DEPARTMENT OF
CIVIL ENGINEERING

PERIYAR MANIAMMAI UNIVERSITY
(Under Sec. 3 of UGC Act, 1956)
NAAC ACCREDITED

CURRICULUM & SYLLABUS

(Based on Outcome Based Education)

For

B.Tech – CIVIL ENGINEERING

(REGULAR – 4 Years)

Regulations 2017

PERIYAR MANIAMMAI UNIVERSITY

Vision	To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.	
Mission	**UM1**	Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.
	UM2	Providing student - centred education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.
	UM3	Involving progressive and meaningful research with concern for sustainable development.
	UM4	Enabling the students to acquire the skills for global competencies.
	UM5	Inculcating Universal values, Self respect, Gender equality, Dignity and Ethics.

Core Values

- Student – centric vocation
- Academic excellence
- Social Justice, equity, equality, diversity, empowerment, sustainability
- Skills and use of technology for global competency.
- Continual improvement
- Leadership qualities.
- Societal needs
- Learning, a life – long process
- Team work
- Entrepreneurship for men and women
- Rural development
- Basic, Societal, and applied research on Energy, Environment, and Empowerment.

DEPARTMENT OF CIVIL ENGINEERING

Vision		To create technocrats in the discipline of Civil Engineering through research integrated academic programme of UG, PG and Ph.D. of global standards and in turn contribute to the socio-economic development of the nation through research and consultancy.
Mission	**DM1**	To create, disseminate and integrate knowledge of science , engineering and technology through innovative teaching learning process that expands Civil Engineering Knowledge base and enhance the betterment of industry and human society
	DM2	To develop , perform forward looking research by integrating proper blend of applied and theoretical knowledge with a positive impact for the society
	DM3	To educate , inspire and create competent civil engineering professionals who possess the knowledge and skills required by industries for careers or to become an entrepreneur
	DM4	To serve as a reliable , highly capable resource for society , the profession and the university through activities in the professional organization , committees , consultancy and continuing education

Table: 1 Mapping of University Mission (UM) and Department Mission (DM)

	UM 1	**UM 2**	**UM 3**	**UM 4**	**UM 5**
DM 1	2	3	2	1	3
DM 2	1	2	2	1	2
DM 3	2	3	3	2	2
DM 4	3	2	2	2	3
	8	**10**	**9**	**6**	**10**

1-Low 2- Medium 3 – High

PROGRAMME EDUCATIONAL OBJECTIVES

Based on the mission of the department, the programme educational objectives is formulated as

PEO1	Graduates will successfully apply the engineering concepts to the formulation and provide solution to the emerging technical problems in industry, government or other organizations towards implementing efficient civil engineering practices.
PEO2	Graduates will have the ability to use their education to be lifelong learners and in turn utilize intellectual curiosity in enhancing technical, personal and professional growth.
PEO3	Graduates will become entrepreneurs (professional engineers) in starting-up and growing their own new firms in the domain of civil engineering and also exhibit leadership role of highest standards of professional endeavors in their chosen profession and in other activities.
PEO4	Graduates will be aware of ethical, social and cultural issues within a global context and their importance in the exercise of professional skills and responsibilities.

Table: 2 Mapping of Program Educational Objectives (PEOs) with Department Mission (DM)

	DM 1	**DM 2**	**DM3**	**DM 4**
PEO 1	3	2	1	1
PEO 2	2	3	2	1
PEO 3	1	1	3	2
PEO 4	2	1	1	3
	8	**7**	**7**	**7**

1- Low 2 – Medium 3-High

GRADUATE ATTRIBUTES

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM OUTCOMES

PO 1	Apply the knowledge of mathematics, science, Engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering.
PO 2	Identify, formulate, research literature and analysis complex civil engineering problems reaching substantiated conclusions using first principles of mathematics and Engineering Sciences.
PO 3	Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health and safety and the cultural, societal and environmental conservations
PO 4	An ability to plan, draw and 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
PO 5	An ability to work effectively as an individual and a team.
PO 6	An ability to identify, formulate, and solve engineering problems.
PO 7	An understanding of professional and ethical responsibility in a global context
PO 8	An ability to articulate and communicate ideas persuasively and effectively both in written and oral.
PO 9	A recognition of the need for, and an ability to engage in lifelong learning
PO 10	A knowledge of contemporary issues relevant to engineering practice
PO 11	An ability to understand the critical issues of professional practice such as the procurement of work, financial management and the interaction with contractors during the construction phase of a project.
PO 12	An ability to use the techniques, skills, and modern engineering tools necessary for Engineering practice

PROGRAM SPECIFIC OUTCOME

PSO 1	Capably plan, analyse and design the civil engineering structures.
PSO 2	Apply knowledge of three technical areas appropriate to Civil Engineering such as Geotechnical, Environmental and water resources engineering etc.

Table 3 Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
PEO 1	3	2	2	1	1	2	-	-	-	1	2	-	3	-
PEO 2	1	3	2	3	2	1	1	-	-	2	1	1	-	2
PEO 3	-	1	3	2	3	-	2	1	1	2	1	2	1	1
PEO 4	-	1	2	2	-	1	3	1	1	1	1	1	-	1
	4	**7**	**9**	**8**	**6**	**4**	**6**	**2**	**2**	**6**	**5**	**4**	**4**	**4**

1 - Low 2 – Medium 3 - High

CURRICULUM

REGULATIONS – 2017

(Applicable to the students admitted from the Academic year 2017– 2021)

SEMESTER I

Sub. Code	Name of the Course	L	T	P	C	H
XMA101	Algebra, Differential Calculus and their applications	3	1	0	4	5
XEM102	Engineering Mechanics	3	1	0	4	5
XBE103	Electrical and Electronics Engineering Systems	3	1	1	5	7
XAP104	Applied Physics	3	1	1	5	7
XGS105	Study skills and Language Laboratory	1	0	0	1	3
XUM106	Human Ethics, Values, Rights and Gender Equality	1	0	0	1	3
TOTAL		**14**	**4**	**2**	**20**	**30**

SEMESTER II

Sub. Code	Name of the Course	L	T	P	C	H
XMA201	Calculus and Laplace Transforms	3	1	0	4	5
XCP202	Computer Programming	3	0	1	4	5
XBW203	Mechanical and Civil Engineering Systems	3	1	1	5	7
XAC204	Applied Chemistry	3	1	1	5	7
XEG205	Engineering Graphics	2	1	0	3	4
XGS206	Speech Communication	1	0	0	1	3
TOTAL		**15**	**4**	**3**	**22**	**31**

SEMESTER III

Sub. Code	Name of the Course	L	T	P	C	H
XMA301	Transforms and Partial Differential Equations	3	1	0	4	5
XCE302	Fluid Mechanics	3	1	0	4	5
XCE303	Surveying	3	0	1	4	5
XCE304	Solid Mechanics	3	1	1	5	7
XCE305	Building Materials	3	0	0	3	3
XEP306	Entrepreneurship Development	2	0	0	2	3*
XGS307	Interpersonal Communication	0	0	0	0	2
XCE308	In-plant Training-I	-	-	-	1	-
TOTAL		**17**	**3**	**2**	**23**	**30**

* Self Study – 1 Hour

SEMESTER IV

Sub. Code	Name of the Course	L	T	P	C	H
XOR401	Operations Research	3	0	0	3	3
XCE402	Concrete Technology	2	0	1	3	4
XCE403	Geotechnical Engineering	3	0	1	4	5
XCE404	Open Channel Flow and Hydraulic Machines	3	1	1	5	7
XCE405	Structural Mechanics	3	1	0	4	5
XUM406	Economics for Engineers	3	0	0	3	3
XGS407	Technical Communication	1	0	0	1	3
	NCC/NSS/YRC/RRC/Sports	-	-	-	-	-
TOTAL		**18**	**2**	**3**	**23**	**30**

SEMESTER V

Sub. Code	Name of the Course	L	T	P	C	H
XMA501	Numerical Methods	2	1	0	3	4
XCE502	Structural Analysis	2	1	0	3	4
XCE503	Environmental Engineering	3	0	1	4	5
XCE504	Building Planning and Drawing	3	1	1	5	7
XCE505*	Professional Elective I	2	1	0	3	4
XTQ506	Total Quality Management	3	0	0	3	3
XGS507	Business Communication	1	0	0	1	3
XCE508	In-plant Training –II	-	0	0	1	1
TOTAL		**16**	**4**	**2**	**23**	**30**

SEMESTER VI

Sub. Code	Name of the Course	L	T	P	C	H
XCE601**	OE I	3	0	0	3	3
XCE602	Irrigation Engineering	3	0	0	3	3
XCE603	Transportation Engineering	3	0	1	4	5
XCE604	Design of Concrete Structures	3	1	1	5	7
XCE605	Structural Steel Design	3	1	0	4	5
XCE606*	Professional Elective II	3	0	0	3	3
XUM607	Environmental studies	0	0	0	0	3
XGS608	Academic Writing	0	0	0	0	2
TOTAL		**18**	**2**	**2**	**22**	**31**

SEMESTER VII

Sub. Code	Name of the Course	L	T	P	C	H
XCE701**	OE II	3	0	0	3	3
XCE702	Construction Project Management	3	0	1	4	5
XCE703	Cost Estimation and Valuation	3	1	1	5	7
XCE704	Professional Elective – III	3	0	0	3	3
XCE705	Professional Elective – IV	3	0	0	3	3
XUM706	Cyber Security	0	0	0	0	3
XCE707	Project Phase – I	0	0	2	2	4
XGS708	Career Development Skills	0	0	0	0	1
XCE709	In-plant Training-III	0	0	0	2	2
TOTAL		**15**	**1**	**4**	**22**	**31**

SEMESTER VIII

Sub. Code	Name of the Course	L	T	P	C	H
XCE801**	OE III	3	0	0	3	3
XCE802*	Professional Elective – V	3	0	0	3	3
XCE803*	Professional Elective – VI	3	0	0	3	3
XCE804	Project Phase- II	0	0	12	12	24
	TOTAL	**9**	**0**	**12**	**21**	**33**

*Denotes A,B,C and D from corresponding Groups

TOTAL CREDITS - 176

LIST OF PROFESSIONALELECTIVES

PROFESSIONAL ELECTIVES GROUP – I

Sub. Code	Name of the Course	L	T	P	C	H
XCE505A	Basics of Earthquake Engineering and Seismic Design	2	1	0	3	4
XCE505B	Tall Buildings	2	1	0	3	4
XCE505C	Advanced Pavement Design	2	1	0	3	4
XCE505D	Design of Plate and Shell Structures	2	1	0	3	4

PROFESSIONALELECTIVES GROUP – II

Sub. Code	Name of the Course	L	T	P	C	H
XCE606A	Construction Techniques, Equipments and Practices	3	0	0	3	3
XCE606B	Advanced Geotechnical Engineering	3	0	0	3	3
XCE606C	Town Planning	3	0	0	3	3
XCE606D	Alternate Building Materials	3	0	0	3	3

PROFESSIONALELECTIVES GROUP – III

Sub. Code	Name of the Course	L	T	P	C	H
XCE704A	Prestressed Concrete Structures	3	0	0	3	3
XCE704B	Earth Retaining Structures	3	0	0	3	3
XCE704C	Finite Element Method	3	0	0	3	3
XCE704D	Experimental Stress Analysis	3	0	0	3	3

PROFESSIONALELECTIVES GROUP– IV

Sub. Code	Name of the Course	L	T	P	C	H
XCE 705 A	Repair and Rehabilitation of Structures	3	0	0	3	3
XCE 705 B	Smart Materials and Structures	3	0	0	3	3
XCE 705 C	Industrial Waste Water Management	3	0	0	3	3
XCE 705 D	Solid and Hazardous Waste Management	3	0	0	3	3

PROFESSIONALELECTIVES GROUP–V

Sub. Code	Name of the Course	L	T	P	C	H
XCE802A	Prefabricated Structures	3	0	0	3	3
XCE802B	Disaster Management	3	0	0	3	3
XCE802C	Water Resource planning and management	3	0	0	3	3
XCE802D	Environmental Impact Assessment	3	0	0	3	3

PROFESSIONALELECTIVES GROUP – VI

Sub. Code	Name of the Course	L	T	P	C	H
XCE803A	Air Quality Management	3	0	0	3	3
XCE803B	Urban and Regional Planning-Future Trends	3	0	0	3	3
XCE803C	Construction and Law	3	0	0	3	3
XCE803D	Docks, Harbour and Airport Engineering	3	0	0	3	3

OPEN ELECTIVES

Sub. Code	Name of the Course	L	T	P	C	H
XCE0E1	Remote Sensing and GIS	3	0	0	3	3
XCE0E2	Building Services	3	0	0	3	3
XCE0E3	IT in Engineering Construction	3	0	0	3	3

Semester **I**

Subject Name **ALGEBRA, DIFFERENTIAL CALCULUS AND THEIR APPLICATIONS**

Subject Code **XMA 101**

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

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO1	Explain the Properties of eigen values and eigen vectors of the matrices, make use of orthogonal and similarity transformation and construct the quadratic form to canonical form	C (Understand & Application)
CO2	Define and find the radius and circle of curvature in Cartesian and polar coordinates and to explain evolutes and envelopes.	C (Analyse)
CO3	Explain the convergence of series of positive terms, alternating series, and power series using tests of convergence	C (Comprehension) P (Diagnose)
CO4	Find total and partial derivatives,Taylor series expansions of functions and the extremum of functions and their applications.	C (Knowledge)
CO5	Solve the linear equations of second and higher order with constant and variable coefficientsand simultaneous first order differential equations and to apply Method of variation of parameters to solve the differential equation.	C (Knowledge)

COURSE CONTENT

UNIT I **MATRICES 15 hrs**

Eigen values and Eigenvectors of a real matrix –Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (excluding proof) - Similarity transformation (Concept only) – Orthogonal matrix - Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to Canonical form by Orthogonal transformation.

UNIT II **GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS15 hrs**

Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes.

UNIT III **INFINITE SERIES** **15 hrs**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test – Statement of theorems and problems only) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series (Simple

problems only)

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 15 hrs

Functions of two variables – Partial derivatives – Total differentiation – Taylor's expansion – Maxima and Minima – Constrained maxima and minima – Lagrange's Multiplier method – Jacobian Determinants.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS15 hrs

Linear equations of second and higher order with constant and variable coefficients (Euler's and Legendre's equations) – Simultaneous first order linear equations with constant coefficients – Method of variation of parameters - Applications to electrical circuit problems.

L=45 hrs T=30 hrs Total = 75 hrs

Text books

1. Grewal, B.S. Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi, 2007.
2. Kreyszig, E, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons(Asia) Ltd, Singapore, 2001.

References

1. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003.
2. Veerarajan T, Engineering Mathematics Fourth Edition, Tata – McGraw Hill Publishing Company Ltd, New Delhi, 2005.
3. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005.
4. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.

E-References

1. www.nptel.ac.in
   Advanced Engineering Mathematics Prof. Pratima Panigrahi Department of Mathematics Indian Institute of Technology, Kharagpur.

Mapping of CO with GA's

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3								1			1
CO 2	3	2							1			1
CO 3	3	2			1				1			2
CO 4	3	2			1				1			2
CO 5	3	2			1				1			1
	15	**8**			**3**				**5**			**7**

Semester **I**

Subject Name **ENGINEERING MECHANICS**

Subject Code **XEM 102**

L –T –P –C	**C: P: A**	**L –T -P- H**
3 - 1 – 0- 4	**2.6: 0.2: 0.2**	**3- 2 - 0 -5**

Course Outcome: After the completion of the course, students will be able to		**Domain**
CO1	Identify and choose various types of loading and support conditions that act on structural and dynamic systems.	C(Understand)
CO2	Apply pertinent mathematical, physical and engineering mechanics principles to the system to predict the problem.	C(Application)
CO3	Display and Apply knowledge on the concepts of centroid and moment of inertia of various sections and solids.	C (Application) A (Develop)
CO4	Analyze and Model the problem using free-body diagrams and accurate equilibrium equations and finding the solution.	C(Analyse) P (Model)
CO5	Develop concepts of friction, rigid body kinematics and dynamics with an emphasis on the modeling and analysis and solving simple dynamic problems involving kinematics and momentum.	C(Create)

COURSE CONTENT

UNIT-I **BASICS AND STATICS OF PARTICLES** **15 hrs**

Introduction - Units and Dimensions - Laws of Mechanics –Coplanar and Non coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility – single equivalent force.

