vol-I, Pearson, 6thEdition, 2002
3. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	**:**	**I**
Subject Name	**:**	**Microbiology for Environmental Engineers**
Subject Code	**:**	**QEN 103**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**Microbiology**

L	T	P	C
3	0	1	4

L	T	P
3	0	2

COURSE CONTENT

UNIT I INTRODUCTION TO MICROORGANISMS 12

Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways- Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae.

UNIT II MICROBIAL NUTRITIONAL REQUIREMENTS 12

Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection

UNIT III AQUATIC MICROBIOLOGY 12

Ecotoxicology - toxicants and toxicity - factors influencing toxicity, effects, acute, chronic, concentration response relationships, test organismns, toxicity testing bioconcentration - bioaccumulation - bio-magnification - bioassay – biomonitoring

UNIT IV MICROBIOLOGY IN WASTE WATER 12

Biological methods to treat waste water-Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

UNIT V APPLICATION 12

Application:- Recycling of waste biomass- Biofertilizer, Biopesticides, bioremediation. Biofuels: - Role of microorganism role in algal biofuel, consortia of anaerobic digester Agriculture and Health, Vermi - composting.

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition., Tata McGraw Hill Publishing Company Limited, New Delhi-2001
2. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008
3. Stainer, R.Y., Ingrahum, J.L., Wheelis, M.C and Painter, P.R. " General Microbiology", Mac Millan Edn., Ltd., London, 2007

REFERENCES

1. Reddy S. Ram Reddy S. M. "Microbial Physiology" by Scitech publishersa, 2005
2. Talaro K and Talaro A Cassida Pelzar and Reid, Foundations in Microbiology, by W.C.Brown Publishers, 2008.
3. Gerard J. Tortora, Microbiology : An Introduction, byPearson 9th Edition, 2008

Semester : **II**

Subject Name : **TRANSPORT OF WATER AND WASTEWATER**

Subject Code : **QEN201**

Designed by : **Department of Civil Engineering**

Prerequisite : **Environmental Engineering – I & II**

L	T	P	C
3	0	1	4

L	T	P
3	0	2

COURSE CONTENT

UNIT I **TRANSPORT OF WATER** **20**

Water Storage and Transmission, Storage- requirements, impounding reservoirs- intakes, pressure conduits, hydraulics - pumps and pumping units, capacity - selection of water pumps -economic design of pumps and economic design of gravity and pumping mains- Analysis of physical and Chemical characteristics of Water

UNIT II **MATERIALS FOR PIPES** **9**

Specification for pipes, merits and demerits, pipe appurtenances, types of loads and stresses, water hammer, causes and prevention, control devices, laying, jointing and Testing of pipes.

UNIT III **DISTRIBUTION SYSTEM** **10**

Principles of design, analysis of distribution networks, Hardy Cross, equivalent pipe and Newton Raphson methods, computer applications in distributions network analysis, optimal design of networks, maintenance of distribution systems, methods of control and prevention of corrosion, storage, distribution and balancing reservoirs – EPANET-LOOP

UNIT IV **SANITARY SEWERAGE** **12**

Storm Drainage: Basic philosophy in storm drainage - drainage layouts - storm runoff estimation - Rainfall data analysis - hydraulics of flow in storm water drains - storm water drain materials and sections - design of storm drains - storm water inlets - Sanitation technology selection - sanitary sewage flow estimation - sewer materials - hydraulics of flow in sanitary sewers - partial flows - sewer design - sewer layouts. - Analysis of physical and Chemical characteristics of Waste water.

UNIT V **OPERATION & MAINTENANCE** **9**

Maintenance requirements of sanitary sewerage - storm drainage systems - manpower requirement - Equipment requirement - preventive maintenance - monitoring safety requirements- corrosion in sewers - prevention and control - Specific problems related to waste water pumping - pumping - pump selection - wastewater pumping networks

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. G.S.Bridie & J.S. Bridie, Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi, 2010.
2. Hammer, M.J. Water & Waste water Technology, John Wiley & Sons, New York, 7TH edition, 2012.
3. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 2000
5. Manual on Sewage and Sewerage system, CPHEEO, Government of India, New Delhi, 2000

REFERENCES

1. 'Water supply and wastewater removal' Vol.I. John Wiley and Sons Manual on Water Treatment, CPHEEO, Government of India, New Delhi, 2010
2. Hussain S.K. A Text book of water supply and sanitary Engineering, Oxford and IBH Publishing Co., New, 2010.
3. Larry W. Mays, Mays Larry." Water Distribution System Handbook, "McGraw-Hill Professional Publishing, 1999.

Semester : **II**

Subject Name : **UNIT OPERATION IN ENVIRONMENTAL SYSTEMS**

Subject Code : **QEN202**

Designed by : **Department of Civil Engineering**

Prerequisite : **Environmental Engineering – I & II**

L	T	P	C
3	1	0	4

L	T	P
3	2	0

COURSE CONTENT

UNIT I PRIMARY TREATMENT METHODS 12

Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation

UNIT II SEDIMENTATION AND FILTRATION 12

Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters

UNIT III AERATION 12

Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays

UNIT IV ADSORPTION 12

Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics

UNIT V BIOLOGICAL TREATMENT 12

Fundamentals of microbiology of wastewater – kinetics of aerobic and anaerobic, anoxic process – suspended growth and attached growth – Biological reactors – Batch, plug flow – completely mixed.