UNIT –II **EQUILIBRIUM OF RIGID BODIES** **15 hrs**

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

UNIT-III **PROPERTIES OF SURFACES AND SOLIDS** **15 hrs**

Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorem and Perpendicular axis theorem - Polar moment of inertia – Mass moment of inertia - relation to area moment of inertia.

UNIT –IV **DYNAMICS OF PARTICLES** **15 hrs**

Displacement, Velocity and Acceleration - their relationships - Relative motion - Curvilinear motion - Newton's Law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

UNIT V ELEMENTS OF RIGID BODY DYNAMICS AND FRICTION 15 hrs

Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid Body - Work energy equation. Frictional Force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.

L=45 hrs T = 30 hrs Total = 75 hrs

Text books

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

References

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

Mapping of CO's with GA 's:

	GA1	GA2	GA3	GA 4	GA5	GA6	GA7	GA 8	GA9	GA10	GA11	GA12
CO1	2	3	1	3								
CO2		3		2								
CO3									2			
CO4	3	3										1
CO5	3	3										
	8	12	1	5					2			1

1 - Low , 2 – Medium , 3 – High

Semester **I**

Subject Name **ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS**

Subject Code **XBE 103**

L –T –P –C	**C:P:A**	**L –T –P –H**
3 - 1 – 1– 5	**3:1:0**	**3 - 2 – 2 - 7**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Describe AC and DC circuits and measuring devices. Construct and test AC, DC circuits and measuring devices.	C (Remember) P (Mechanism, Set)
CO2	Explain different types of Electrical machines.	C (Understand)
CO3	Describe semiconductor devices and show the input output characteristics of basic semiconductor devices.	C(Remember) P (Set)
CO4	Explain logic gates and their applications and construct and verify the logic gates and construct simple adders and subtractors using logic gates.	C(Understand) P(Complex over Response& Set)
CO5	Describe microprocessors in detail.	C(Remember)

COURSE CONTENT

UNIT I **FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS 10 + 9 + 20 hrs**

Fundamentals of DC– Ohm's Law – Kirchoff's Laws - Sources - Voltage and Current relations –Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter).

UNIT II **ELECTRICAL MACHINES** **8 + 9 hrs**

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 + 5 hrs**

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 +6 +5 hrs

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

UNIT V MICROPROCESSORS 9 + 3 hrs

Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts - Simple Programming concepts.

Practical 30 hrs

1. Study of Electrical Symbols, Tools and Safety Precautions, Signal Generators, Power Supplies and Voltage Regulators.
2. Study of Active and Passive Elements - Resistors, Inductors and Capacitors, Bread Board and Printed Circuit Board.
3. Verification of AC Voltage, Current and Power in Series connection and Parallel connection.
4. Fluorescent lamp connection with choke.
5. Staircase Wiring.
6. Calibration of Ammeter, Voltmeter, Wattmeter, Energy meter, Multimeter and Lux meter.
7. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
8. Measuring input signal magnitude and frequency by using Cathode Ray Oscilloscope.
9. Forward and Reverse bias characteristics of PN junction diode and Zener diode.
10. Input and Output Characteristics of NPN transistor.
11. Verification of Truth Tables of Logic Gates.
12. Construction and verification of simple adders and subtractors.

L - 45 hrs T-30hrs P -30hrs Total - 105 hrs

Text books

1. Mittle, V. N., 2007. Basic Electrical and Electronics Engineering. 1st ed. New Delhi: Tata McGraw-Hill.
2. Malvino, A. P., 2006. Electronics Principles. 7th Edition. New Delhi: Tata McGraw-Hill.
3. Rajakamal, 2007. Digital System-Principle & Design. 2nd Edition. Pearson education.
4. Moris Mano, 1999. 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.

References

1. Corton,H., 2004. Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1988. Electrical Circuits. Schaum Outline Series, McGraw-Hill.
3. Jacob Millman and Christos, C. Halkias, 2010. Electronics Devices and Circuits. 3rded. New Delhi: McGraw-Hill.
4. Millman, J. and Halkias, C. C., 2011. Integrated Electronics: Analog and Digital Circuits and Systems. 2nded. New Delhi: McGraw-Hill.
5. Mohammed Rafiquzzaman, 1992. 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. http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#Prof.L.Umanand , IISc Bangalore.
3. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. Nagendra Krishnapura , IIT Madras.
4. http://www.nptelvideos.in/2012/11/basic-electrical-technology.html,Dr.L.Umanand,IISc Bangalore.

Mapping of COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	2	2	1				1			1
CO2	3	2	-	2	1				-			1
CO3	3				1				1			1
CO4	3	2	2	2	1				1			1
CO5	3				1				-			1
	15	6	4	6	5				3			5

Semester **I**

Subject Name **APPLIED PHYSICS**

Subject Code **XAP 104**

L –T –P –C	**C:P:A**	**L –T –P –H**
3 - 1 – 1– 5	**2.8:0.8:0.4**	**3 - 2 – 2 - 7**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Identify the basics of mechanics, explain the principles of elasticity, viscosity and determine its significance in engineering systems and technological advances.	C (Remember & Understand) P (Mechanism)
CO2	Describe the production, propagation, perception & analysis of acoustical wave and locate basic acoustical problem encountered in constructed buildings.	C (Remember& Analyse) A (Receive)
CO3	Understand the fundamental phenomena in optics by measurement and describe the working principle and application of various lasers and fibre optics.	C(Understand & Apply) A(Receive)
CO4	Analyse different crystal structures, discuss and use physics principles of latest technology by visualizing.	C(Understand & Analyse) P(Mechanism)
CO5	Develop Knowledge on engineering materials, its properties and application.	C(Understand & Apply)

COURSE CONTENT

UNIT I **MECHANICS AND PROPERTIES OF MATTER 9 + 6 + 12 hrs**

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 - I shape girders.

Viscosity: Coefficient of viscosity - Laminar flow - streamline flow - turbulent flow - Reynold's number - Poiseuille's method.

UNIT II **ACOUSTICS, ULTRASONICS AND SHOCK WAVES9 + 6 hrs**

Acoustics: Classification of sound - Characteristics of musical sound - Loudness - Weber Fechner law - Decibel - Absorption coefficient - Reverberation - Reverberation time - Sabin's formula (growth and decay) - Factors affecting acoustics of buildings (reverberation time, loudness, focussing, echo, echelon effect - resonance and noise) and their remedies.

Ultrasonics: Production: Magnetostriction and Piezoelectric methods - NDT: Ultrasonic flaw detector.

Shock waves: Definition of Mach number - Description of a shock wave - Characteristics - Methods of creating shock waves.

UNIT III OPTICS, LASERS AND FIBRE OPTICS 9 + 6 + 12 hrs

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 - Semiconductor Laser (homojunction) - Applications

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

UNIT IV SOLID STATE PHYSICS 9 + 6 + 6 hrs

Crystal Physics: Lattice - Unit cell - Lattice planes - Bravais lattice - Miller indices - Sketching a plane in a cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing density for SC, BCC, FCC and HCP structures.

Semiconductors: Semiconductor properties - Types of semiconductor - Intrinsic - Extrinsic: P-type and N-type semiconductor - PN junction diode - Biasing - Junction diode characteristics.

UNIT V NOVEL ENGINEERING MATERIALS AND BIOMETRICS 9 + 6 hrs

Novel Engineering Materials: Introduction - Metallic glasses: Melt spinning technique, properties, applications - Shape Memory Alloys: Transformation temperature, working of SMA, characteristics - Biomaterials: Properties, interaction of biomaterials with tissues, applications - Nano phase materials: Production, properties and applications.

Biometrics: Introduction - definition - instrumentation - devices -advantages

Text Books

1. Avadhanulu M. N. and Kshirsagar P. G., "A Text Book of Engineering Physics", 7th Enlarged Revised Edition., S. Chand & Company Ltd., New Delhi, 2005.
2. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2003.
3. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2005.
4. Prabu P. and Gayathri P., " Applied Physics", PMU Press, Thanjavur, 2013

References

1. Gaur R.K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2001.
2. Pillai S.O., "Solid State Physics", 5th Edition, New Age International Publication, New Delhi,2003.

E-References

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

Practical **30 hrs**

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. Poiseuille's flow - Determination of coefficient of viscosity of the given liquid.
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.

L = 45 hrs T = 30 hrs P = 30 hrs Total = 105hrs

References

1. Srinivasan M. & others, "A text book of Practical Physics", Sultan Chand & Sons, 2001.
2. Shukla R.K., "Practical Physics", New Age International Publication, New Delhi, 2011.
3. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

Semester **I**

Subject Name **STUDY SKILLS AND LANGUAGE LABORATORY**

Subject Code **XGS 105**

L –T –P –C	**C:P:A**	**L –T –P –H**
1- 0 – 0– 1	**2:1:0**	**1– 0 – 0 – 3**

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO1	Identify different strategies of reading and writing skills.	C (Remember)
CO2	Make use of library skills in their learning process.	C (Remember)
CO3	Apply different techniques to various types of material such as a novel, newspaper, poem, drama and other reading papers	C(Apply)
CO4	Ability to use visual aids to support verbal matters into language discourse.	C(Understand)
CO5	Prepares to face the written exam with confidence and without any fear or tension.	C(Understand) P(Guided response)

COURSE CONTENT

UNIT I **5 hrs**

Introduction to study skills; Learning Skills and Strategies of Learning; Cognitive Study skills and physical study skills, Library skills (How to use Library), familiarization of library facilities by the librarian; familiarization of basic cataloguing techniques, how to ransack the library etc.

UNIT II **5 hrs**

Reference Skills, how to use the library facilities for research and to write assignments; how to find out reference books, articles, journals and other e- learning materials; how to use a dictionary and thesaurus

UNIT III **5 hrs**

Reading related study skills, Process of reading, various types of reading materials and varied reading techniques; familiarization to materials written by various authors; features of scientific writing and familiarization to scientific writing by renowned authors; note making skills

UNIT IV **5 hrs**

Writing related study skills; process of writing, characteristics of writing, discourse analysis, use of visual aids, and note making and note taking skills

UNIT V **5 hrs**

Exam preparation skills; anxiety reduction skills; familiarization with various types of exam/evaluation techniques etc.

Practical **20 hrs**

1. Sounds of English Language; vowels, consonants, diphthongs, word stress, sentence stress, intonation patterns, connected speech etc
2. Vocabulary building – grammar, synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, idioms and phrases.
3. Reading comprehension – reading for facts, meanings from context, scanning, skimming, inferring meaning, and critical reading. Active listening, listening for comprehension etc.

L = 20hrs P = 20 hrs Library = 5 hrs Total = 45 hrs

Text books

1. V.R. Narayanaswamy ,Strengthen Your Writing by (Orient Longman), 2000
2. Ghosh, R N; Inthira, S R [Author],A Course in written English: New Delhi, 1978
3. Jaya Sasikumar, Champa Tickoo, Writing With A Purpose, Published by Oxford University Press, 2000
4. Freeman, Sarah: Study Strategies. New Delhi: Oxford University Press, 1979
5. Paul Gunashekar M.L. Tickoo, Reading for Meaning, Published by S. Chand & Company Ltd. Sultan Chand & Company, 2000
6. Bernard Hartley (Author), Peter Viney (Author**)** Streamline English: Departures (Oxford English) Paperback ,1990.
7. Bernard Hartley (Author), Peter Viney (Author),Streamline English: Destinations,Oxford University Press, 1992.
8. Bernard Hartley (Author), Peter Viney (Author),Streamline English Directions, (Oxford University Press 1982).

References

1. Jaya Sasikumar, Champa Tickoo, Writing With A Purpose, Oxford University Press | Paper Back | Language – English.
2. Freeman, Sarah*:* Study Strategies. New Delhi: Oxford University Press, *1979*.
3. Reading for Meaning, Paul Gunashekar M.L. Tickoo, Published by S. Chand & Company Ltd. Sultan Chand & Company, 2000
4. Susan Fawcett (Author)Evergreen: A Guide to Writing with Readings Paperback – January 4, 2013.

Mapping of COs with GAs

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO1	1						2					
CO2	1						2		1			
CO3	1						2		1			
CO4	1								1			
CO5	3								1			
	7						6		4			

Semester **I**

Subject Name **HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY**

Subject Code **XUM 106**

L –T –P –C	**C:P:A**	**L –T –P –H**
1- 0 – 0– 1	**1.8:0:0.2**	**1+2*- 0– 0- 3**

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

		Domain C or P or A
CO1	Relate and Interpret the human ethics and human relationships	C (Remember & Understand)
CO2	Explain and Apply gender issues, equality and violence against women	C (Understand &Apply)
CO3	Classify and Develop the identify of human rights and their violations	C(Analyse) A(Receive)
CO4	Classify and Dissect necessity of human rights and report on violations.	C(Understand & Analyse)
CO5	List and respond to family values, universal brotherhood, fight against corruption by common man and good governance.	C(Remember) A(Response)

COURSE CONTENT

UNIT I **HUMAN ETHICS AND VALUES** **7 hrs**

Human Ethics and values - Understanding of oneself and others- motives and needs- Social service, Social Justice, Dignity and worth, Harmony in human relationship: Family and Society, Integrity and Competence, Caring and Sharing, Honesty and Courage, Valuing Time, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence and Personality- Living in harmony at various levels.

UNIT II **GENDER EQUALITY9 hrs**

Gender Equality - Gender Vs Sex -, Concepts, definition, Gender equity, equality, empowerment. Status of Women in India Social, Economical, Education, Health, Employment, HDI, GDI, GEM. Contributions of Dr.B.R.Ambedkar, Thanthai Periyar and Phule to Women Empowerment.

UNIT III **WOMEN ISSUES AND CHALLENGES9 hrs**

Women Issues and Challenges- Female Infanticide, Female feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Access to education, Marriage. Remedial Measures – Acts related to women: Political Right, Property Rights, Right to Education, Medical Termination of Pregnancy Act, and Dowry Prohibition Act.

UNIT IV **HUMAN RIGHTS** **9 hrs**

Human Rights Movement in India – The preamble to the Constitution of India, Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Discrimination and

forced Labour, Rights of Children. National Human Rights Commission and other statutory Commissions, Creation of Human Rights Literacy and Awareness. - Intellectual Property Rights (IPR). National Policy on occupational safety, occupational health and working environment.

UNIT V GOOD GOVERNANCE AND ADDRESSING SOCIAL ISSUES 11hrs

Good Governance - Democracy, People's Participation, Open and Transparence governance, Corruption, Impact of corruption on society, on how and whom to make corruption complaints, fight against corruption and related issues and character building, Fairness in criminal justice administration, Government system of Redressal. Issues and intervention in situations of family violence, substance abuse and corruption. Creation of People friendly environment and universal brotherhood.

L = 15 hrs SS = 30 hrs Total = 45 hrs

Text books

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).

References

1. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
2. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
3. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).
4. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
5. Veeramani, K. (ed) Periyar Feminism, (Periyar Maniammai University, Vallam, Thanjavur: 2010).

E-References

1. PlanningCommissionreportonOccupationalHealthandSafety http://planningcommission.nic.in/about/committee/wrkgrp12/wg_occup_safety.p
2. Central Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html

Semester **I**

Subject Name **CALCULUS AND LAPLACE TRANSFORMS**

Subject Code **XMA 201**

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

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Make use of standard results to Find the Laplace transforms of derivatives and integrals and to solve differential equations.	C (Remember & Apply)
CO2	Apply multiple integral concepts to find the area, volume and to understand the order of integration.	C (Remember & Apply)
CO3	Define the gradient, divergent curl of vectors. Find directional derivative, unit vector normal to the surface.Apply corresponding theorems to Find the line, surface and Volume integrals.	C(Remember & Apply)
CO4	Construct and examine the analytic functions, and their the complex Conjugate and to Explain the concept of conformal mapping and to Construct the bilinear transformation.	C(Understand & Apply)
CO5	Explain the poles , singularities and residues of functions and to solve the problems using contour integration.	C(Understand & Apply)

COURSE CONTENT

UNIT I **LAPLACE TRANSFORMS 15 hrs**

Transforms of elementary functions – properties – derivatives and integrals of transforms-Transforms of derivatives and integrals - Transforms of unit step function and impulse function - Transform of periodic functions – Convolution Theorem – Inverse transforms – Solutions of differential and integral equations.

UNIT II **MULTIPLE INTEGRALS 15 hrs**

Double integration – Cartesian and polar coordinates – change of order of integration - area as a double integral – change of variables between Cartesian and polar coordinates - triple integration-– Simple applications (Finding area & volume of a certain region).

UNIT III **VECTOR CALCULUS 15 hrs**

Gradient, divergence and curl - directional derivative – normal and tangent to a given surface – angle between two surfaces – irrotational and solenoidal vector fields - Line, Surface and Volume Integral – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proof).

UNIT IV **ANALYTIC FUNCTIONS 15hrs**

Function of a complex variable – analytic function – necessary and sufficient condition (excluding proof) – Cauchy Riemann equations – properties of analytic

functions - harmonic conjugate - construction of an analytic function – Conformal mapping: w= z + c, cz, $\frac{1}{z}$, sinz, coshz, $z + \frac{k^2}{z}$ - Bilinear transformation.

UNIT V COMPLEX INTEGRATION 15hrs

Statement and application of Cauchy's integral theorem and integral formula - Taylor's and Laurent's expansion - Residues – Cauchy's Residue Theorem - Contour integration over unit circle.

L = 45 hrs T = 30 hrs Total = 75 hrs

Text books

1. Grewal, B.S. Higher Engineering Mathematics, 41st Edition, Khanna Publication, Delhi, 2011.
2. Kreyszig, E, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Son(Asia) Ltd, Singapore, 2001.

References

1. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003.
2. Veerarajan T, Engineering Mathematics Fourth Edition, Tata – McGraw Hill Publishing Company Ltd, New Delhi, 2005.
3. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005.
4. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.

E-References

1. www.nptel.ac.in

Advanced Engineering Mathematics Prof. Jitendra Kumar,Department of Mathematics Indian Institute of Technology, Kharagpur

Mapping of Cos with GAs

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

1 - Low , 2 – Medium , 3- high

Semester **I**

Subject Name **COMPUTER PROGRAMMING**

Subject Code **XCP 202**

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

	Course Outcome: After the completion of the course, students will be able to	**Domain C or P or A**
CO1	Define programming fundamentals and Solve simple programs using I/O statements.	C (Remember) P (Guided response)
CO2	Define syntax and write simple programs using control structures and arrays	C (Remember) P (Guided response)
CO3	Explain and write simple programs using functions and pointers	C(Understand) P(Guided response)
CO4	Explain and write simple programs using structures and unions	C(Understand)
CO5	Explain and write simple programs using files and Build simple projects	P(Guided response)

COURSE CONTENT

UNIT I **PROGRAMMING FUNDAMENTALS AND INPUT /OUTPUT STATEMENTS** **9 + 6 hrs**

Program – Flowchart – Pseudo code – Software – Introduction to C language – Character set – Tokens: Identifiers, Keywords, Constants, and Operators – sample program structure -Header files – Data Types - Output statements – Input statements.

UNIT II **CONTROLSTRUCTURE AND ARRAYS** **9 + 6 hrs**

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 + 6 hrs**

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 - Pointers and structures - Pointers on pointer.

UNIT IV **STRUCTURES AND UNIONS** **9 + 6 hrs**

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+ 6 hrs**

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.

Practical **30 hrs**

1. Program to display a simple picture using dots.
2. Program for addition of two numbers
3. Program to swap two numbers
4. Program to solve any mathematical formula.
5. Program to find greatest of 3 numbers using Branching Statements
6. Program to display divisible numbers between n1 and n2 using Looping Statement
7. Program to remove duplicate element in an array.
8. Program to perform string operations.
9. Program to find factorial of a given number using four function types.
10. Programs using Recursion
11. Programs using Pointers
12. Program to read and display student mark sheet Structures with variables
13. Program to read and display student marks of a class using Structures with arrays
14. Program to create linked list using Structures with pointers
15. Program for copying contents of one file to another file.
16. Program using files using structure with pointer

L = 45 hrs T = 30 hrs Total = 75 hrs

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

References

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. (2005).
2. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001.
3. Johnsonbaugh R. and Kalin M., “Applications Programming in ANSI C”, III Edition, Pearson Education India, 2003.

E-Refernces

1. https://iitbombayx.in/courses/IITBombayX/BMWCS101.1x/2015_T1/courseware

Mapping of COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2			2							2
CO2	3	2			2							2
CO3	3	2	1	2	2							2
CO4	3	2	1	2	2							2
CO5	3	2	1		2			1			2	2
	15	10	3	4	10			1			2	10

Semester **II**

Subject Name **MECHANICAL AND CIVIL ENGINEERING SYSTEMS**

Subject Code **XBW 203**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 1 - 1- 5	**1.5:1.5:0**	**3- 2- 2- 7**

Course Outcome: After the completion of the course, students will be able to		**Domain** (C or P or A)
CO1	Define and visualize the working principles of the various boilers, turbines and engines	C & P (Knowledge)
CO2	Differentiate and auscultate the measurements by using various metrology instruments	C & P (Comprehension)
CO3	Categorise and palpate the various metal forming, joining and cutting processes	C & P (Synthesis)
CO4	Characterize and diagonose the quality of the good Building materials; and measure linear and angular dimensions	C & P (Knowledge)
CO5	Summarize and palpate the components of a substructures and super structures.	C & P (Evaluation)

COURSE CONTENT

UNIT-I **BASICS OF THERMAL AND ENERGY SYSTEMS9+6+6 hrs**

Introduction to Mechanical Engineering – Streams – Thermal, Design, and Manufacturing Conventional and non conventional sources of energy – Heat energy – Modes of heat transfer – Working principles of Boilers and Turbines – Classification of IC Engines – 4 stroke and 2 stroke engines – Petrol and diesel engines – Performance and heat balance – Working principles of hydel, steam and nuclear power plants

UNIT –II **FUNDAMENTALS OF MACHINE ELEMENTS AND MEASUREMENTS9+6+6 hrs**

Engineering materials – Machine elements – fasteners and support systems – Belt drives – Types – Velocity ratio and Length of belt – Gear drives – Types – Velocity ratio. Principle of measurements – Accuracy – Precision – Errors – Measuring instruments – Scale – Vernier Caliper – Micrometer – Slip gauges – Spirit level

UNIT-III **ELEMENTS OF MANUFACTURING9+6+6 hrs**

Manufacturing processes – Classification – Principles of metal forming – forging, moulding, casting – Principles of metal joining – welding, soldering and brazing. Machining – turning, drilling, milling and grinding – Machining time and material removal rate.

UNIT -IV **SURVEYING AND CONSTRUCTION MATERIALS9+6+6 hrs**

Surveying: Definition – Survey Instruments – Classification of Survey – Linear and Angular Measurements – Measurement of area – Illustrative Examples.

Construction Materials:Bricks – Stones – Timber – Steel – Cement – Sand –

Aggregates – Concrete

UNIT V **COMPONENTS AND OF CONSTRUCTION OF CIVIL STRUCTURES 9+6+6 hrs**

Substructure: Bearing capacity - Types of Foundation – Application – Requirement of good foundations. Superstructure: Brick masonry – Types of bond – Flooring – Beams – Columns – Lintels – Roofing – Doors and windows fittings – Introduction to bridges and dams – Building drawing

Practical **30 hrs**

1. Petrol engine performance – BHP
2. Diesel engine performance – BHP
3. Demonstration of refrigeration and air conditioning units
4. Measurements using Vernier Caliper, Micrometer, Slip gauges and Spirit level.
5. Demonstration of transmission system in machines and suspension system in automobiles.
6. Exposure to workshop tools
7. Fitting exercises: Square and triangle
8. Simple turning and drilling
9. Demonstration of welding and mould preparation
10. Surveying

11. Building drawing, Carpentry, Plumbing.

L=45 hrs P=30 hrs T=30 hrs Total = 105 hrs

Text books

1. Dr. P.K. Srividhya, P. Pandiyaraj, S. Balamurugan, "Basic Civil and Mechanical Engineering", PMU Publications, Vallam, 2013.
2. Dr. B.C.Punmia, Ashok Kumar Jain, "Basic Civil Engineering", Laxmi Publications, New Delhi, 2003.
3. Dr. B.C.Punmia, "Surveying – Volume I", Laxmi Publications, New Delhi, 2005

References

1. Venugopal K., Basic Mechanical Engineering, Anuradha Publications, Kumbakonam, 2007.
2. Shanmugam G. and Palanichamy M. S.,"Basic Civil and Mechanical Engineering", Tata Mc Graw Hill Publishing Co., New Delhi, 3rd Edition, 2009.

Mapping of CO's with GA's:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	2			2								
CO2	2		1	2					**1**			**1**
CO3	5	2	1	1	2				**1**			**2**
CO4	5	3	1	1					**1**			**1**
CO5	1	1	1		3							**1**
	15	6	4	6	5				**3**			**5**

1 - Low, 2 – Medium, 3 – High

Semester **II**

Subject Name **APPLIED CHEMISTRY**

Subject Code **XAC 204**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 1 - 1- 5	**2.8:0.8 :0.4**	**3 - 2-2-7**

Course Outcome: After the completion of the course, students will be able to		Domain (C or P or A)
CO1	Identify and describe the various water quality parameters and methods to purify water in contest with boilers and domestics usage.	C(Remember) P(Perception)
CO2	Explain the fundamental principles of electrochemical reactions, its applications in redox reactions and calculate the different electrochemical processes.	C(Understand) P (Set)
CO3	Interpret the types of corrosion, use and measure its control by various methods including protective techniques.	C (Apply) A (Receive) P (Mechanism)
CO4	Describe,Illustrate and Discussthe generation of energy in batteries, nuclear reactors, solar cells, fuel cells and anaerobic digestion.	C(Remember&Analyse) A (Response)
CO5	Apply and measure the different types of spectral techniques for quantitative chemical analysis and listnano materials for various engineering processes.	C (Remember & Apply) P(Mechanism)

COURSE CONTENT

UNIT-I **WATER TECHNOLOGY** **7 + 8 +9 hrs**

Sources and types of water – water quality parameters – BIS and ISO specifications- hardness: types and estimation of hardness (problems) - alkalinity: types and estimation (problems) – boiler feed water – requirements – disadvantages of using hard water in boilers – internal treatment, external treatment – demineralization process – desalination using reverse osmosis – domestic water treatment - Effluent treatment processes in industries

UNIT –II **ELECTROCHEMISTRY** **8+5 +15 hrs**

Basic concepts of conductance – Kohlraush's law and conductometric titrations – electrode potentials– Nernst equation: derivation and problems - reversible and irreversible cells – electrolytic and electrochemical cells– emf and its measurements - types of electrodes-reference electrodes - primary and secondary - glass electrode - determination of pH using quinhydrone and glass electrodes - electrochemical series and its applications - Galvanic cells and concentration cells - potentiometric titrations - redox titrations.

UNIT-III CORROSION AND PROTECTIVE COATINGS 9 + 4 +3 hrs

Corrosion- causes- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion in electronic devices, corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method.

Protective coatings: paints- constituents and functions - electroplating of copper and gold, Electroless plating - Distinction between electroplating and electroless plating,advantages of electroless plating, electroless plating of nickel and copper on PCB.

UNIT -IV ENERGY STORAGE DEVICES AND NUCLEAR ENERGY 12 + 7hrs

Energy storage devices – Batteries: Types – primary (dry cell, alkaline cells) and secondary (lead acid, Ni-Cd and Lithium ion batteries) - Supercapacitors – Fuel cells-Hydrogen-Oxygen fuel cell- Solar cells .Nuclear energy: nuclear fission and fusion –chain reaction and its characteristics – nuclear energy and calculations (problems) – atom bomb –Nuclear reactor- light water nuclear power plant – breeder reactor- Weapon of mass destruction- nuclear, radiological, chemical and biological weapons. Disarmament - National and International Cooperation- Chemical Weapon Convention (CWC), Peaceful Uses of Chemistry. Bio fuels: biomethanation- anaerobic digestion process, biomass: sources and harness of energy.

UNIT V SPECTROSCOPY AND NANOCHEMISTRY 9 +6 +3 hrs

Electromagnetic spectrum - Lambert law and Beer-Lambert's law (derivation and problems) – molecular spectroscopy -UV- visible spectroscopy: electronic transitions - chromophores and auxochromes – instrumentation (block diagram) - applications – IR spectroscopy: principle – fundamental modes of vibrations – calculations of vibrational frequency – IR spectrophotometer instrumentation (block diagram) – applications of IR spectroscopy.

Nanochemistry - Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis ; properties and applications of nano materials-Buckminister fullerenes, CNT"S(Single walled carbon nano tubes and Multi-walled carbon tubes)-Graphene- advantages and applications.

L= 45hrs T=30hrs P= 30hrs Total =105 hrs

Text books

1. Jain and Jain , "A Text book of Engineering Chemistry", Dhanapatrai Publications,New Delhi,2011.
2. Gadag and Nityananda Shetty , "Engineering Chemistry", I.K International Publishing House Pvt. Ltd, 2010.
3. P. Atkins, J.D. Paula ,"Physical Chemistry" , Oxford University Press, 2009.
4. S. S. Dara,S.S.Umare, "A Text Book of Engineering Chemistry",S. Chand Publications, 2011
5. C.P. Poole and F.J. Owens, "Introduction to Nanotechnology",Wiley, New Delhi ,2007.

References

1. Puri B R Sharma L R and Madan S Pathania, " Principles of Physical Chemistry", Vishal Publishing Co.,Edition 2004
2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

E 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/

Practical **30 hrs**

1. Determination of total hardness, temporary and permanent hardness of water by EDTA method.
2. Determination of alkalinity of water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Conductometric titration of a strong acid with a strong base.
5. Determination of strength of hydrochloric acid by pH metric method.
6. Conductometric precipitation titration using barium chloride and sodiumsulphate.
7. Determination of strength of iron by potentiometric method using dichromate.
8. Potentiometric acid-base titration using quinhydrone electrode.
9. Corrosion inhibition efficiency by weight loss method.
10. Estimation of iron by colorimetric method.

References

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.
3. Sirajunnisa.A., Sundaranayagi.S.,Krishna.,Rajangam.R.,Gomathi.S., "Applied Chemistry Lab Manual", Department of Chemistry, PMU Press, Thanjavur, 2016.

E – References

1. http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-ChemistryFall2011
3. http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

Mapping of Cos with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12		
CO1	3	3	3	2	2	1	3	3	1	2		1	2	
CO2	2		3	3	3	2	2	3	1	2		1	2	2
CO3	3	3	3	3	3	2	3	3	1	2		1	2	2
CO4	3	3	2	3	3	2	3	2	1	2	1	1	2	2
CO5	2	2	1	3	3	1	2	1	1	2	1	1	3	2
	13	11	12	14	14	8	13	12	5	10	2	5	11	8

Semester **II**

Subject Name **ENGINEERING GRAPHICS**

Subject Code **XEG 205**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L - T –P –H**
1- 0 – 0 - 3	**0.66 : 0.66 : 0.66**	**3 – 0- 0– 3**

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

		Domain (C or P or A)
CO1	Apply the national and international standards, construct and practice various curves	C(Apply) P(Guided response) A(Response)
CO2	Interpret, construct and practice orthographic projections of points, st. lines and planes.	C(Understand) P(Mechanism) A(Response)
CO3	Construct Sketch and Practice projection of solids in various positions and true shape of sectioned solids.	C(Apply) P(Complex over Response) A(Response)
CO4	Interpret, Sketch and Practice the development of lateral surfaces of simple and truncated solids, intersection of solids.	C(Understand) P(Complex over Response) A(Response)
CO5	Construct,sketch and practice isometric and perspective views of simple and truncated solids.	C(Apply) P(Complex over Response) A(Response)

COURSE CONTENT

UNIT-I **INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE9 hrs**

Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003.

Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects.

Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves.

UNIT–II **PROJECTION OF POINTS, LINES AND PLANE SURFACES 9 hrs**

General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection.

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

Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections.

UNIT-IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS 9 hrs

Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset.

UNIT V ISOMETRICAND PERSPECTIVE PROJECTIONS 9 hrs

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.