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002
2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.
3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.
2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011
3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester : **III**

Subject Name : **Theory and Practice of Water and Waste Water Treatment**

Subject Code : **QEN301**

Designed by : **Department of Civil Engineering**

Prerequisite : **Transport of water and waste water , Unit operation in Environmental Systems**

L	T	P	C
3	1	0	4

L	T	P
3	2	0

COURSE CONTENT

UNIT I PHYSICAL TREATMENT 12

Principles and Design of Screening – Grit Chamber, Skimming Tank

UNIT II CHEMICAL TREATMENT 12

Principles and Design of Equalisation, chemical dosing tanks, Flash mixers, Flocculators, Sedimentation tanks, Clariflocculators.

UNIT III ADVANCED WATER TREATMENT 12

Principles and Design of filter units - Nano filtration, ultra filtration and hyper filtration - Disinfection units - Reverse Osmosis, Electro dialysis and distillation

UNIT IV BIOLOGICAL TREATMENT 12

Design of Aerobic and anaerobic treatment : Trickling filters, Rotating Biological contactor, activated sludge process, Septic tank, aerated lagoons, waste stabilization ponds and oxidation pond – UASB Reactor and Fluidized Bed Reactor

UNIT V SLUDGE TREATMENT AND DISPOSAL 12

Sludge Processing and management - Effluent Disposal in natural water - Operational problems – Trouble shooting, Planning, Organising and Controlling of plant operations

L	T	P	Total
45	15	0	60

TEXT BOOKS

1. David Hendricks," Fundamentals of Water Treatment Unit Processes: Physical, Chemical, and Biological",CRC Press, 2010.
2. Manual on " Water Supply and Treatment ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999
3. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002.
4. Arceivala.J, Shyam, Asolekar R," Wastewater Treatment For Pollution Control", Tata Mcgraw Hill Education Private Limited, 3rd Edition,2006.

REFERENCES

1. Casey, T.J. Unit treatment processes in water and wastewater Engineering, John Wiley and Sons, London 1997.
2. Edward M. Motley, Guang Zhu, Syed R. Qasim," Water Works Engineering: Planning, Design and Operation", Prentice Hall, 2000.
3. Ronald L. Droste," Theory And Practice of Water And Wastewater Treatment," Wiley India Pvt Ltd, 2011

Semester : **III**

Subject Name : **Solid and Hazardous Waste Management**

Subject Code : **QEN 302**

Designed by : **Department of Civil Engineering**

Prerequisite : **None**

L	T	P	C
3	0	1	4

L	T	P
3	0	2

COURSE CONTENT

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK 9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous 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, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management.

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 20

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

Practical: Composition of MSW, Determination of Physical and Chemical Properties of MSW

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

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

UNIT IV	WASTE PROCESSING TECHNOLOGIES	12

Objectives of waste processing – material separation and processing technologies – biological &chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

UNIT V	WASTE DISPOSAL	10

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

L	T	P	Total
45	0	15	60

TEXT BOOKS

1. George Techobanoglous et al,"Integrated Solid Waste Management", McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.

REFERENCES

1. R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions" ,Lewis, 1997.
2. Blide A.D.& Sundaresan, B.B,"Solid Waste Management in Developing Countries", INSDOC, 1993.
3. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000.
4. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.

Semester : **IV**

Subject Name : **Environmental Impact Assessment**

Subject Code : **QEN401**

Designed by : **Department of Civil Engineering**

Prerequisite : **None**

L	T	P	C
3	1	0	4

L	T	P
3	2	0

COURSE CONTENT

UNIT I INTRODUCTION TO EIA **12**

Environmental Impact Assessment (EIA)- Environmental Impact Statement - Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural.

UNIT II METHODOLOGIES **12**

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case Studies.

UNIT III PREDICTION AND ASSESSMENT **12**

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN **12**

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000

UNIT V CASE STUDIES **12**

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

L	T	P	Total
45	15	0	60

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.

Semester	**:**	**IV**
Subject Name	**:**	**Air Pollution and Control**
Subject Code	**:**	**QEN402**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**None**

L	T	P	C
3	0	0	3

L	T	P
3	0	0

COURSE CONTENT

UNIT I INTRODUCTION TO AIR POLLUTANTS 9

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models - Ambient air quality and emission standards – Air pollution indices – Air Quality Sampling and Monitoring.

UNIT II CONTROL OF PARTICULATE CONTAMINANTS 9

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III CONTROL OF GASEOUS CONTAMINANTS 9

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV EMERGING TRENDS 9

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility of selected emerging technologies for Air pollution control

UNIT V INDOOR AIR QUALITY 9

Sources and Causes of Indoor Air Quality Problems- Risk due to Indoor Air pollutants- sources of indoor Air pollutants- Indoor Air Quality Regulations- Indoor Air Quality Models- Indoor Air Quality Control- Case Studies

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 2010.
2. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
3. Anjaneyulu. Y, 'Air Pollution and Control Technologies', Allied Publishers (P) Ltd., India, 2002.

REFERENCES

1. David H.F. Liu, Bela G. Liptak 'Air Pollution', Lweis Publishers, 2000.
2. Arthur C.Stern, ' Air Pollution (Vol.I – Vol.VIII)', Academic Press, 2006.
3. Wayne T.Davis, 'Air Pollution Engineering Manual', John Wiley & Sons, Inc., 2000

Semester : **V**
Subject Name : **PROJECT WORK -- PHASE I**
Subject Code : **QEN501**
Designed by : **Department of Civil Engineering**
Prerequisite : **None**

L	T	P	C
0	0	8	8

L	T	P
0	0	16

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester	**:**	**VI**
Subject Name	**:**	**PROJECT WORK -- PHASE II**
Subject Code	**:**	**QEN601**
Designed by	**:**	**Department of Civil Engineering**
Prerequisite	**:**	**None**

L	T	P	C
0	0	15	15

L	T	P
0	0	30

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.