L = 45 hrs Total = 45 hrs

Text Books

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

References

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

E References

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

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	3	1	1							1
CO2	3	2	1	1	1							1
CO3	3	2	1	1	1							1
CO4	3	2	1	1	1							1
CO5	3	2	1	1	1							1
	15	10	7	5	5							5

1 – Low 2 – Medium 3 – High

Semester **II**

Subject Name **SPEECH COMMUNICATION**

Subject Code **XGS 206**

L –T –P –C	**C:P:A**	**L –T –P –H**
1- 0 – 0– 1	**1.8:0.8:0.4**	**1- 0– 0–3**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Choose and identify different styles to various forms of public speaking skills and presentation skills.	C (Understand)
CO2	Understand and identify the proper tone of language required in writing and speaking.	C (Understand)
CO3	Adapting the speech structures and developing the speech outline.	P(Adaptation)
CO4	Ability to communicate and develop presentation skills.	A(Response)
CO5	Calibrates the speaker to face the audience without any anxiety.	P(Guided response)

COURSE CONTENT

UNIT I **5 hrs**

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 **5 hrs**

Manuscript, impromptu, rememorized and extemporaneous speeches; analyzing the audience and occasion; developing ideas; finding and using supporting materials

UNIT III **5 hrs**

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 **5 hrs**

Basic tips; how to present a paper assignment etc; using visual aids to the speeches; using body language to communicate.

UNIT V **25 hrs**

Public speaking and speech anxiety, public speaking and critical listening
Speech practice (4-6 speeches per student)

L = 20 hrs P = 25 hrs Total = 45 hrs

Text books

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

Mapping COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2				1										
CO3				1						2				
CO4				2						2	1	1		
CO5										2	1	1		
				4						6	2	2		

1- Low 2- Medium 3 – High

Semester **III**

Subject Name **TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**

Subject Code **XMA 301**

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

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Explain and demonstrate the basic concepts in partial differential equations and to solve linear, nonlinear,homogeneous and non-homogeneous partial Differential equations.	C (Remember & Understand)
CO2	Demonstrate the basic concept and properties of Fourier series and to state Parseval's identity and Diritchlet's condition.	C (Remember & Understand)
CO3	Solve the standard Partial Differential Equations, arising in engineering problems, like wave equation and heat flow equation by Fourier series method.	C(Apply)
CO4	Explain and apply the concept of fourier transform and its properties.	C(Understand & Apply)
CO5	State and apply the properties of Z transform and to find the Z transform and inverse Z transform .	C(Remember& Apply)

COURSE CONTENT

UNIT I **PARTIAL DIFFERENTIAL EQUATIONS15 hrs**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II **FOURIER SERIES15 hrs**

Drichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic Analysis.

UNIT III **APPLICATIONS OF BOUNDARY VALUE PROBLEMS 15 hrs**

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV **FOURIER TRANSFORM** **15 hrs**

Fourier integral theorem (without proof) – Fourier transform pairs – Fourier Sine and Cosine transforms – properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V **TRANSFORM AND DIFFERENCE EQUATIONS 15hrs**

Z-transform – Elementary properties – Inverse Z – transform – Convolution theorem – Initial and Final value theorems - Formation of difference equations – Solution of difference equations using Z-transform.

L = 45 hrs T = 30 hrs Total = 75 hrs

Text books

1. Grewal, B.S., "Higher Engineering Mathematics", 40th Edition Khanna Publishers, New Delhi, (2007).
2. Narayanan,S.,Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S.Viswanathan (Printers and Publishers)Pvt. Ltd. Chennai, (2002).

References

1. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems",4th Edition, McGraw Hill Book Co., Singapore, (1987).
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " Engineering Mathematics Volume III", S. Chand & Company Ltd., New Delhi, (1996).
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering Mathematics" 7th Edition Lakshmi Publications (P) Limited, New Delhi, (2007)

E-References

1. **www.nptel.ac.in**

Advanced Engineering Mathematics, Prof. Jitendra Kumar ,Department of Mathematics, Indian Institute of Technology, Kharagpur.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3							1	1			
CO2	3							1	1			
CO3	3	2						1	2		1	
CO4	3	2	1					1	1		1	
CO5	3	2	1					1	1		1	
	15	6	2					5	6		3	

1 - Low , 2 – Medium , 3- High

Semester **III**

Subject Name **FLUID MECHANICS**

Subject Code **XCE 302**

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

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

		Domain C or P or A
CO1	Acquiring knowledge of fluid mechanics fundamentals, including concepts of mass and momentum conservation	C (Knowledge)
CO2	Application of Bernoulli equation to solve problems in fluid mechanics	C (Application)
CO3	Identify the losses in pipes and field applications	C(Knowledge) & P (Measure)
CO4	Perform dimensional analysis for problems in fluid mechanics.	C (Analyse)

COURSE CONTENT

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

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**

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 12 hrs**

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 12 hrs**

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 12 hrs**

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=45 hrs T =15 hrs Total = 60 hrs

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

Reference books

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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	3												
CO2	3	3	1										2	1
CO3	3	3												
CO4	3	3											2	
	12	12	1										4	1

1 - Low, 2 – Medium, 3 – High

Semester **III**

Subject Name **SURVEYING**

Subject Code **XCE 303**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 1- 4	1.5:1:0.5	3- 0 – 2- 5

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	***Identify*** the Principles and function of various surveying methods	Cognitive Psychomotor
CO2	***Identify*** the types of Levelling and ***determine*** the reduced levels using Dumpy Level	Cognitive Affective Psychomotor
CO3	***Classify*** the methods of Contouring and measure the capacity of Reservoir	Cognitive Psychomotor
CO4	***Describe*** the methods and ***measure*** the angles and distances using Theodolite and Tacheometric Surveying	Cognitive Psychomotor Affective

COURSE CONTENT

UNIT I BASIC SURVEYING **9 hrs**

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 hrs**

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 hrs**

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 hrs**

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 hrs**

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

Practical **15 hrs**

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=45 hrs P = 15 hrs Total = 60 hrs

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's with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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
Total	**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	**C:P:A**	**L –T –P –H**
3- 1 – 1- 5	**1.5:1:0.5**	**3 -2 - 2- 7**

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

COURSE CONTENT

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

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/SHELLS15 hrs**

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 BEAMS15 hrs**

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 BEAMS15hrs**

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 SPRINGS15 hrs

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 hrs**

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=45 hrs T =30 hrs P=30 hrs Total = 105 hrs

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's 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	2									1		1	
CO3	1	3				2					2		2	
CO4	1	2	2	1			1	1			2		1	
CO5	1	1	1		3		1	1					1	
	6	11	3	2		2	2	2			7		7	

1 - Low , 2 – Medium , 3 – High

Semester **III**

Subject Name **ENGINEERING MATERIALS**

Subject Code **XCE305**

L –T –P –C	C:P:A	L –T –P –H
3 - 0 – 0 - 3	**3:0:0**	**3 – 0 –0- 3**

Course Outcome: After the completion of the course, students will be able to		Domain/Level C or P or A
CO1	Identify and characterize building materials	C (Understand)
CO2	Understand the manufacturing process of bricks and cement	C (Remember)
CO3	Identify the methods for preservation of timber and metals	C(Understand)
CO4	Understand the use of non-conventional Civil Engineering materials	C (Understand)

COURSE CONTENT

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

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 hrs**

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 hrs**

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 hrs**

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 hrs**

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=45 hrs Total = 45 hrs

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's with PO's:

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

1 - Low, 2 – Medium, 3 – High

Semester **III**

Subject Name **ENTREPRENEURSHIP DEVELOPMENT**

Subject Code **XEP 306**

L –T –P –C	**C:P:A**	**L –T –P –H**
2- 0 –0– 2	**3:0:1**	**2+1*– 0 – 0 - 3**

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

		Domain C or P or A
CO1	Recognise and describe the personal traits of an entrepreneur.	A(Receive) C(Understand)
CO2	Determine the new venture ideas and analyse the feasibility report.	C(Understand & Analyse)
CO3	Develop the business plan and analyse the plan as an individual or in team.	A (Receive) C (Analyse)
CO4	Describe various parameters to be taken into consideration for launching and managing small business.	C(Understand)
CO5	Describe Technological management and Intellectual Property Rights.	C(Understand)

COURSE CONTENT

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

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 hrs**

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 hrs**

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 MANGEMENT9 hrs**

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 hrs**

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 = 30 hrs SS – 15 hrs Total = 45 hrs

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.

References

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 Materialfor 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 COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1										3	3	
CO2			1	2	2	2	1	1	1	2	3	
CO3			1	1		1		2		3	1	
CO4	1	1	1	1		1	1		3		3	3
CO5	1		1	3		1	1					3
	2	1	4	7	2	5	3	3	4	8	10	6

Semester **III**

Subject Name **INTERPERSONAL COMMUNICATION**

Subject Code **XGS 307**

L –T –P –C	**C:P:A**	**L –T –P –H**
0- 0 – 0– 0	**1:1:0**	**2*- 0– 0–2**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Recognize culture and a need for interpersonal communication.	C(Understand)
CO2	Demonstrateon the need for effective communication between two people.	C (Understand)
CO3	Explainon family and social relationships and need for socialization.	C (Understand)
CO4	Practicethe IP principles as to how to reduce and repair conflict in interpersonal relationships.	P(Guided response)
CO5	Make use to use effective and appropriate language at various interpersonal situations to avoid conflict.	C(Understand & Apply)

COURSE CONTENT

UNIT I **9 hrs**

Universals of interpersonal communications; Axioms of interpersonal Communication; culture in interpersonal communication and the self in interpersonal communication.

UNIT II **9 hrs**

Apprehension and assertiveness; aggressiveness and assertiveness; perception in interpersonal communication; listening in interpersonal communication**.**

UNIT III **9 hrs**

Verbal and non verbal messages; relationship and involvement; relationship maintenance and repair.

UNIT IV **9 hrs**

Power in interpersonal relationship; conflict in interpersonal relationship; friends and relatives; primary and family relationships.

UNIT V **9 hrs**

Socialization, need for socialization and benefits of socialization among students.

L = 30 hrs IS = 15 hrs Total = 45 hrs

Text books

1. DeVito, Joseph, The Interpersonal Communication Book, 13th Edition - , Published by Longman Pub Group, Updated in its 13th edition,2000
2. Kathleen S. Verderber, Inter-Act: Interpersonal Communication Concepts, Skills and Contexts, Rudolph F. Verderber, 2000
3. Clifford Whitcomb, Effective Interpersonal and Task Communication Skills for Engineers, Atlantic Publishers. 2010

Mapping of Cos with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1												
CO2												
CO3				2		1				1		
CO4	1			1		1						
CO5	1					1				1		
	2	0	0	3	0	3	0	0	0	2	0	0

1-Low , 2 – Medium ,3-High

Semester **III**

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

Subject Code **XCE 308**

L –T –P –C	**C:P:A**	**L –T –P –H**
0- 0 –0– 1	**2:2:2**	**0 – 0 –0 - 0**

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

Mapping of COs with GAs

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO1	2											
CO2							1	3			1	
CO3									3	1	3	1
CO4		1	2	1	3							3
CO5				3						3		1
	2	1	2	4	3		1	3	3	4	4	5

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **OPERATIONS RESEARCH**

Subject Code **XOR 401**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 –0– 3	**3:0:0**	**3 – 0 – 0 - 3**

Course Outcome: After the completion of the course, students will be able to **Domain C or P or A**

CO1	***Explain*** the basic concepts of optimization and To F***ormulate*** and Solve linear programming S problems.	Cognitive	Understanding Applying
CO2	***Apply*** the concepts of transportation problem, assignment problem and travelling salesman Problem. Participate in the class discussion in the Transportation model.	Cognitive Affective	Apply Receiving
CO3	***Explain*** and demonstrate the basic concepts of PERT- CPM and their applications in product Planning control.	Cognitive	Understanding
CO4	***Solve*** the Minimal Spanning Tree Problem, Shortest Route Problem, Maximal Flow Problem and Minimal Cost Capacitated Flow Problem**.** Reproduce the Network model.	Cognitive Psychomotor	Apply Manipulation
CO5	***Apply*** the concepts of Game theory to Find the Solution and saddle point.	Cognitive	Apply Remembering

COURSE CONTENT

UNIT I **LINEAR MODELS** **9 hrs**

Basics of OR, Linear programming problems (L.P.P), Mathematical Formulation of L.P.P, Graphical method, Simplex algorithm, Duality.

UNIT II **TRANSPORTATION MODELS** **9 hrs**

Transportation problem, Assignment problem, Travelling Salesman problem.

UNIT III **PROJECT SCHEDULING BY PERT-CPM 9 hrs**

PERT-CPM, product planning control with PERT-CPM.

UNIT IV **NETWORK MODELS** **9 hrs**

Network definition, Minimal Spanning Tree Problem, Shortest Route Problem, Maximal Flow Problem, Minimal Cost Capacitated Flow Problem.

UNIT V **GAME THEORY9 hrs**

Introduction - competitive game - finite and infinite game - two person zero sum game - rectangular game - solution of game- saddle point, solution of a rectangular game with saddle point.

L = 45 hrs Total = 45 hrs

Text books

1. Hamdy A. Taha, "Operations Research" An Introduction, Eighth Edition, by Pearson Education, Inc.(2008).
2. Frederick.S Hillier and Gerald J. Lieberman, Introduction to Operations Research, Sixth Edition,Mc Graw Hill International Edition, Industrial Engineering Series, (2001).
3. Kantiswaroop,Gupta P.K and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi, (2008).

References

1.Hadley G, Linear Programming, Narosa publishing House, (1995).

2. Hadley G, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass, (1973).

3. Gupta R. K. "Linear Programming",Krishna Prakashan Media(P) Ltd. ,(2009).

E-References

1. www.nptel.ac.in
   Fundamentals of Operations Research , Advanced Operation Research
   Prof.G.Srinivasan, Department of Management Studies, Indian Institute of Technology, Madras.

TABLE 1: CO VS PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	1		1				1			
CO 2	3	2			1			1	1			
CO 3	3	2			1			1	1			
CO 4	3	2	1		1			1	1			
CO 5	3	2			1			1	1			
Total	15	10	2	0	5	0	0	4	5	0	0	0
Scaled value	3	2			1				1			

1-5→1, 6-10 → 2, 11-15 → 3

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

Mapping of COs with GAs

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

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **CONCRETE TECHNOLOGY**

Subject Code **XCE 402**

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

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

COURSE CONTENT

UNIT I **CONSTITUENT MATERIALS** **6+0+12 hrs**

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

UNIT II **FRESH CONCRETE** **6+0+9hrs**

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

UNIT III **CONCRETE MIX DESIGN6+0+9hrs**

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

UNIT IV **HARDENED CONCRETE6+0+0hrs**

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

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

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

L=45 hrs Total = 45 hrs

Text Books

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

References

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

E-References

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

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

Mapping of COs with POs

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

1 - Low, 2 – Medium, 3 – High

Semester **IV**

Subject Name **GEOTECHNICAL ENGINEERING**

Subject Code **XCE 403**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 1- 4	**1.25:0.5:0.5**	**3- 0 –2- 5**

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO 1	***Identify*** and ***test*** various types and properties of soils for engineering utilization.	Cognitive Psychomotor	Understanding Observation
CO 2	***Recognise*** the deformation behaviour of soil	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO 3	***Determine*** and ***analyse*** the Strength parameters of soil.	Cognitive, Psychomotor Affective	Applying Manipulation Valuing
CO 4	***Compute*** the load carrying capacity of Shallow foundation for different soils.	Cognitive	Analysing
CO 5	***Compute*** the load carrying capacity of Deep foundation for different soils.	Cognitive	Analysing

COURSE CONTENT

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

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 hrs**

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 hrs**

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 hrs

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 hrs

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 30hrs

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 - 45 hrs P - 30hrs Total - 75 hrs

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 2011

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	3			3				1			1	1	1
CO2	3				3				1			1	1	1
CO3	2	3			3				1			2	1	1
CO4	2		3	3		3		1	1	2	2		2	1
CO5	2		3	3		3		1	1	1	2		2	1
Total	**12**	**6**	**6**	**6**	**9**	**6**		**2**	**5**	**3**	**4**	**4**	**7**	**5**

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **OPEN CHANNEL FLOW AND HYDRAULIC MACHINES**

Subject Code **XCE 404**

L –T –P –C	**L –T –P –H**
3- 1 – 1- 5	**3- 2 –2- 7**

COURSE OUTCOMES

At end of the course the students should be able to		**DOMAIN**	**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 FLOW15 hrs

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 JET15 hrs

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 TURBINES15 hrs

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 PUMP15 hrs

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 hrs**

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 hrs**

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=45 hrs T=15 hrs P= 15 hrs Total = 75 hrs