Semester	Course Code	Course Name	L	T	P	C
I	YEN101	Chemistry and Microbiology for Environmental Engineers	3	0	0	3

COURSE CONTENT

UNIT I	**FUNDAMENTALS ON ANALYTICAL CHEMISTRY**	**12**
	Oxidation and reduction reactions, balancing equation by electron method -Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV–visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2& H_2S by spectrophotometry.	
UNIT II	**DEGRADATION OF CHEMICALS**	**6**
	Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons	
UNIT III	**SOIL CHEMISTRY**	**9**
	Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation	
UNIT IV	**MICROORGANISMS AND NUTRITIONAL REQUIREMENTS**	**9**
	Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways- Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae. Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection.	

UNIT V	MICROBIOLOGY IN WASTE WATER	9

Biological methods to treat waste water- Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.
2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.
3. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition.
4. Tata McGraw Hill Publishing Company Limited, New Delhi-2001
5. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005
2. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	Course Code	Course Name	L	T	P	C
I	YEN102	Unit Operation and Processes in Environmental systems	3	0	0	3

COURSE CONTENT

UNIT I	PRIMARY TREATMENT METHODS	9

Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation

UNIT II	SEDIMENTATION AND FILTRATION	9

Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters

UNIT III	AERATION	9

Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays

UNIT IV	ADSORPTION	9

Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics

UNIT V	MEMBRANE PROCESSES	9

Reverse Osmosis and Electro dialysis - Species Transformation Processes - Chemical Oxidation / Reduction Processes, Disinfection using Chlorine and UV, Advanced Oxidation Process.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002
2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.
3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.
2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011
3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester	Course Code	Course Name	L	T	P	C
I	YEN105	Environmental Quality Measurements Laboratory-I (Water and Wastewater)	0	0	2	2

List of Experiments:

1. Determination of pH, Turbidity and Electrical conductivity
2. Determination of Alkalinity
3. Determination of Acidity
4. Determination of Hardness
5. Determination of Sulphates
6. Determination of Fluorides
7. Determination of Nitrates
8. Residual chlorine analysis
9. Test on Dissolved Oxygen and BOD
10. Test on COD

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
I	YEN106	Microbiology Laboratory	0	0	2	2

List of Experiments:

1. Preparation of culture media
2. Isolation, culturing and Identification of Microorganisms
3. Microorganisms from polluted habitats (soil, water and air)
4. Measurement of growth of microorganisms
5. Biodegradation of organic matter in waste water Analysis of air borne microorganisms
6. Staining of bacteria.
7. Effect of pH, temperature on microbial growth
8. Pollutant removal using microbes from industrial effluent.
9. Bacteriological analysis of wastewater (Coliforms, *E.coli, Streptococcus*) – MPN
10. Bacteriological analysis of wastewater (Coliforms, *Streptococcus)* - MF techniques

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Benfield, L.D.; Weand, B.L.; Judkins, J.F. (1982) Process chemistry for water and wastewater. Prentice Hall Inc Englewood Cliffs New Jersey.
2. Weber Jr., W.J. (1972) Physico-chemical Process for Water Quality Control. Wiley Inc. Newyork.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York, 1985.

Semester	Course Code	Course Name	L	T	P	C
I	YRM 107	Research Methodology and IPR	2	0	0	2

COURSE CONTENT

UNIT I **6**

Meaning of research problem, Sources of research problem, Criteria-Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection,analysis, interpretation, Necessary instrumentations

UNIT II **6**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III **6**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting,

development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV **6**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V **6**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

L	T	P	Total
30	0	0	30

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester	Course Code	Course Name	L	T	P	C
II	YEN202	Biological Treatment of Wastewater	3	0	0	3

COURSE CONTENT

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

Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process- reactors-batch-continuous type

UNIT II **AEROBIC TREATMENT OF WASTEWATER** **9**

Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends

UNIT III **ANAEROBIC TREATMENT OF WASTEWATER** 9

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends.

UNIT IV	SLUDGE TREATMENT AND DISPOSAL	9

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering(mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal –

recent advances.

UNIT V	OPERATION AND MAINTENANCE	9

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata Mcgraw Hill, New Delhi, III Edition, 2006.
2. David Hendricks, "Fundamentals of Water Treatment Unit Process", CRC Press, New York, 2010
3. F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York, III, Edition, 2013.

REFERENCES

1. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Government of India,New Delhi, 1999.
2. Metcalf & Eddy, INC, "Wastewater Engineering – Treatment and Reuse", Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.
3. Qasim, S.R. "Wastewater Treatment Plant, Planning, Design & Operation", Technomic Publications, New York, II Edition, 1998.

Semester	Course Code	Course Name	L	T	P	C
II	YEN206	Unit Operation Laboratory	0	0	2	2

List of Experiments:

1. Coagulation and Flocculation
2. Studies on Filtration- Characteristics of Filter media
3. Disinfection for Drinking water (Chlorination
4. Water Softening - Lime and Caustic Soda Process
5. Sludge volume Index
6. Sedimentation - Settling Column Analysis of Flocculating Particles
7. Adsorption - Colour Removal by Adsorption
8. Heavy Metal Precipitation
9. Kinetics of Activated Sludge Process

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
III	YEN 207	Mini Project	0	0	4	2

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a panel of examiners

Semester	Course Code	Course Name	L	T	P	C
III	YEN303	Dissertation Phase - I	0	0	20	10

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester	Course Code	Course Name	L	T	P	C
IV	YEN401	Dissertation Phase - II	0	0	32	16

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.

Semester	Course Code	Course Name	L	T	P	C
I	YEN103B	Environmental Economics	3	0	0	3

COURSE CONTENT

UNIT I THEORY AND CONCEPT **9**

Nature and significance of environmental economics – definition and scope of environmental economics – basic theory – market system and the environment – welfare and environment – the economics of externalities.