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 COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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
Total	**13**	**15**	**10**	**3**	**2**	**7**	**4**	**5**	**3**	**5**	**3**	**5**	**7**	**5**

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **STRUCTURAL MECHANICS**

Subject Code **XCE 405**

L –T –P –C	C:P:A	L –T –P –H
3 - 1 – 0 - 4	2:0.5:0.5	3- 2 –0- 5

Course Outcome: After the completion of the course, students will be able to		DOMAIN	LEVEL
CO 1	***Identify*** the behavior of structural element and ***Discuss*** the failure theories.	Cognitive & Affective	Remembering & Respond
CO 2	***Analyse*** indeterminate structures and ***Reports*** the results	Cognitive& Affective	Analyzing & Respond
CO 3	***Infer***the end conditions&***Discuss*** the failure criteria of the column and cylinder.	Cognitive & Affective	Understanding & Respond
CO 4	***Compute and Locate*** the deflection of beams by energy principles.	Cognitive& Affective	Application & Receive
CO 5	***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 hrs

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

UNIT II INDETERMINATE BEAMS 12 hrs

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 hrs

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

UNIT IV ENERGY PRINCIPLES 12 hrs

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 hrs

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

L=45 hrs T=15 hrs Total = 60 hrs

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 COs with POs

	PO1	**PO2**	PO3	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	PO10	**PO11**	PO12	**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	
Total	10	5		3	1	2	2	1	1		2		5	1

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **ECONOMICS FOR ENGINEERS**

Subject Code **XEE 406**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0– 3	**3:0:0**	**3 - 0– 0 - 3**

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

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 hrs**

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 ACCOUNTING10 hrs**

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 hrs**

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 hrs

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 = 45 hrs Total = 45 hrs

Text books

1. S.P Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K GlobalPublications, 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

Table 1 : Mapping of CO's with POs

	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO1	**1**	**2**	**0**	**1**	**0**	**0**	**1**	**1**	**1**	**2**	**2**	**3**
CO2	**2**	**2**	**1**	**2**	**0**	**0**	**2**	**1**	**1**	**2**	**3**	**3**
CO3	**2**	**2**	**1**	**3**	**0**	**0**	**2**	**2**	**1**	**2**	**2**	**3**
CO4	**1**	**2**	**1**	**2**	**0**	**0**	**0**	**1**	**1**	**1**	**2**	**3**
CO5	**1**	**2**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**2**	**3**
Total	**7**	**10**	**3**	**9**	**0**	**0**	**6**	**6**	**4**	**8**	**11**	**15**

Mapping of COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2					1	1					
CO 2	2	3										
CO 3	2					1	1					
CO 4	3	1				1			1			
CO 5		1					1		2			
	9	5				3	3		3			

1-Low , 2- Medium ,3-High

Semester **IV**

Subject Name **TECHNICAL COMMUNICATION**

Subject Code **XGS 407**

L –T –P –C	**C:P:A**	**L –T –P –H**
1- 0 – 0– 1	**3:0:0**	**1+2 *- 0– 0 - 3**

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

		DOMAIN	**LEVEL**
CO 1	***Identify*** the features of a technical project report and Knowledge on the linguistic competence to write a technical report	Cognitive	Remember
CO 2	***Integrate*** both technical subject skill and language skill to write a project.	Cognitive	Create
CO 3	Confidence to ***present*** a project in 10 to 15 minutes	Affective	Response
CO 4	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
CO 5	***Enables*** the speaker speaks clearly and fluently with confidence and it trains the learner to listen actively and critically	Psychomotor	Perception
CO 1	***Identify*** the features of a technical project report and Knowledge on the linguistic competence to write a technical report	Cognitive	Remember

COURSE CONTENT

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

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

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

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

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

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 hrs**

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 hrs**

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

L = 15 hrs SS = 30 hrs Total = 45 hrs

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

TABLE 1: CO VS PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1						1	3					
CO 2						1	1					
CO 3						1	2					
CO 4						1	1					
CO 5						1	1					
Total						**5**	**8**					

Mapping of COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1												
CO2										2		
CO3	2						2			1		
CO4							2	1	1			
CO5	2						2	1	1	1		
	4						6	2	2	4		

1-Low , 2- Medium ,3-High

Semester **V**

Subject Name **NUMERICAL METHODS**

Subject Code **XMA 501**

L –T –P –C	C:P:A	L –T –P –H
2- 1– 0 – 3	3:0:0	2- 2– 0 -4

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO1	Solve algebraic and transcendental equations and to find eigen values of a matrix by power method	C(Response) C(Application)
CO2	Interpret and approximate the data using interpolation methods	C (Understand)
CO3	Solve the numerical differentiation and integration and to apply the Trapezoidal and Simpson's rules.	C(Application)
CO4	Solve the first order and second order differential equations using single step and multistep methods.	C(Application)
CO5	Apply finite difference methods to solve two-point linear boundary value problems and to solve one dimensional heat-flow equation and wave equation.	C(Application)

COURSE CONTENT

UNIT I **SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS** **12 hrs**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton- Raphson method- Solution of linear system of equations - Gauss Elimination method –Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.

UNIT II **INTERPOLATION AND APPROXIMATION** **12 hrs**

Interpolation with equal intervals - Newton's forward and backward difference formulae- Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation.

UNIT III **NUMERICAL DIFFERENTIATION AND INTEGRATION** **12 hrs**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV **INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** **12 hrs**

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-Corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12 hrs

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit methods - One dimensional wave equation by explicit method.

L = 30 hrs T = 30 hrs Total = 60hrs

Text books

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, (2004).
2. SankaraRao, K. "Numerical methods for Scientists and Engineers', 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, (2007).

References

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, (2007).
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, (2006).
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, (2007)
4. Jain M.K.IyengarS.R.K,JainR.K,"NumericalMethods problems and solutions",Revised Second Edition (2007).

E-References

1. www.nptel.ac.in
   Elementary Numerical Analysis Prof. Rekha P. Kulkarni. Department of Mathematics, Indian Institute Of Technology, Bombay.

Mapping of COs with GAs

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

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **STRUCTURAL ANALYSIS**

Subject Code **XCE 502**

L –T –P –C	**C:P:A**	**L –T –P –H**
2 - 1 – 0 - 3	**2.5:0:0.5**	**2 – 2 - 0- 4**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Identify the behavior of structural element under various loading condition.	C & A
CO2	Understand the advantage of statically indeterminate structure and the statically determinate structure.	C
CO3	Superimpose the effects of settlement and rotation of the supports over the regular analysis.	C
CO4	Apply knowledgeonadvanced methods of analysis of structuresincludingarches and cables.	C
CO5	Recognize the failure mechanism of structural elements.	C

COURSE CONTENT

UNIT I **SLOPE DEFLECTION METHOD12hrs**

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** **12hrs**

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 LINES12 hrs**

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 CABLES12hrs**

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 STRUCTURES12hrs**

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- 30 hrs T-30hrs Total – 60hrs

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

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	3				1							1	
CO2	3	1	1			1								
CO3	1	3	2					1	1		1			
CO4	3	2	2		1	1					1		1	
CO5	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	**C:P:A**	**L –T –P –H**
3- 0– 1- 4	**2:0.5:0:5**	**3- 0 –2- 5**

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

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

COURSE CONTENT

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

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 WATER12hrs**

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** **12hrs**

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** **12hrs**

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** **12Hrs**

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.

Practicals **30hrs**

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 - 60hrs P - 30hrs Total -90 hrs

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,17thEdition,WPCF,APHA and AWWA,USA,1989.

Mapping of CO s with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1		1	4	1	1	1			1				1	
CO2		1	2	1	1	1			2				2	1
CO3	1		3	2			1		1	1	1		2	
CO4	1	1	1	1			1	1	2			1	1	
CO5			2	2				1	4	1		2	5	
	2	3	12	7	2	2	2	2	10	2	1	3	11	1

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **BUILDING PLANNING AND DRAWING**

Subject Code **XCE 504**

Prerequisite NIL

L –T –P –C	C:P:A	L –T –P –H
3- 1 – 1- 5	2:0.5:0.5	3- 2 –2- 7

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

COURSE CONTENT

UNIT-I **INTRODUCTION15hrs**

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 15hrs**

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 18hrs**

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

UNIT –IV **PUBLIC BUILDINGS AND TRUSSES18hrs**

Planning ofeducational buildings-Hospitals- Offices - Factory buildings –Roof trusses.

UNIT – V **COMPUTER AIDED DRAFTING9hrs**

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

L-75hrs P-30hrs Total – 105hrs

Practical30hrs

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

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 COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	1	1			1		1				1	1
CO2		1		1			1		1	1	1	1		1
CO3	1	1	2	1	1	1		1	1	1		1		1
CO4	1	2		1		1		1				1		1
CO5	3	2	3		1									
	7	7	6	4	2	2	2	2	3	2	1	3	2	4

1 - Low, 2 – Medium, 3 – High

Semester	**V**
Subject Name	**TOTAL QUALITY MANAGEMENT**
Subject Code	**XTQ 506**
L –T –P –C	**L –T –P –H**
3- 0– 0- 3	**3- 0 –0- 3**

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

COURSE CONTENT

UNIT I INTRODUCTION9hrs

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 9hrs

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) 9hrs

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 9hrs

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 9hrs

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-45 hrs Total -45 hrs

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.

E-References

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

Semester **V**

Subject Name **BUSINESS COMMUNICATION**

Subject Code **XGS 507**

L –T –P –C	**L –T –P –H**
1- 0– 0 - 1	**1+2*- 0 –0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO1	To choose and apply different styles to various forms of business communication.	C (Knowledge)
CO2	Identify the proper tone of language required in writing and speaking in business communication.	C (Understand)
CO3	Display knowledge on grammar and other linguistic features in writing various forms of business communication.	C (Understand)
CO4	To distinguish between letters and memos and various forms of Business Communication.	C (Grasp)
CO5	Learn how to write business reports, minutes, proposals.	P (Apply)

COURSE CONTENT

UNIT I **9 hrs**

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 **9hrs**

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 hrs**

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 hrs**

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

UNIT V **9 hrs**

Writing Business reports, proposals and minutes.

L = 15hrs SS = 30 hrsTotal = 45hrs

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 COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1							2			2		
CO2							2			2		
CO3				2			2			1		1
CO4				2			2					1
CO5							2			1	2	
				4			10			6	2	2

1 - Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **IN-PLANT TRAINING-II**

Subject Code **XCE 508**

L –T –P –C	**C:P:A**
0- 0 – 0- 1	**0.66:0.66:0.66**

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

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

Mapping of COs with GAs

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO1	2											
CO2							1	3			1	
CO3									3	1	3	1
CO4		1	2	1	3							3
CO5				3						3		1
Total	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	**C:P:A**	**L –T –P –H**
3- 0– 0- 3	**2.5:0.5:0**	**3- 0 –0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain/Level C or P or A**
CO1	Understand the knowledge on methods of irrigation including canal irrigation.	C(Understand)
CO2	Find the crop water requirement for various crops in the commanded area.	P(Measure)
CO3	Understand the design aspects of dams and channel systems.	C (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.	C(Knowledge)
CO5	Know the water resources available and management system.	C(Knowledge)

COURSE CONTENT

UNIT I **IRRIGATION ENGINEERING9hrs**

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** **9hrs**

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

UNIT III **HYDRAULIC STRUCTURES9hrs**

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 IRRIGATION9hrs**

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

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

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 = 45hrs **Total = 45hrs**

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 COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSo1**	**PSo2**
CO1	3	2			2								1	1
CO2		3							1				1	2
CO3	2		2	1				1	1				1	
CO4	2	2				1	1	1					1	1
CO5	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	**C:P:A**	**L –T –P –H**
3 – 0 –1–4	**2:0.5:0.5**	**3 – 0 – 2 –5**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Understand the importance of transportation infrastructure planning and design.	C
CO2	Apply basic science principles in estimating stopping and passing sight distance requirements.	C&P
CO3	Design and analyse the highway system and railway track system.	C & A
CO4	Make use of computer technology in the development of transportation infrastructure.	C & A
CO5	Insight on the basics of Airport and Harbour Engineering	C

COURSE CONTENT

UNIT I **INTRODUCTION TO TRANSPORTATION ENGINEERING9hrs**

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 ENGINEERING9 hrs**

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 DESIGN9 hrs**

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 ENGINEERING9 hrs**

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 hrs**

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 hrs**

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-45 hrs P-30hrs Total – 75 hrs

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, 5thRevision , 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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1			1	1									1	1
CO2		1	1	1	1			1	1		1		1	
CO3	2		3	2	1	1		1	1				3	
CO4			1	1	2	1	1			3		3	1	
CO5	1	2		1			1						1	
	3	3	6	6	4	2	2	2	2	3	1	3	7	1

1 – Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **DESIGN OF CONCRETE STRUCTURES**

Subject Code **XCE 604**

L –T –P –C	C:P:A	L –T –P –H
3- 1 – 1- 5	1.5:0.5:1	3- 2 –2- 7

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

		Domain C or P or A
CO1	Acquaint knowledge on design processes for idealising RC structures and construct their load paths.	C
CO2	Interpret ultimate and serviceability limit state approaches in current structural design philosophy	C&A
CO3	Estimate primary design loads on structural elements to find the critical load combination that governs design.	C&A
CO4	Model building structure and analyse structural elements for design actions	C&P

COURSE CONTENT

UNIT-I **METHODS OF DESIGN OF CONCRETE STRUCTURES15 hrs**

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 hrs**

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 TORSION15 hrs**

Behaviour of RC members in bond and anchorage – Design requirements –Behaviour of RC beams in shear and torsion – Design of RC members for combined bending shear and torsion.

UNIT –IV **DESIGN OF COLUMNS AND FOOTINGS 15 hrs**

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 hrs**

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

Practical 30 hrs

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

L-45 hrs T-15 hrs P-15hrs Total- 75 hrs

Text books

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

References

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

Mapping of COs with POs

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

1 – Low, 2 – Medium, 3 – High

Semester **VI**

Subject Name **STRUCTURAL STEEL DESIGN**

Subject Code **XCE 605**

L –T –P –C	C:P:A	L –T –P –H
3- 1 – 0- 4	2 : 1: 0	3- 2 –0- 5

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

COURSE CONTENT

UNIT-I INTRODUCTION 12 hrs

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 hrs

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 hrs

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 hrs

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 hrs

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

L-45 hrs T -15 hrs Total – 60 hrs

Text Books

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

Reference Books

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

IS codes

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

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	3	2			1	1	1				2	
CO2	2	1	3	2			1		1				2	
CO3	1	1	3	1		1							1	
CO4	3	1	3	3	1	1							2	
	8	4	12	8	1	2	2	1	2				7	

1 - Low, 2 – Medium, 3 – High

Semester **VI**

Subject Name **ENVIRONMENTAL STUDIES**

Subject Code **XCE 607**

L –T –P –C	**C:P:A**	**L –T –P –H**
0- 0 – 0- 0	**2.5 :0: 0.5**	**3 - 0 – 0 - 3**

Course Outcome: After the completion of the course, students will be able to		Domain C or P or A
CO1	Describe the significance of natural resources and explain anthropogenic impacts	C(Remember) & Understand)
CO2	Illustrate the significance of ecosystem and biodiversity for maintaining ecological balance	C(Understand)
CO3	Identify the facts , consequences , preventive measures of major pollution and Recognize the disaster phenomenon	C(Remember) A (Receive)
CO4	Explain the socio- economics, policy dynamics and practice the control measures of global issues for sustainable development.	C(Understand& Analyse)
CO5	Recognize the impact of population and apply the concept to develop various welfare programs.	C(Understand &Apply)

COURSE CONTENT

UNIT-I **INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY9 hrs**

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 BIODIVERSITY9hrs**

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 POLLUTION12hrs**

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 9hrs**

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 ENVIRONMENT6hrs**

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-45 hrs Total – 45hrs

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.

Reference Books

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.
   G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006
6. 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 COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3											
CO2	2					2	1			1		
CO3	2	1	3			1			1		1	
CO4	1	1	2					2				
CO5	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	**L –T –P –H**
0- 0– 0 - 0	**0- 0 –0- 2**

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

COURSE CONTENT

UNIT I **10hrs**

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 hrs**

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

UNIT III **25hrs**

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

UNIT IV **15hrs**

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 hrs**

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

L - 45hrs P - 30 hrs Total - 75 hrs

Text books&References

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 COs with POs

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

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 1- 4	**2:0.5:0.5**	**3- 0 -2- 5**

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

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

COURSE CONTENT

UNIT-I **CONSTRUCTION PROJECT FORMULATION** **9 hrs**

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** **9hrs**

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 PLANNING12 hrs**

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 hrs**

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 hrs**

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.

L-45 hrs P-30hrs Total – 75 hrs

Text books

1. Kumar Neeraj Jha, "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.

Practicals **30 hrs**

1. Introduction to Microsoft projects and Primavera

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1				1	3	2	1	1	**1**					1
CO2	2	1						2	1	1		1	1	1
CO3	2	1		2		1	1	1	2		1		1	
CO4						2	1	1	1	1			1	
CO5			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	C:P:A	L –T –P –H
3- 1 – 1- 5	2:0.5:0.5	3- 2 – 2- 7

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

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

COURSE CONTENT

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

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 hrs**

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 hrs**

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

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

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

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

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

Practical **30 hrs**

1. Building marking
2. Estimation using Spread Sheet

L- 45 hrs **T - 30hrs** **P -30hrs** **Total – 105hrs**

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", Dhanpat Rai 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 COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**
CO1	2				1	2				2				
CO2	2				2	3				3				
CO3	2				3			**1**			3	3	1	
CO4	2			2	3			**1**	3				1	
CO5	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 **CYBER SECURITY**

Subject Code **XUM 706**

L –T –P –C	C:P:A	L –T –P –H
0- 0 – 0- 0	3:0:0	0- 0 – 0- 3

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

		Domain C or P or A
CO1	To learn the basic concepts of networks and cyber-attacks.	C (Response)
CO2	To define the concepts of system vulnerability scanning and the scanning tools	C (Response)
CO3	To understand the network defence mechanisms and the tools used to detect and quarantine network attacks.	C (Response)
CO4	To learn the different tools for scanning.	C (Response)
CO5	To identify the types of cybercrimes, cyber laws and cyber-crime investigations.	C (Response)

COURSE CONTENT

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

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 SCANNING9 hrs**

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 TOOLS9hrs**

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 SCANNING9hrs

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 LAW9hrs

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- 45 hrsTotal – 45 hrs

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

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 COs with GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	3	3	2	1	1	1	1	1	0	0	1
CO2	2	1	1	1	1	1	1	1	1	0	0	1
CO3	2	2	2	1	1	1	1	1	1	0	0	1
CO4	1	1	1	1	0	0	0	0	0	0	0	1
CO5	1	1	1	2	2	1	1	2	2	0	0	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	**C:P:A**	**L –T –P –H**
0- 0 – 2- 2	**1.5:0.5:0.5**	**0- 0 – 2- 4**

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

Mapping of COs with GAs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**CO7**	**Total**
GA1	3	2	1	2	1	-	1	10
GA2	3	2	1	2	1	-	1	10
GA3	-	-	1	3	1	-	-	5
GA4	-	1	2	3	1	2	2	11
GA5	-	-	2	3	1	-	-	6
GA6	1	-	1	1	-	3	3	10
GA7	1		1	1	-	1		4
GA8	1	-	1	1	-	3	-	6
GA9	-	-	-	-	2	3	1	6
GA10	-	-	-	-	3	3	3	9
GA11	-				2	2	2	6
GA12	1				3	3	1	8

1 – Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **CAREER DEVELOPMENT SKILLS**

Subject Code **XGS 708**

L –T –P –C	**C:P:A**	**L –T –P –H**
0- 0– 0 - 0	**1.8:0.8:0.4**	**0- 0 –0- 1**

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

COURSE CONTENT

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

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 hrs**

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

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

Mock interviews - workshop on CV writing – Group Discussion.

L-20 hrs **Workshop - 10 hrs** **Total = 30 hrs**

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-references

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/

Semester **VII**

Subject Name **IN-PLANT TRAINING-III**

Subject Code **XCE 709**

L –T –P –C	**C:P:A**
0- 0 – 0- 2	**1.33:1.33:1.33**

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

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

Mapping of COs with GAs

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO1	2											
CO2							1	3			1	
CO3									3	1	3	1
CO4		1	2	1	3							3
CO5				3						3		1
	2	1	2	4	3		1	3	3	4	4	5

1 - Low, 2 – Medium, 3 – High

Semester **VIII**

Subject Name **PROJECT PHASE-II**

Subject Code **XCE 804**

L –T –P –C	**C:P:A**	**L –T –P –H**
0- 0 – 12- 12	**6:3:3**	**0- 0 – 12- 24**

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

		Domain C or P or A
CO1	Identify the Engineering Problem relevant to the domain interest.	C(Analyze)
CO2	Interpret and Infer Literature survey for its worthiness.	C(Analyze, Apply)
CO3	Analyse and identify an appropriate technique for solve the problem.	C(Analyze, Apply)
CO4	Perform experimentation /Simulation/Programming/Fabrication, Collect and interpret data.	P&C(CoR, Create, Apply)
CO5	Record and Report the technical findings as a document.	C(Remember, Understand)
CO6	Devote oneself as a responsible member and display as a leader in a team to manage projects.	A & C(Value, Organization, Create)
CO7	Responding of project findings among the technocrats.	A(Responding)

Mapping of COs with GAs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**CO7**	**Total**
GA1	3	2	1	2	1	-	1	10
GA2	3	2	1	2	1	-	1	10
GA3	-	-	1	3	1	-	-	5
GA4	-	1	2	3	1	2	2	11
GA5	-	-	2	3	1	-	-	6
GA6	1	-	1	1	-	3	3	10
GA7	1		1	1	-	1		4
GA8	1	-	1	1	-	3	-	6
GA9	-	-	-	-	2	3	1	6
GA10	-	-	-	-	3	3	3	9
GA11	-				2	2	2	6
GA12	1				3	3	1	8

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **BASICS OF EARTHQUAKE ENGINEERING AND SEISMIC DESIGN**

Subject Code **XCE505A**

Prerequisite NIL

L –T –P –C	**C :P:A**	**L –T –P –H**
2– 1– 0–3	**3:0:0.5**	**2– 2– 0– 4**

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

		Domain C or P or A
CO1	Differentiate the static and dynamic analysis.	C
CO2	Analyse SDOF and MDOF systems with distributed mass for continuous system.	C
CO3	Quantify the effect of seismic waves.	C & A
CO4	Understand the concept of response spectrum and application of structural dynamics.	C
CO5	Design Earthquake resistant structures withcodal recommendations.	C

COURSE CONTENT

UNIT-I **THEORY OF VIBRATIONS** **12hrs**

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** **12hrs**

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** **12hrs**

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** **12hrs**

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 12hrs

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-30hrs T-15 hrsTotal-45 hrs

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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	2			1				1			2	
CO2	2	3											1	
CO3	2	1	1			2				1			1	1
CO4	1	2			1		1	1	1	1	1	1		
CO5	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 **TALL BUILDINGS**

Subject Code **XCE505B**

Prerequisite Design of Concrete Structures, Design of Steel Structures

L –T –P –C	C:P:A	L –T –P –H
2- 1 – 0- 3	2: 0: 2	2- 2 – 0- 4

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

		Domain C or P or A
CO1	Explain hybrid structural systems widely used in tall buildings and conduct conceptual design	C
CO2	Understand advanced methods of computational mechanics, analysis, structural optimisation and design for resilience, safe construction, reliability in-service phases	C
CO3	Evaluate wind sensitivity, user comfort and dynamic response of structures	A
CO4	Analyse various structural systems of tall buildings constructed using Concrete, Steel and Steel/Concrete Composite material	A

COURSE CONTENT

UNIT-I **DESIGN CRITERIA AND MATERIALS** **9hrs**

Development of High Rise Structures – General Planning Considerations – Design philosophies- Materials used for Construction – High Strength Concrete – High Performance Concrete – Self Compacting Concrete – Glass – High Strength Steel.

UNIT –II **LOADING** **8 hrs**

Dead Loads -Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads-Seismic Loading –Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes ofMaterial - Impact and Dynamic Loads - Blast Loads - Combination of Loads.

UNIT-III **STRUCTURAL FORMS9hrs**

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems – Rigid frames, Braced frames, Infilledframes,Wall frames, Tubular structures, Cores, Outriggersystems and Hybrid Mega systems.

UNIT -IV **ANALYSIS AND DESIGN OF TALL STRUCTURES** **10hrs**

Wind tunnel-Chimney-Design Factors, Stresses, Components, Refractory linings, Caps and foundation - Cooling towers: Types, components, design forces, analysis and design - Transmission Line and Microwave towers:Load types, Tower Configuration, Analysis and Design of towers

UNIT - V STABILITY OF TALL BUILDINGS 9hrs

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational,Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

L- 30hrs T- 15hrs Total - 45 hrs

Text books

1. B.S.Taranath, "Reinforced Concrete Design of Tall Buildings", CRC Press, 2009,
2. Sarkisian, M.P., Designing Tall buildings: Structure as Architecture,Routledge, 2011,

References

1. IS:6533 (Part 2) –Code of Practice for Design and Construction of Steel Chimney
2. IS:4998 (Part 1)- Criteria for Design of Reinforced Concrete Chimneys
3. IS: 4091 Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
4. Handbook of Concrete Structures - Mark Fintel

Mapping of COs with POs:

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

1 - Low, 2 – Medium, 3 – High

Semester	**V**
Subject Name	**ADVANCED PAVEMENT DESIGN**
Subject Code	**XCE 505C**
Prerequisite	**TRANSPORTATION ENGINEERING**

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

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Adopt the right principles of pavement design	C & A
CO2	Utilize identified traffic factors efficiently in the pavement design.	C & A
CO3	Simulate the behavioural characteristics of input pavement materials considering various physical conditions.	C & A
CO4	Optimally design pavements using competent methods.	C & A
CO5	Assess pavement performance and suggest rectification options.	C & A

COURSE CONTENT

UNIT I **INTRODUCTION: PRINCIPLES OF PAVEMENT DESIGN12 hrs**

Pavement types – Pavement performance characteristics – performance criteria – Pavement failures – stress, strain and deflections in pavements - pavement design approaches – Conceptual framework for pavement design.

UNIT II **TRAFFIC FACTORS IN PAVEMENT DESIGN12hrs**

Vehicle types – Axle configurations – contact shapes and contact stress distributions – Traffic loading and volume – Vehicle damage factor – Axle load surveys – Lateral placement characteristics of wheels – estimation of design traffic.

UNIT III **PAVEMENT MATERIAL CHARACTERIZATION12 hrs**

Identification of material inputs needs in analysis and design of pavements – Selection of appropriate conditions such as temperature, moisture content, loading, etc for characterizing pavement materials – Overview of principles of different laboratory and field methods adopted for characterizing pavement materials.

UNIT IV **ANALYSIS AND DESIGN OF PAVEMENTS12 hrs**

Analysis : Introduction to various theoretical pavement analysis models and selection criteria – linear elastic layered theory of flexible pavement – analysis of wheel load stresses, curling/warping stresses and critical stress combinations – need for advanced analytical techniques for flexible pavements – review of various pavement analysis softwares.

Design : Introduction on various pavement design methods – IRC guidelines for pavement design (IRC:37 and IRC:58) – AASHTO (1993) method of pavement design - TRRL method – PCA method – concept of continuously reinforced concrete

– salient features of the AASHTO 2002 draft design guidelines for flexible and rigid pavement design - -comparison of design concepts.

UNIT V PAVEMENT EVALUATION AND REHABILITATION 12 hrs

Functional and Structural Evaluation of pavements – roughness concept – international roughness index – Pavement evaluation techniques – roughness measurement – Benkleman beam and falling weight deflectometer methods. Overlay design methods – IRC guidelines (IRC: 81) and AASHTO 1993 guidelines. Drainage design for pavements.

L - 45hrs T- 15 hrs Total – 60 hrs

Text books

1. Yang H. Huang : Pavement Analysis and Design, prentice Hall; second edition, August 18, 2003.
2. L. Collis , R.A. Fox , M.R. Smith: Aggregates: Sand, Gravel and Crushed Rock Aggregates for Construction Purposes, Geological Society Engineering Geology Special Publication,2001
3. T. Papagiannakis, E. A. Masad, Pavement Design and Materials, John Wiley & Sons, 2008.

References

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

Mapping of CO's with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1											1	
CO2		1		1	1			1					1	
CO3	1			1				1	1		1		1	
CO4	2		3	3		1	1			1		2	3	
CO5		2	1		3	1	1			1				2
	4	4	4	5	4	2	2	2	1	2	1	2	6	2

1 - Low, 2 – Medium, 3 – High

Semester **V**

Subject Name **DESIGN OF PLATE AND SHELL STRUCTURES**

Subject Code **XCE505D**

Prerequisite **NIL**

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

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Perform analysis of thin plates for various boundary conditions.	C
CO2	Analyse rectangular plates by different methods for various loading conditions.	C & A
CO3	Understand the structural importance of shells.	C
CO4	Examine the cylindrical shells and form differential equation.	C & A

COURSE CONTENT

UNIT-I **INTRODUCTION TO PLATES** **9hrs**

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

UNIT –II **RECTANGULAR PLATES** **9hrs**

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

UNIT-III **CIRCULAR AND FOLDED PLATES** **9hrs**

Circular Plates - Symmetrical bending - Differential equations - Uniformly loaded and concentrically loaded plates with various boundary conditions. Folded plate - structural behaviour - various types.

UNIT -IV **THEORIES OF SHELLS** **9hrs**

Structural behaviour of shells - classification of shells - methods of generating the surface of different shells. Gaussian curvature-synclastic and anticlastic surfaces.

UNIT - V **CYLINDRICAL SHELLS** **9hrs**

Cylindrical Shells-Membrane theory of singly curved shells - cylindrical shells-free body diagram of a cylindrical shell element-formulation of equilibrium equation.

L=30hrs T- 15 hrs Total –45 hrs

Text books.

1. Stephen .P. Timoshenko &Woinowsky Krieger, "Theory of Plates and Shells", McGraw Hill, 2010.
2. AnselC.Ugural, "Stresses in Plate and Shells", CRC press, Third Edition, 2010.
3. G.S. Ramaswamy, Design and Construction of Shell Structures, CBS Publishers, New Delhi, Revised Edition.

4. Reddy J N, “Theory and Analysis of Elastic Plates and Shells”, McGraw Hill Book Company, 2007

References

1. N. K. Bairagi, “Plate Analysis,” Khanna Publishers, New Delhi, Revised Edition.
2. Rudolph Szilard, R., “Theory and Analysis of Plates Analysis”, Prentice Hall Inc., 2004.
3. Chatterjee.B.K. - ″Theory and Design of Concrete Shell″, - Chapman & Hall, New York, 2007.

Mapping of CO’s with PO’s:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2										2	
CO2	2	3	2					1					2	
CO3	2	1	1		1	1	**1**	1	1		1		1	
CO4	2	3	1		1	1	**1**						1	
	8	10	6		2	2	**2**	2	1		1		6	

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	C:P:A	L –T –P –H
3- 0 – 0- 3	2:0:1	3- 0 – 0- 3

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

		Domain C or P or A
CO1	Understand the properties of fresh and hardened concrete.	C & A
CO2	Implement modular construction practices related to substructure and superstructure construction	C
CO3	Analyze productivity and economics in construction techniques	C
CO4	Select appropriate construction equipment and can estimate ownership and operating costs.	C&A

COURSE CONTENT

UNIT-I CONCRETE TECHNOLOGY9 hrs

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 hrs

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 hrs

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 hrs

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 hrs

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-45 hrs Total-45 hrs

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’s with PO’s:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1	1	3	1										
CO2	1				1			1				2		
CO3	1	2			2	1	**1**	1	1				1	1
CO4	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 **ADVANCED GEOTECHNICAL ENGINEERING**

Subject Code **XCE 606B**

Prerequisite

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 0- 3	**2:0:1**	**3- 0 – 0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Know about the engineering properties of soils.	C (Knowledge)
CO2	Understand about the compaction and consolidation of soil.	C (Comprehension)
CO3	Compute the stress distribution and evaluate shear strength of soil.	C (Analysis)
CO4	Calculate the safe bearing capacity of soils	C (Analysis) P (Measure) A(Response)
CO5	Acquire knowledge about shallow and deep foundation.	C(Knowledge) P (Palpate) A(Receive)

COURSE CONTENT

UNIT-I **EARTH PRESSURE THEORY** **9 hrs**

Earth pressure theories for calculation of active and passive pressure, Rankines and coulombs earth pressure theories, analytical and graphical methods.