UNIT II ENVIRONMENT AND ECONOMICS **9**

Environment – economy linkage – environment as a necessity and luxury – population and environment linkage – environmental use as an allocative problem – environment as a public good – valuation of environmental damages: land, water, air and forest.

UNIT III ENVIRONMENTAL PROBLEMS **9**

Economic development and environmental problems – air pollution – water pollution – sound pollution – energy use and environment problem – pollution and urbanization – global warming and green house effect – health, urbanization, transport and technology – environmental degradation.

UNIT IV POLLUTION CONTROL **9**

Prevention, control and abatement of pollution – choice of policy instruments in developing countries – environmental law – sustainable development – indicators of sustainable development – environmental planning – environmental accounting.

UNIT V POLICY MEASURES **9**

Basic approach – design of environmental policy – Indian environment policies and performance – pollution control boards and their function.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. M. Karpagam (1993), Environmental Economics, Sterling Publishers, New Delhi.
2. S. Sankaran(1994) Environmental Economics, Margham , Madras
3. N.Rajalakshmi and DhulasiBirundha (1994), Environomics, Economic analysis of Enviroment, Allied publishers, Ahmedabad.
4. S.Varadarajan and S. Elangovan(1992), Environmental economics, Speed, Chennai.

REFERENCES

1. Singh G.N (Ed.) (1991) Environmental Economics, Mittal Publications, New Delhi.
2. Garge, M.R. (Ed.) (1996), Environmental Pollution and Protection, Deep and Deep Publications, New Delhi.
3. Lodha, S.L (Ed.) (1991), Economics of Environment, Publishers, New Delhi. 8. The Hindu survey of Environment: Annual Reports.

Semester	Course Code	Course Name	L	T	P	C
I	YEN103 C	Air Pollution and Control	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION TO AIR POLLUTANTS 9

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models - Ambient air quality and emission standards – Air pollution indices – Air Quality Sampling and Monitoring.

UNIT II CONTROL OF PARTICULATE CONTAMINANTS 9

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III CONTROL OF GASEOUS CONTAMINANTS 9

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV EMERGING TRENDS 9

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility of selected emerging technologies for Air pollution control

UNIT V INDOOR AIR QUALITY 9

Sources and Causes of Indoor Air Quality Problems- Risk due to Indoor Air pollutants- sources of indoor Air pollutants- Indoor Air Quality Regulations- Indoor Air Quality Models- Indoor Air Quality Control- Case Studies

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 2010.
2. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
3. Anjaneyulu. Y, 'Air Pollution and Control Technologies', Allied Publishers (P) Ltd., India, 2002

REFERENCES

1. David H.F. Liu, Bela G. Liptak 'Air Pollution', Lewis Publishers, 2000.
2. Arthur C.Stern, ' Air Pollution (Vol.I – Vol.VIII)', Academic Press, 2006.
3. Wayne T.Davis, 'Air Pollution Engineering Manual', John Wiley & Sons, Inc., 2000

Semester	Course Code	Course Name	L	T	P	C
I	YEN104C	Environmental Policies and Legislation	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION **8**

Basics of jurisprudence – Environmental law relation with other disciplines - Criminal law – Common Law – Relevant sections of the Code of Civil Procedure, Criminal Procedure Code – Indian Penal Code.

UNIT II INDIAN CONSTITUTION AND ENVIRONMENT **10**

Introduction – Fundamental Rights – Directive Principles of State Policy – Article 48 (A) and 51-A(g) Judicial enforceability – Constitution and Resources management and pollution control – Indian Forest Policy (1990) – Indian Environmental Policy (1992).

UNIT III ADMINISTRATIVE REGIME & LEGAL REGIME **9**

Administrative regulations – constitution of Pollution Control Boards Powers, functions, Accounts, Audit etc. – Formal Justice Delivery mechanism Higher and Lower of judiciary – Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement – Equitable remedies for pollution control

UNIT IV POLLUTION CONTROL LAWS **9**

Administrative regulation under recent legislations in water pollution control. Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & control or Pollution) cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

UNIT V ENVIRONMENTAL (PROTECTION) ACT 1986 **9**

Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Eco-labeling, and E.I.A.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Constitution of India Eastern Book Company Lucknow 12th Edn. 1997.
2. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
3. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.
4. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997

REFERENCES

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

Semester	Course Code	Course Name	L	T	P	C
II	YEN203C	Solid and Hazardous Waste Management	3	0	0	3

COURSE CONTENT

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK 9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous 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, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management.

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 9

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

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

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

UNIT IV WASTE PROCESSING TECHNOLOGIES 9

Objectives of waste processing – material separation and processing technologies – biological &chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

UNIT V WASTE DISPOSAL 9

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. George Techobanoglous et al, "Integrated Solid Waste Management", McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.

REFERENCES

1. R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions" ,Lewis, 1997.
2. Blide A.D.& Sundaresan, B.B,"Solid Waste Management in Developing Countries", INSDOC, 1993.
3. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000.
4. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.

Semester	Course Code	Course Name	L	T	P	C
II	YEN204B	Environmental Geotechnology	3	0	0	3

COURSE CONTENT

UNIT I SOIL PROFILE **9**

Soil as a multiphase system; Soil – environment interactions; Properties of water in relation to porous media; Water cycle with special reference to soil medium.

UNIT II SOIL MINERALOGY **9**

Soil mineralogy; significance of mineralogy in determining soil behavior; Mineralogical characterization

UNIT III MECHANISMS OF SOIL-WATER INTERACTIONS **9**

Diffuse double layer models; Force of attraction and repulsion; Soil- Water contaminant interaction; Theories of Ion exchange; Influence of organic and inorganic chemical interaction.