UNIT –II **DESIGN OF EARTH RETAINING STRUCTURES** **9 hrs**

Design of gravity and cantilever retaining walls, design - cantilever sheet pile walls, anchored sheet pile walls, timbering and bracing for open cuts.

Geosynthetics: Geosynthetics- types, functions, properties and functional requirements. Application of geosynthetics in geoenviroment.

Reinforced soil: Mechanism, reinforcement soil – interaction. Applications – reinforcement soil structures with vertical faces, reinforced soil embankments. Reinforcement soil beneath unpaved roads, reinforcement of soil beneath foundations. Open excavation and slope stabilization using soil nails.

UNIT-III **SOIL BEHAVIOR UNDER DYNAMIC LOADS9 hrs**

Soil behavior under static and dynamic loads. Acceptable levels of strain under static and dynamic loading. Soil properties relevant for dynamic loading and its determination.

Machine foundations:

Types of machine foundations, design criteria, methods of analysis – elastic half space method, linear elastic weightless spring method. Evaluation of soil parameters. Design Procedure for a block foundation for cyclic loading and impact loading.

UNIT -IV GROUND IMPROVEMENT9 hrs

In-situ ground improvement by compaction piles, dynamic loads, sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibroflotation.

UNIT - V RHEOLOGY9 hrs

Rheological elements, basic and composite rheological models. Examples of compound models used to explain different soil phenomena; such as secondary consolidation, creep etc.

L-45 hrs Total-45 hrs

References

1. Physical and Geotechnical properties of soils- Joseph E. Bowels, Tata MacGrawhill 2. Advance Soil Mechanics – Braja Mohan Das- Tata Mc- Grawhill 3. Geotechnical Engineering by Shashi K. Gulati&ManojDatta – Tata Mc-Grawhill 4. Basic and Applied Soil Mechanics- GopalRanjan& A.S. Rao- New Age Publication B)

I.S .Codes

1. IS: 1892-1979 – "Code of Practice for Subsurface Investigation for Foundation".

2. IS: 2131-1981 (Reaffiemed 1997), "Method for Standard penetration Test for Soils". C) Handbooks
1. Bolt, Bruce A.(1999),"Earthquakes", W.H.Freeman.

3. Baghi, A.,(1994)" Design, Construction and Monitoring of Landfills."John Wiley & Sons.

4. Day.R.W.(2002),"Geotechnical Earthquake Engineering Handbook",McGraw Hill

Mapping of CO's with PO's:

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

1 - Low, 2 – Medium, 3 – High

Semester **VI**

Subject Name **TOWN PLANNING**

Subject Code **XCE606C**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 0- 3	**2.5:0.5:0**	**3- 0 – 0- 3**

		Domain C or P or A
Course Outcome: After the completion of the course, students will be able to		
CO1	Explain the serviceable fundamentals for town planning.	C
CO2	Distinguish the housing and public buildings towards the modern life.	P
CO3	Construct the methods of congregation and generating new present master plan.	C
CO4	Be grateful for the techniques and methods worn in current development concept and position of in sequence knowledge In town planning.	C
CO5	Illustrate methods of miscellaneous topics and traffic management of town planning.	C

COURSE CONTENT

UNIT-I **TOWN PLANNING PRINCIPLES** **9 hrs**

General - Evolution of planning - Objects of town planning – Economic justification for town planning - Principles of Town planning - Necessity of town planning - Origin of towns - Growth of towns – Stages in town development - Personality of town - Distribution of land - Forms of planning - Site for an ideal town - Requirements of new towns - Planning of a modern town - Powers required for enforcement of Town planning scheme - Cost of Town planning - Present position of Town Planning in India.

UNIT –II **HOUSING** **9hrs**

General - Importance of housing - Demand for houses - Building site - Requirements of residential buildings -Classification of residential buildings - Design of residential areas - Rural Housing - Agencies for housing -Investment in housing - HUDCO – CIDCO - Housing problems in India.

UNIT-III **PUBLIC BUILDING** **9 hrs**

General – Suitable Location of Public Buildings – Classification of Public Buildings - Principles of design of public buildings - Town centres - Grouping of public buildings – Requirements of Public buildings – Green House– Civic aesthetics.

UNIT -IV **URBAN ROADS** **9 hrs**

General - Objects - Requirements of good city road – Factors to be considered – Classification of urban roads – Types of street systems - Through and By-pass roads

– Outer and inner ring roads - Expressways – Freeways – Precincts - Road aesthetics.

UNIT V MISCELLANEOUS TOPICS 9 hrs

Airports – Location - size - Noise control - Parts of an airports - Betterment and compensation – City blocks –Conurbations - Cul-de-sac streets - Focal point - Green belt - Public utility services - Rapid transit – Remote sensing application – Urban planning using remote sensing – Site suitability analysis Location of Bus Terminus, Whole sale markets, Exhibition Centres etc., – Location for water/sewage treatment plants, location for waste disposal etc.,– Transportation planning.

L=45 hrs Total – 45 hrs

Text books

1. Town Planning - S.C. Rangwala,: Charotar Publisher (2011), Publisher
2. K.S.Rangwala and P.S.Rangwala,. 'Town Planning",Charotar Publishing House,15th Edition,2012.
3. Michael Hord, R. Remote sensing methods and application, John Wiley and Sons, NewYork, 2010.

References

1. National Building Code of India- Part-III.(2010).
2. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
3. KA. Ramegowda, "Urban and Regional Planning"University of Mysore
4. Lewis B. Keeble "Principles and practice of town and country planning", Estates Gazette, University of Michigan, 2010

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1											1	2	
CO2	1	2										1	1	1
CO3	1				2	1		**1**			1	1	1	1
CO4	1		3	1		1	2	**1**	**1**		1			1
CO5	1													
	5	2	3	1	2	2	2	2	**1**		2	3	4	3

1 - Low, 2 – Medium, 3 – High

Semester **VI**

Subject Name **ALTERNATE BUILDING MATERIALS**

Subject Code **XCE 606 D**

Prerequisite **NIL**

L –T –P –C	C-P-A	L –T –P –H
3- 0 – 0- 3	3-0-0	3- 0 – 0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain** C or P or A
CO1	Understand the fundamental energy building materials	C
CO2	Gain the knowledge for alternative materials and its technologies	C
CO3	Compare the properties of most common and advanced building materials	C
CO4	Understand the typical and potential applications of structural masonry works	C

COURSE CONTENT

UNIT-I INTRODUCTION9hrs

Energy in building materials- Environmental issues concerned to building materials - Global warming and construction industry -Environmental friendly and cost effective building technologies - Requirements for building of different climatic regions - Traditional building methods and vernacular architecture.

UNIT-II ALTERNATIVE BUILDING MATERIALS 9hrs

Raw materials, Manufacturing process, Properties and uses - Matrix materials, Fibers: metal and synthetic, Properties and applications - Fiber reinforced plastics - Building materials from agro and industrial wastes - Types of agro wastes - Types of industrial and mine wastes - Properties and applications, Aluminium, Bitumen Materials, Soil Conditioning Agents, Tempered Glass, Crumb Rubber, Glass Fibre Reinforced Plastics, Bamboo reinforced plastics.

UNIT –III ALTERNATIVE BUILDING TECHNOLOGIES9hrs

Characteristics of building blocks for walls - Stones and Laterite blocks - Bricks and hollow clay blocks - Concrete blocks - Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block, Alternative for wall construction – Types - Construction method - Masonry mortars, Types – Preparation – Properties - Ferro cement and ferroconcrete building components - Materials and specifications, Properties, Construction methods, Applications - Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs.

UNIT -IV STRUCTURAL MASONRY9hrs

Compressive strength of masonry elements - Factors affecting compressive strength - Strength of units, prisms / wallettes and walls - Effect of brick work bond on strength -

Bond strength of masonry: Flexure and shear -Elastic properties of masonry materials and masonry - IS Code provisions - Design of masonry compression elements

UNIT - V ALTERNATIVE BUILDING DESIGN AND EQUIPMENTS9hrs

Cost concepts in buildings - Cost saving techniques in planning, design and construction - Cost Analysis: Case studies using alternatives. - Machines for manufacture of concrete - Equipment's for production of stabilized blocks

L-45hrs Total – 45 hrs

Text books

1. K.S. Jagadish, B.V. Venkatarama Reddy , K. S. NanjundaRao"Alternative Building Materials and Technologies"2009
2. Jamal M.Khatib,"Sustainability of Construction"

References

1. Green building products: the green spec guide to residential building by Alex Wilson and Mark Piepkorn ,2013
2. Ross Spiegel, Dru Meadows "Green Building Materials (3 rd edition)",2010
3. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1				1	1		**1**	**1**				1	1	2
CO2		1	3		1	1	**1**	**1**				2	2	2
CO3	1	1	1	1	1	2		**1**		**2**			1	3
CO4	1	1	2			1				**1**			1	1
CO5	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 **PRESTRESSED CONCRETE STRUCTURES**

Subject Code **XCE 704A**

Prerequisite **DESIGN OF CONCRETE STRUCTURES**

L –T –P –C	C-P-A	L –T –P –H
3- 0 – 0- 3	2-0.5-0.5	3- 0 – 0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain** C or P or A
CO1	Identify and apply the applicable industry design codes relevant for the design of prestressed concrete members	C
CO2	Discuss and appraise the recent advances in the prestressed concrete technology including the use of advanced materials and application of new technologies	C & P
CO3	Accomplish design calculations to predict service behaviour of prestressed concrete structures	A

COURSE CONTENT

UNIT-I INTRODUCTION – THEORY AND BEHAVIOUR9 hrs

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 hrs

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 hrs

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 hrs

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 hrs

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

L - 45hrs Total-45 hrs

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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1	2	1		1	1	**1**	**1**		2	1	1	2	4
CO2	1		2	1	1	1	**1**	**1**		**1**		2	1	3
CO3	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	**EARTH RETAINING STRUCTERS**
Subject Code	**XCE704 B**
Prerequisite	**Strength of Materials, Theory of Structures, Soil Mechanics and Concrete Structures.**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0- 3	2:1:0	3- 0 – 0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	To describe the main concepts related with the behavior of flexible earth retaining structures.	C
CO2	To identify the appropriated methods of analysis and design and to select the adequate constructive solutions	C
CO3	To discuss the selection, design and performance evaluation of reinforced earth retaining structures.	C
CO4	To formulate solutions on the basis of alternative quality criteria and construction sustainability according to site constraints.	C &P

COURSE CONTENT

UNIT I EARTH DAMS AND EMBANKMENTS9 hrs

Different types of earthen dams with sketches and their suitability. Hydraulic fill and rolled fill methods of construction – Causes of failure of earth dam – Design criteria of earth dams– Stability analysis of earthen dams – Seepage control in earthen dams. Role of Filters in Earth Dam Design.

UNIT II RETAINING WALLS9 hrs

Types of retaining walls, failure of retaining walls by sliding, overturning and bearing. Stability analysis and Principles of the design of retaining walls – Gravity retaining walls, Cantilever retaining walls, Counter fort retaining walls (no structural design) – Modes of failure of retaining walls – Drainage from the backfill.

UNIT III SHEET PILE WALLS- BULK HEADS9 hrs

Types of sheet pile walls –Free cantilever sheet pile - cantilever sheet pile in cohesion-less soils –cantilever sheet pile in clay. Anchored sheet pile with free earth support in cohesion-less and cohesive soil. Bulkheads with fixed earth support method – Types, locations and design of anchors.

UNIT IV BRACED CUTS AND ROCK FILL DAMS9 hrs

Introduction, Lateral earth pressure on sheeting, Different types of sheeting and bracing systems – design of various components of bracings. Introduction, Origin and usage of rock fill dams, types of rock fill dams, and design of rock fill dams and construction of rock fill dams.

UNIT V COFFER DAMS9hrs

Introduction – Types of coffer dams - Design of cellular coffer dam on soil -safety against sliding, slipping, overturning, vertical shear and stability against bursting

L- 45 hrsTotal -45 hrs

Text books

1. Dr. Arora, "Soil mechanics and foundation Engineering", Standard Publishers and Distributors, 2nd edition, – 2014.
2. Dr. V.N.S. Murthy, "Soil mechanics and foundation Engineering"- Engg. Publishers & Distributions 1st edition, 2007.
3. Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond , JarbasMilititsky"Earth Pressure and Earth-Retaining Structures", Third Edition,2014.
4. Foundations and Earth Retaining Structures, 1st Edition - Muni Budhu , December 2007.

References

1. P.C.Varghese, Foundation Engineering, Prentice Hall India Pvt Ltd, New Delhi, 2005.
2. Swami Saran, Analysis and design of substructures, Oxford and IBH Publishing Company Pvt. Ltd. 2008
3. Das S. C., Som N. N, "Theory And Practice of Foundation Design", PHI Learning Private Limited, 2009.
4. P.C.Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Private Limited, 2009.
5. GopalRanjan, "Basic and Applied Soil Mechanics", New Age International, 2000.
6. V. N. S. Murthy, **"**Soil Mechanics And Foundation Engineering Geotechnical Engineering", CBS Publishers & Distributors, 2008.
7. B. C. Punmia, "Soil Mechanics and Foundations", Laxmi Publication Ltd, 2008.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	2	1	1					1	2	1	2	2
CO2	1	3	2		2	1	1		1	1	1	2	1	1
CO3	2	3	3		1	1	1	1	1	1	1		3	
CO4	2	3	3		1			1	1				3	
	8	10	10	1	4	2	2	2	3	3	4	3	9	3

1 - Low, 2 – Medium, 3 – High

Semester	**VII**
Subject Name	**FINITE ELEMENT METHOD**
Subject Code	**XCE704C**
Prerequisite	**Structural Analysis**

L –T –P –C	**C:P:A**	**L –T –P –H**
3 - 0 – 0 - 3	**2:0:1**	**3- 0 –0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Gain knowledge on basic concepts of FEM	C
CO2	Determine stresses and displacements for one and two dimensional elements under various loading.	C
CO3	Analyse the higher order elements using Isoparametric mapping and numerical integration.	C
CO4	Identify and Apply concepts of FEM in fluid mechanics.	C& A

COURSE CONTENT

UNIT I INTRODUCTION – VARIATIONAL FORMULATION9 hrs

Methods of Engineering analysis – Basic concept of FEM and its procedure- Advantages and Disadvantages - Weighted Residual Method – Principle of Stationary Total Potential – Rayleigh Ritz method.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS9 hrs

Finite element: modelling, coordinates, shape functions, stiffness matrix, stiffness equation, finite element equation for onedimensional element. Load or force vector – Temperature effects.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS9 hrs

Finite element modelling, coordinates, shape functions, stiffness matrix, stiffness equation, finite element equation for twodimensional elements. Plane stress and plane strain – Constant Strain Triangular element – Linear Strain Triangular elements - Temperature effects.

UNIT IV ISOPARAMETRIC ELEMENTS AND FORMULATION9 hrs

Shape function for 4 noded elements using natural coordinate system and transformation – element stiffness matrix equations –Higher order two dimensional

element – Shape function derivation for rectangular and triangular element – Lagrangean and Serendipity elements.

UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSION9hrs

Heat Transfer – Application to Heat Transfer in two dimensions – Application to Fluid Mechanics in two dimensions.

L-45hrs Total- 45 hrs

Text books

1. Krishnamoorthy,C.S.,"Finite Element Analysis –Theory and Programming", Second Edition,TataMcGraw Hill, 2015.
2. Bhavikati , S.S., "Finite Element Analysis ", New Age International Publishjers , 2016.
3. S.S.Rao, "The Finite Element Method in Engineering", Pergaman Press, 2011.