UNIT IV WASTE & ITS TRANSPORT IN SOIL **9**

Concepts of waste containment facilities; desirable properties of soil; contaminant transport and retention; contaminated site remediation

UNIT V REMEDIAL TECHNIQUES **9**

Introduction to advanced soil characterization techniques; volumetric water content; gas permeation in soil; electrical and thermal properties; pore –size distribution; contaminant analysis

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Geotechnical and Geoenvironmental Engineering Handbook, Rowe R. K, Kluwer Academic Publishers 2001
2. Fundamentals of Soil Behavior, Mitchell J.K and Soga K., John Wiley and Sons Inc. 2012
3. Introduction to Environmental Geotechnology, Fang, H.Y., CRC press 1997
4. Geotechnical Practice for Waste Disposal, Daniel D.E, Chapman and Hall 1993

REFERENCES

1. Clay Barrier Systems for Waste Disposal Facilities, Rowe J.R., Quigley R.K., R.M. and Booker, Chapman and Hall 1995
2. Geoenvironmental Engineering: Principles and Applications, Reddi L.N. And Inyang H.F, Marcel Dekker Inc 2000
3. Waste Containment Systems, Waste Stabilization And Landfills: Design and Evaluation, Sharma H. D. And Lewis S.P, John Wiley & Sons Inc 1994

Semester	Course Code	Course Name	L	T	P	C
II	YEN301A	Ground Water Contamination and Transport Modeling	3	0	0	3

COURSE CONTENT

UNIT I **INTRODUCTION TO TRANSPORT PHENOMENA** **9**

Transport phenomenon, diffusion, dispersion, advection, adsorption, conservative and non-conservative pollutants, sources and sinks- point and nonpoint.

UNIT II **FLOW AND TRANSPORT EQUATIONS** **9**

Governing Equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for lakes, streams, and estuaries.

UNIT III **MODEL COMPLEXITY** **9**

Selection and development, model resolution, coupled and uncoupled models, Linear and nonlinear models, solution techniques, data requirements for calibration, application and evaluation of environmental control.

UNIT IV **NUMERICAL MODELS** **9**

FDM, FEM and Finite volume techniques, explicit vs. implicit methods, numerical errors, and stability, High resolution techniques.

UNIT V **SOFTWARE MODELLING** **9**

Stream quality modeling and Groundwater transport modeling using software.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Alexander H.-d Cheng, Jacob Bear, “Modeling Groundwater Flow and Contaminant Transport”, springer 02, 2011.
2. PascualHoracio Benito,” Approaches to Modeling Contaminant Transport in Porous Media: Pore-Scale to Regional Scale Investigations,”Proquest, Umi Dissertation Publishing, 09-2011.
3. Mark Goltz, Junqi Huang,” Analytical Modeling of Solute Transport in Groundwater: Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport I”,John Wiley & Sons, Aug 2010.

REFERENCES

1. Rafael Antonio PrietoPiedrahita,” Treatment of Contaminated Sediments Using Reactive Cap Technology: Characterization and Modeling of Geotechnical, Hydraulic and Contaminant Transport”, Proquest, Umi Dissertation Publishing, Sep 2011.
2. ChunmiaoZheng, Gordon D. Bennett,” Applied Contaminant Transport Modeling”, Wiley-Interscience, February 2002.
3. Shahar Shlomi,”Combining Geostatistical Analysis and Flow-And-Transport Models to Improve Groundwater Contaminant Plume Estimation, ”Proquest, Umi Dissertation Publishing,2011

Semester	Course Code	Course Name	L	T	P	C
	YMEOE1	INDUSTRIAL SAFETY	3	0	0	3

COURSE CONTENT

UNIT I **9**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II **9**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III **9**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV **9**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V **9**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

L	T	P	Total
45	0	0	45

REFERENCES

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Semester	Course Code	Course Name	L	T	P	C
I	QEN101	Chemistry and Microbiology for Environmental Engineers	3	0	0	3

COURSE CONTENT

UNIT I FUNDAMENTALS ON ANALYTICAL CHEMISTRY 12

Oxidation and reduction reactions, balancing equation by electron method -Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – Electrode potential – Applications of potentiometry – pH measurements, glass electrodes, ion selective electrodes – Instrumentations- Atomic spectroscopy – Flame photometry – Atomic Adsorption Spectrophotometry – principle- UV–visible spectrophotometer -Application in determination of mercury, lead and cadmium in water samples. Chromatography – Gas chromatography – simple instrumentation – Application in measuring SO_2, NO_2& H_2S by spectrophotometry

UNIT II DEGRADATION OF CHEMICALS 6

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of foodstuffs, detergents, pesticides and hydrocarbons

UNIT III SOIL CHEMISTRY 9

Soil properties, clay minerals - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

UNIT IV MICROORGANISMS AND NUTRITIONAL REQUIREMENTS 9

Basic principles of microbiology- structure and function of microbial cell-pure and mixed cultures-metabolism-Aerobic and Anaerobic pathways- Microbial growth and growth kinetics-Classification and morphological aspects of Bacteria, Fungi, Protozoa and algae. Microbial Nutrition –Growth of micro-organism in different media, growth curve, methods of enumeration of micro-organisms, sterilization and disinfection.

UNIT V MICROBIOLOGY IN WASTE WATER 9

Biological methods to treat waste water- Microbiology in air pollution control (biofilter and bio scrubber), biodegradation of toxic pollutant. Practical: culture, identify and explain microorganisms in environmental cultures

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003.
2. Colin Baird 'Environmental Chemistry', Freeman and company, New York, 2011.
3. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and Pelczar Merna Foss. "Microbiology 5th edition.
4. Tata McGraw Hill Publishing Company Limited, New Delhi-2001
5. Maeir, R.M., I.L.Pepper and C.P. Gerba, " Environmental Microbiology", Academic Press, New York, 2008

REFERENCES

1. Des W. Connell, "Basic Concepts of Environmental Chemistry", CRC Press, 2nd Edition, 2005
2. Gary W VanLoon, Stephen J Duffy," Environmental Chemistry: A Global Perspective", Oxford University Press, 2010

Semester	Course Code	Course Name	L	T	P	C
I	QEN103	Microbiology Laboratory	0	0	2	2

List of Experiments:

1. Preparation of culture media
2. Isolation, culturing and Identification of Microorganisms
3. Microorganisms from polluted habitats (soil, water and air)
4. Measurement of growth of microorganisms
5. Biodegradation of organic matter in waste water Analysis of air borne microorganisms
6. Staining of bacteria.
7. Effect of pH, temperature on microbial growth
8. Pollutant removal using microbes from industrial effluent.
9. Bacteriological analysis of wastewater (Coliforms, *E.coli, Streptococcus*) – MPN
10. Bacteriological analysis of wastewater (Coliforms, *Streptococcus)* - MF techniques

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Benfield, L.D.; Weand, B.L.; Judkins, J.F. (1982) Process chemistry for water and wastewater. Prentice Hall Inc Englewood Cliffs New Jersey.
2. Weber Jr., W.J. (1972) Physico-chemical Process for Water Quality Control. Wiley Inc. Newyork.
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York, 1985.

Semester	Course Code	Course Name	L	T	P	C
I	QRM 104	Research Methodology and IPR	2	0	0	2

COURSE CONTENT

UNIT I **6**

Meaning of research problem, Sources of research problem, Criteria-Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection,analysis, interpretation, Necessary instrumentations

UNIT II **6**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III **6**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV **6**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V		6
	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	

L	T	P	Total
30	0	0	30

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester	Course Code	Course Name	L	T	P	C
II	QEN201	Unit Operation and Processes in Environmental systems	3	0	0	3

COURSE CONTENT

UNIT I	PRIMARY TREATMENT METHODS	9
	Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation	
UNIT II	**SEDIMENTATION AND FILTRATION**	**9**
	Principles – Types of settling – Thickening – Dick's theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters	
UNIT III	**AERATION**	9
	Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays	
UNIT IV	**ADSORPTION**	**9**
	Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics	
UNIT V	**MEMBRANE PROCESSES**	**9**
	Reverse Osmosis and Electro dialysis - Species Transformation Processes - Chemical Oxidation / Reduction Processes, Disinfection using Chlorine and UV, Advanced Oxidation Process.	

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Metcalf Eddy ,Inc. George Tchobanoglous, Franklin Burton H, David Stensel," Wastewater Engineering", Tata McGraw-Hill Education ,2002
2. Hendricks," Water Treatment Unit Processes: Physical and Chemical," CRC, 2006.
3. Pelczar Jr. Michael," Microbiology", Tata McGraw-Hill Education,2001

REFERENCES

1. Tushar p,"Adsorption: Surface Chemistry," Rajat Publications, 2004.
2. Ajey Kumar Patel, Achanta Ramakrishna Rao," Aeration Systems for Wastewater Treatment", Lap Lambert Academic PublishinG,-2011
3. James Cappucciono, Natalic Sherman,"Microbiology: A Laboratory Manual," Pearson, 2007.

Semester	Course Code	Course Name	L	T	P	C
II	QEN203	Environmental Quality Measurements Laboratory-I (Water and Wastewater)	0	0	2	2

List of Experiments:

1. Determination of pH, Turbidity and Electrical conductivity
2. Determination of Alkalinity
3. Determination of Acidity
4. Determination of Hardness
5. Determination of Sulphates
6. Determination of Fluorides
7. Determination of Nitrates
8. Residual chlorine analysis
9. Test on Dissolved Oxygen and BOD
10. Test on COD

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
III	QEN303	Environmental Quality Measurements Laboratory-II (Air,Noise and Solidwaste)	0	0	2	2

List of Experiments:

1. Determination of Ambient Air Quality Parameters- SPM, CO, NOx and SOx
2. Soil Analysis – pH and Conductivity,
3. Cation Exchange Capacity
4. Determination of Noise
5. Composition of Municipal Solidwaste
6. Proximate and Ultimate Analysis
7. Total Solids, Suspended Solids, Volatile Solids, Non Volatile Solids

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN401	Biological Treatment of Wastewater	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION **9**

Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process- reactors-batch-continuous type

UNIT II AEROBIC TREATMENT OF WASTEWATER **9**

Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends

UNIT III ANAEROBIC TREATMENT OF WASTEWATER 9

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends.

UNIT IV SLUDGE TREATMENT AND DISPOSAL **9**

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering(mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal –

recent advances.

UNIT V	OPERATION AND MAINTENANCE	9

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata Mcgraw Hill, New Delhi, III Edition, 2006.
2. David Hendricks, "Fundamentals of Water Treatment Unit Process", CRC Press, New York, 2010
3. F.R. Spellman, "Hand Book of Water and Wastewater Treatment Plant operations", CRC Press, New York, III, Edition, 2013.

REFERENCES

1. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Government of India,New Delhi, 1999.
2. Metcalf & Eddy, INC, "Wastewater Engineering – Treatment and Reuse", Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.
3. Qasim, S.R. "Wastewater Treatment Plant, Planning, Design & Operation", Technomic Publications, New York, II Edition, 1998.

Semester	Course Code	Course Name	L	T	P	C
II	QEN403	Unit Operation Laboratory	0	0	2	2

List of Experiments:

1. Coagulation and Flocculation
2. Studies on Filtration- Characteristics of Filter media
3. Disinfection for Drinking water (Chlorination
4. Water Softening - Lime and Caustic Soda Process
5. Sludge volume Index
6. Sedimentation - Settling Column Analysis of Flocculating Particles
7. Adsorption - Colour Removal by Adsorption
8. Heavy Metal Precipitation
9. Kinetics of Activated Sludge Process

L	T	P	Total
0	0	30	30

TEXT BOOKS

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN404	Mini Project	0	0	4	2

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a panel of examiners

Semester	Course Code	Course Name	L	T	P	C
III	QEN503	Dissertation Phase - I	0	0	20	10

COURSE CONTENT

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN601	Dissertation Phase - II	0	0	32	16

COURSE CONTENT

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external.

Semester	Course Code	Course Name	L	T	P	C
I	QEN102B	Environmental Economics	3	0	0	3

COURSE CONTENT

UNIT I THEORY AND CONCEPT **9**

Nature and significance of environmental economics – definition and scope of environmental economics – basic theory – market system and the environment – welfare and environment – the economics of externalities.

UNIT II ENVIRONMENT AND ECONOMICS **9**

Environment – economy linkage – environment as a necessity and luxury – population and environment linkage – environmental use as an allocative problem – environment as a public good – valuation of environmental damages: land, water, air and forest.

UNIT III ENVIRONMENTAL PROBLEMS **9**

Economic development and environmental problems – air pollution – water pollution – sound pollution – energy use and environment problem – pollution and urbanization – global warming and green house effect – health, urbanization, transport and technology – environmental degradation.

UNIT IV POLLUTION CONTROL **9**

Prevention, control and abatement of pollution – choice of policy instruments in developing countries – environmental law – sustainable development – indicators of sustainable development – environmental planning – environmental accounting.

UNIT V POLICY MEASURES **9**

Basic approach – design of environmental policy – Indian environment policies and performance – pollution control boards and their function.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. M. Karpagam (1993), Environmental Economics, Sterling Publishers, New Delhi.
2. S. Sankaran(1994) Environmental Economics, Margham , Madras
3. N.Rajalakshmi and DhulasiBirundha (1994), Environomics, Economic analysis of Enviroment, Allied publishers, Ahmedabad.
4. S.Varadarajan and S. Elangovan(1992), Environmental economics, Speed, Chennai.

REFERENCES

1. Singh G.N (Ed.) (1991) Environmental Economics, Mittal Publications, New Delhi.
2. Garge, M.R. (Ed.) (1996), Environmental Pollution and Protection, Deep and Deep Publications, New Delhi.
3. Lodha, S.L (Ed.) (1991), Economics of Environment, Publishers, New Delhi. 8. The Hindu survey of Environment: Annual Reports.

Semester	Course Code	Course Name	L	T	P	C
I	QEN102 C	Air Pollution and Control	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION TO AIR POLLUTANTS 9

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability – Micrometeorology - Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles - Atmospheric Diffusion - Atmospheric diffusion theories - Steady-state atmospheric diffusion equation – Plume rise - Diffusion models - Ambient air quality and emission standards – Air pollution indices – Air Quality Sampling and Monitoring.

UNIT II CONTROL OF PARTICULATE CONTAMINANTS 9

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III CONTROL OF GASEOUS CONTAMINANTS 9

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - design and performance equation – Incineration - Equipment description - design and performance equations - Biological Air Pollution Control Technologies – Bio-Scrubbers, Biofilters – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT IV EMERGING TRENDS 9

Process Modification – Automobile Air Pollution and its control – Fuel Modification - Mechanical Particulate Collectors – Entrainment Separation – Internal Combustion Engines – Membrane Process – Ultraviolet Photolysis – High Efficiency Particulate Air Filters – Technical & Economic Feasibility of selected emerging technologies for Air pollution control

UNIT V INDOOR AIR QUALITY 9

Sources and Causes of Indoor Air Quality Problems- Risk due to Indoor Air pollutants- sources of indoor Air pollutants- Indoor Air Quality Regulations- Indoor Air Quality Models- Indoor Air Quality Control- Case Studies

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 2010.
2. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
3. Anjaneyulu. Y, 'Air Pollution and Control Technologies', Allied Publishers (P) Ltd., India, 2002

REFERENCES

1. David H.F. Liu, Bela G. Liptak 'Air Pollution', Lewis Publishers, 2000.
2. Arthur C.Stern, ' Air Pollution (Vol.I – Vol.VIII)', Academic Press, 2006.
3. Wayne T.Davis, 'Air Pollution Engineering Manual', John Wiley & Sons, Inc., 2000

Semester	Course Code	Course Name	L	T	P	C
II	QEN202C	Environmental Policies and Legislation	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION **8**

Basics of jurisprudence – Environmental law relation with other disciplines - Criminal law – Common Law – Relevant sections of the Code of Civil Procedure, Criminal Procedure Code – Indian Penal Code.

UNIT II INDIAN CONSTITUTION AND ENVIRONMENT **10**

Introduction – Fundamental Rights – Directive Principles of State Policy – Article 48 (A) and 51-A(g) Judicial enforceability – Constitution and Resources management and pollution control – Indian Forest Policy (1990) – Indian Environmental Policy (1992).

UNIT III ADMINISTRATIVE REGIME & LEGAL REGIME **9**

Administrative regulations – constitution of Pollution Control Boards Powers, functions, Accounts, Audit etc. – Formal Justice Delivery mechanism Higher and Lower of judiciary – Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement – Equitable remedies for pollution control

UNIT IV POLLUTION CONTROL LAWS **9**

Administrative regulation under recent legislations in water pollution control. Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & control or Pollution) cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

UNIT V ENVIRONMENTAL (PROTECTION) ACT 1986 **9**

Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Eco-labeling, and E.I.A.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Constitution of India Eastern Book Company Lucknow 12th Edn. 1997.
2. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
3. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.
4. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997

REFERENCES

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

Semester	Course Code	Course Name	L	T	P	C
III	QEN302C	Solid and Hazardous Waste Management	3	0	0	3

COURSE CONTENT

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK 9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous 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, lead acid batteries, electronic wastes , plastics and fly ash – Financing waste management.

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 9

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

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

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

UNIT IV WASTE PROCESSING TECHNOLOGIES 9

Objectives of waste processing – material separation and processing technologies – biological &chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

UNIT V WASTE DISPOSAL 9

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

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. George Techobanoglous et al, ”Integrated Solid Waste Management”, McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.

REFERENCES

1. R.E.Landrefh and P.A.Rebers,” Municipal Solid Wastes-Problems & Solutions” ,Lewis, 1997.
2. Blide A.D.& Sundaresan, B.B,”Solid Waste Management in Developing Countries”, INSDOC, 1993.
3. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000.
4. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.

Semester	Course Code	Course Name	L	T	P	C
IV	QEN402B	Environmental Geotechnology	3	0	0	3

COURSE CONTENT

UNIT I SOIL PROFILE **9**

Soil as a multiphase system; Soil – environment interactions; Properties of water in relation to porous media; Water cycle with special reference to soil medium.

UNIT II SOIL MINERALOGY **9**

Soil mineralogy; significance of mineralogy in determining soil behavior; Mineralogical characterization

UNIT III MECHANISMS OF SOIL-WATER INTERACTIONS **9**

Diffuse double layer models; Force of attraction and repulsion; Soil- Water contaminant interaction; Theories of Ion exchange; Influence of organic and inorganic chemical interaction.

UNIT IV WASTE & ITS TRANSPORT IN SOIL **9**

Concepts of waste containment facilities; desirable properties of soil; contaminant transport and retention; contaminated site remediation

UNIT V REMEDIAL TECHNIQUES **9**

Introduction to advanced soil characterization techniques; volumetric water content; gas permeation in soil; electrical and thermal properties; pore –size distribution; contaminant analysis

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Geotechnical and Geoenvironmental Engineering Handbook, Rowe R. K, Kluwer Academic Publishers 2001
2. Fundamentals of Soil Behavior, Mitchell J.K and Soga K., John Wiley and Sons Inc. 2012
3. Introduction to Environmental Geotechnology, Fang, H.Y., CRC press 1997
4. Geotechnical Practice for Waste Disposal, Daniel D.E, Chapman and Hall 1993

REFERENCES

1. Clay Barrier Systems for Waste Disposal Facilities, Rowe J.R., Quigley R.K., R.M. and Booker, Chapman and Hall 1995
2. Geoenvironmental Engineering: Principles and Applications, Reddi L.N. And Inyang H.F, Marcel Dekker Inc 2000
3. Waste Containment Systems, Waste Stabilization And Landfills: Design and Evaluation, Sharma H. D. And Lewis S.P, John Wiley & Sons Inc 1994

Semester	Course Code	Course Name	L	T	P	C
V	QEN501A	Ground Water Contamination and Transport Modeling	3	0	0	3

COURSE CONTENT

UNIT I INTRODUCTION TO TRANSPORT PHENOMENA **9**

Transport phenomenon, diffusion, dispersion, advection, adsorption, conservative and non-conservative pollutants, sources and sinks- point and nonpoint.

UNIT II FLOW AND TRANSPORT EQUATIONS **9**

Governing Equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for lakes, streams, and estuaries.

UNIT III MODEL COMPLEXITY **9**

Selection and development, model resolution, coupled and uncoupled models, Linear and nonlinear models, solution techniques, data requirements for calibration, application and evaluation of environmental control.

UNIT IV NUMERICAL MODELS **9**

FDM, FEM and Finite volume techniques, explicit vs. implicit methods, numerical errors, and stability, High resolution techniques.

UNIT V SOFTWARE MODELLING **9**

Stream quality modeling and Groundwater transport modeling using software.

L	T	P	Total
45	0	0	45

TEXT BOOKS

1. Alexander H.-d Cheng, Jacob Bear, "Modeling Groundwater Flow and Contaminant Transport", springer 02, 2011.
2. PascualHoracio Benito," Approaches to Modeling Contaminant Transport in Porous Media: Pore-Scale to Regional Scale Investigations,"Proquest, Umi Dissertation Publishing, 09-2011.
3. Mark Goltz, Junqi Huang," Analytical Modeling of Solute Transport in Groundwater: Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport I",John Wiley & Sons, Aug 2010.

REFERENCES

1. Rafael Antonio PrietoPiedrahita," Treatment of Contaminated Sediments Using Reactive Cap Technology: Characterization and Modeling of Geotechnical, Hydraulic and Contaminant Transport", Proquest, Umi Dissertation Publishing, Sep 2011.
2. ChunmiaoZheng, Gordon D. Bennett," Applied Contaminant Transport Modeling", Wiley-Interscience, February 2002.
3. Shahar Shlomi,"Combining Geostatistical Analysis and Flow-And-Transport Models to Improve Groundwater Contaminant Plume Estimation, "Proquest, Umi Dissertation Publishing,2011

Semester	Course Code	Course Name	L	T	P	C
	QMEOE1	INDUSTRIAL SAFETY	3	0	0	3

COURSE CONTENT

UNIT I **9**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II **9**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III **9**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV **9**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V **9**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

L	T	P	Total
45	0	0	45

REFERENCES

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.