References

1. J.N.Reddy, "An Introduction to Finite Element Method", McGraw-Hill, Intl.Student
2. Edition, 2013.
3. Chandrupatla, T.R., and Belegundu, A.D., "Introduction to Finite Element in Engineering", Third Edition, Prentice Hall, India, 2012.
4. O. C. Zienkiewicz, Robert Leroy Taylor, PerumalNithiarasu, "The Finite Element Method for Fluid Dynamics", Butterworth-Heinemann, 2013.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1	3	2			1							1	2
CO2	2	2	3	1		1							2	2
CO3	3	1	1	1		2				2		1	1	2
CO4	3	2	1		1	1	1	1	1	1	1		3	2
	9	8	7	2	1	5	1	1	1	3	1	1	7	8

1 - Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **EXPERIMENTAL STRESS ANALYSIS**

Subject Code **XCE704D**

Prerequisite **Mechanics of solids**

L –T –P –C	**C: P:A**	**L –T –P –H**
3– 0– 0– 3	**2:1:0**	**3 - 0 –0 - 3**

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

		Domain C or P or A
CO1	Calibrating the machineries and equipment used in the laboratory.	C(Understand)
CO2	Determine stresses and displacements under given loading by various gauges.	C(Apply)
CO3	Illustrate the basic concepts of 3D photo elasticity.	C(Understand)
CO4	Recognize the strength of the existing structural elements	C & P(Application)

COURSE CONTENT

UNIT I **MEASUREMENTS** **9 hrs**

Principles of measurements, Accuracy, Sensitivity and Range of measurements

UNIT –II **EXTENSOMETERS** **9 hrs**

Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages

UNIT-III **ELECTRICAL RESISTANCE STRAIN GAUGES** **9 hrs**

Principle of operation and requirements - Types and their uses- Materials for Strain Gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV **PHOTOELASTICITY** **9 hrs**

Two dimensional photo elasticity, Concept of light – photo elastic effects, stress optic law, Interpretation of fringe pattern - Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT V **NON – DESTRUCTIVE TESTING** **9 hrs**

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiberoptic Sensors.

L=45hrs Total=45hrs

Text books

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2013.
2. L.S.Srinath, "Experimental Stress Analysis", Tata McGraw-Hill Publishing Company Limited, 2011.
3. James.W.Dally& William F.Riley – "Experimental Stress Analysis", McGraw Hill, Fourth edition, 2005.

References

1. Hetyenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
2. Pollock A.A., "Acoustic Emission in Acoustics and Vibration Progress", Ed. Stephens R.W.B., Chapman and Hall, 1993.
3. Ramesh, K., Digital Photoelasticity, Springer, New York, 2000.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1								1				
CO2	3	1	1							1		1		1
CO3		2										2		1
CO4						1					1	1		1
CO5					1				**1**		1	2		1
	5	4	1		1	1			**1**	2	2	6		4

1 - Low, 2 – Medium, 3 – High

Semester **VII**

Subject Name **REPAIR AND REHABILITATION OF STRUCTURES**

Subject Code **XCE 705A**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 0- 3	**2.5:0: 0.5**	**3- 0 – 0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain** (C or P or A)
CO1	Understand the concept of quality assurance of concrete properties	C
CO2	Understand the various materials used for repair works	C
CO3	Knowledge in the application of repair techniques in concrete construction	C
CO4	Prepare concrete investigation reports for repair and rehabilitation projects.	C & A

COURSE CONTENT

UNIT I **GENERAL 9hrs**

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.

UNIT II **MAINTENANCE AND REPAIR STRATEGIES 9hrs**

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT III **MATERIALS FOR REPAIR9hrs**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro-cement, Fibre reinforced concrete.

UNIT IV **TECHNIQUES FOR REPAIR9hrs**

Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete - Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT V **REPAIRING OF STRUCTURES 9hrs**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure – Engineered demolition techniques for Dilapidated structures - case studies

L- 45 hrs Total – 45 hrs

Text books

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

References

1. Deterioration, maintenance and repair of structures, Johnson SM McGraw Hill International Publishers, New York.
2. Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing", "RHDC-NBO" Anna University,1992.
3. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, 1987.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2			2										1
CO2	1	2				2							1	1
CO3	3	1						**1**		**1**		2	1	2
CO4	1				2		**1**	**3**		1		3	2	3
	7	3		2	2	2	**1**	**4**		2		5	4	7

1 - Low , 2 – Medium , 3 – High

Semester **VII**

Subject Name **SMART MATERIALS AND STRUCTURES**

Subject Code **XCE 705B**

Prerequisite **NIL**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0- 3	2.5:0:0.5	3- 0 – 0- 3

		Domain (C or P or A)
Course Outcome: After the completion of the course, students will be able to		
CO1	Understand the physical principles and the behaviour of smart materials	C
CO2	Understand the engineering principles in sensor, actuator and transducer technologies	C
CO3	Use principles of measurement, drive and control techniques necessary to developing smart structures and products	C
CO4	Suggest improvement in integrating smart materials and smart structures.	C & A

COURSE CONTENT

UNIT I **INTRODUCTION9hrs**

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effects.

UNIT II **MEASURING TECHNIQUES** **9hrs**

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT III **SENSORS** **9hrs**

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

UNIT IV **ACTUATORS9hrs**

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro orheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS9hrs

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and NonLinear.

L- 45 hrs Total – 45 hrs

Text books

1. Brain Culshaw – Smart Structure and Materials Artech House – Borton.London-1996.
2. Dally, J. W., Riley, W.F., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
3. Gauenzi,P.,Smart Structures, Wiley, 2009

References

1. Srinath, L. S., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
2. Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design, Cambridge University Press, 2000.
3. Yoseph Bar Cohen, Smart Structures and Materials 2003, The International Society for Optical Engineering 2003.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	2				1							1	
CO2	2	2		1	1	2	1	1					1	2
CO3	2		1	1				1	1		2	3	1	2
CO4	1		2	1	2					3			2	1
	7	4	3	3	3	3	1	2	1	3	2	3	5	5

1 - Low , 2 – Medium , 3 – High

Semester **VII**

Subject Name **INDUSTRIAL WASTE WATER MANAGEMENT**

Subject Code **XCE705C**

Prerequisite **Environmental Engineering**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0- 3	2.5:0:0.5	3- 0 –0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain** (C or P or A)
CO1	Explain the pollution effects of Industrial waste water disposal	C
CO2	Understand the principle and concept of physico-chemical and Biological treatment methods.	C
CO3	Describe the manufacturing process in various Industries.	C
CO4	Identify and analyse the treatment and disposal options for wastewater from various industries	C
CO5	Formulate environmental Management plan	C & A

COURSE CONTENT

UNIT I **INTRODUCTION 9 hrs**

Effects of industrial waste water on streams - water quality criteria- Effluent standards. Reduction of Waste and Strength of the waste-Process modifications- Methods and materials changes-Housekeeping-Recovery methods for by-products within the plant operations.

UNIT II **PHYSICO CHEMICAL TREATMENT METHODS9 hrs**

Equalization – Neutralization-Separation of solids- Sedimentation-Filtration – Coagulation- Flocculation- Adsorption- Absorption and Precipitation.

UNIT III **BIOLOGICAL TREATMENT METHODS9 hrs**

Biological treatment methods- Aerobic and Anaerobic-Digestion-Trickling filters-Stabilization ponds-Fluidization- Activated sludge process - Oxidation ditch.

UNIT IV **INDUSTRIAL POLLUTION PREVENTION9 hrs**

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse , Present status and issues.

UNIT V **PRODUCTION, TREATMENT AND DISPOSAL METHODS IN INDUSTRIES 9 hrs**

Industry of Mineral Products: Oil, Steel industries, Oil Refineries Food Processing Industries: Dairy, Sugar, Distillery Processing Industries: Pulp and Paper, Tannery, Textile, Metal Finishing industry, etcMiscellaneous Industries: Atomic Power Plant, Radioactive Industry.

L- 45 hrs Total- 45 hrs

Text books

1. Nelson Leonard Nemerow, Industrial Waste Treatment , Elsevier Inc., 2011
2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999.
3. Metcalf and Eddy, Wastewater Engineering – Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co., 2006
4. Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw-Hill, 2004

References

1. A.D.Patwardhan, Industrial Waste Water Treatment, prentice-Hall of India Private Limited, New Delhi, 2008.
2. John P. Samuelson, "Industrial Waste, Environmental Impact, Disposal and Treatment" Nova Science Publishers, 2009
3. Woodard & Curran, "Industrial Waste Treatment Handbook", Elsevier Inc., 2006

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	1	2										
CO2	1	3	2	1								1	1	1
CO3	1	2	1	1									1	
CO4	1	3	2	2		1							1	
CO5	1	1	2	1		2						2		3
	6	10	8	7		3						3	3	4

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	C:P:A	L –T –P –H
3- 0 – 0- 3	2:0:1	3- 0 –0- 3

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

COURSE CONTENT

UNIT I SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK9 hrs

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 REDUCTION9 hrs

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 WASTES9 hrs

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 TECHNOLOGIES9 hrs

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 DISPOSAL9 hrs

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- 45 hrs Total-45 hrs

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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	2		1								1	2	1
CO2	2	2	1	1								2	3	2
CO3	1	3	1			1	1			1		1	2	3
CO4	2	2	3	2		1							1	3
CO5	2	1	3	1								2	1	2
	9	10	8	5		2	1			1		6	9	11

1 - Low, 2 – Medium, 3 – High

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

L –T –P –C	**C:P:A**	**L –T –P –H**
3 - 0 – 0 - 3	**2:0:1**	**3- 0 –0- 3**

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

COURSE CONTENT

UNIT I INTRODUCTION – PREFABRICATED STRUCTURES9 hrs

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 COMPONENTS9 hrs

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 PRINCIPLES9 hrs

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 JOINTS9 hrs

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

UNIT V DESIGN OF INDUSTRIAL BUILDINGS 9 hrs

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- 45hrs Total- 45 hrs

Text books

1. Hubert Bachmann, Alfred Steinle, "Precast Concrete Construction", Wiley-vchVerlagGmbh, 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's with PO's

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**
CO1	2	2	3	1							2		1	3
CO2		3	1	1	1	1					1	1	2	1
CO3			3	2	1				1	1	1	1	2	3
CO4	2	2		1	1	2			1	1	1	1	2	2
	4	7	7	5	3	3			2	2	5	3	7	9

1 - Low, 2 – Medium, 3 – High

Semester **VIII**
Subject Name **DISASTER MANAGEMENT**
Subject Code **XCE 802B**
Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 0- 3	**3:0:0**	**3- 0 –0- 3**

	Course Outcome: After the completion of the course, students will be able to	**Domain C or P or A**
CO1	Understanding the concepts of application of types of disaster preparedness	C(Application)
CO2	On completion of this course the students will be able to understand planning essentials of disaster.	C(Analyze)
CO3	Have a good understanding of importance of seismic waves occurring globally	C(Analyze)
CO4	On completion of this course, the students will be able to perform drill essential for disaster mitigation	C(Application)
CO5	Have a keen knowledge on essentials of risk reduction	C(Application)

COURSE CONTENT

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

Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach – disaster-development linkages -Principle of risk partnership

UNIT II **APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION** **9 hrs**

Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study.

UNIT III **AWARENESS OF RISK REDUCTION** **9 hrs**

Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness

UNIT IV **DEVELOPMENT PLANNING ON DISASTER** **9 hrs**

Implication of development planning – Financial arrangements – Areas of improvement – Disaster preparedness – Community based disaster management – Emergency response.

UNIT V **SEISMICITY** **9 hrs**

Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes

L - 45 hrs Total-45 hrs

Text 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

References

1. Encyclopaedia Of Disaster Management, Neha Publishers & Distributors, 2008
2. Pardeep Sahni, Madhavi malalgoda and ariyabandu, "Disaster risk reduction in south asia", PHI, 2002
3. Amita sinvhal, "Understanding earthquake disasters" TMH, 2010.
4. Pardeep Sahni, Alka Dhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI, 2000

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					5	2							
CO2	2					1	2					1		
CO3	1					2	2	1				2		
CO4	1					2	2	1				1		
CO5						5	2	3				1		
	5					15	10	5				5		

1 - Low, 2 – Medium, 3 – High

Semester **VIII**

Subject Name **WATER RESOURCE PLANNING AND MANAGEMENT**

Subject Code **XCE 802 C**

Prerequisite **Mathematics, Science and their applications**

L –T –P –C	C: P: A	L –T –P –H
3 – 0- 0- 3	2.5: 0 : 0.5	3 – 0- 0- 3

Course Outcome: After the completion of the course, students will be able to		Domain C or P or A
CO1	Understanding the concept of reservoir planning	C
CO2	Familiarize the drainage system	C
CO3	Develop the model of rain water harvesting	C & A
CO4	Gain knowledge about various types and methods of Irrigation	C
CO5	Understand the Diversion and Impounding Structures	C

COURSE CONTENT

` UNIT-I RESERVOIR PLANNING 9 hrs

River regions and their characteristics – classification of rivers on alluvial plains – meandering of rivers – Reservoir planning – Investigations – zones of storage in a reservoir single purpose and multipurpose reservoir – determination of storage capacity and yield – reservoir sedimentation – Reservoir life.

UNIT –II WATER LOGGING 9 hrs

Water logging – causes and effects of water logging- remedial measures- land reclamation – land drainage – benefits- classification of drains- surface drains- subsurface drains- design principles and maintenance of drainage systems.

UNIT-III RAINWATER HARVESTING AND RECYCLING OF WATER 9 hrs

Rainwater Harvesting and Management – Different Types and Methods of Harvesting in urban and agricultural areas - Recycling of harvested water - runoff collection and conservation of ground water - Types of storage structures- yield from a catchment – Losses of stored water.

UNIT –IV IRRIGATION METHODS 9 hrs

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – Consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and development of irrigation projects. Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits –Sprinkler irrigation – Drip irrigation.

UNIT – V DIVERSION AND IMPOUNDING STRUCTURES9 hrs

Weirs – Elementary profile of a weir – Weirs on pervious foundations – Types of impounding structures – Tanks, sluices and weirs – Gravity dams – Earth dams – Arch dams – Spillways –Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

L- 45 hrs Total – 45 hrs

Text books

1. Punmia,B.C., Irrigation and Water Power Engineering, Laxmi Publications, Ltd., 2009
2. Ragunath.H.M., Hydrology, Willey Eastern Limited, New Delhi,2006
3. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, 2005.
4. Sharma, R.K. and Sharma,T.K., "Irrigation Engineering", S.Chand and Company, 2007.
5. Gupta, B.L., and Amir Gupta, "Irrigation Engineering", SatyaPraheshan, 2000.

References:

1. Subramanya, Engineering Hydrology, Tata –McGraw Hill,2008
2. Dilip Kumar Majumdar, Irrigation Water Management (Principles & Practices), prentice Hall of India(p),Ltd,2009
3. Vedula&Mujumdar, Water Resources Systems, McGraw Hill, 2005
4. Daniel P.Loucks, Water Resources Systems Planning and Management (Studies and Reports in hydrology),2006
5. Majumdar, D.K., "Irrigation Water Management – Principles and Practices", Prentice Hallof India (P) Ltd., 2004.
6. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, 2006.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	3								3				2
CO2	2	3	2	1					**1**	**3**		1	1	3
CO3		3	1	1		1		**1**	**1**	**3**		1	2	3
CO4		2	1	1		1		**1**		**1**	1	1	2	3
CO5	2	2	1	1		1		**1**			1		2	1
	6	13	5	4		3		**3**	**2**	**7**	2	3	7	12

Semester **VIII**

Subject Name **ENVIRONMENTAL IMPACT ASSESSMENT**

Subject Code **XCE802D**

Prerequisite **NIL**

L –T –P –C	C: P: A	L –T –P –H
3 – 0- 0- 3	3: 0 : 0	3 – 0- 0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Identify environmental attributes for the EIA study.	C
CO2	Identify methodology and prepare EIA reports.	C
CO3	Specify methods for prediction of the impacts.	C
CO4	Formulate environmental management plans.	C

COURSE CONTENT

UNIT I **UNIT I-INTRODUCTION TO EIA** **9 hrs**

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

UNIT II **METHODOLOGIES** **9 hrs**

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

UNIT III **PREDICTION AND ASSESSMENT** **9 hrs**

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

UNIT IV **ENVIRONMENTAL MANAGEMENT PLAN9 hrs**

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 STUDIES9 hrs**

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

L – 45 hrs Total – 45 hrs

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.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1	1	2			3	1	1		1				2
CO2	1	3	1	1		3		1			1	1		1
CO3	1	2	2			2		1			1	1		1
CO4	1	2				1	1							3
	4	8	5	1		9	2	3		1	2	2		7

1 - Low, 2- Medium, 3- High

Semester **VIII**

Subject Name **AIR QUALITY MANAGEMENT**

Subject Code **XCE 803A**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L : T: P: H**
3- 0 – 0 - 3	**2:0:1**	**3 – 0 –0-3**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Identify the impact on human being , identifying sampling and analysis techniques for air quality management	C
CO2	Knowledge in the measurements of the dispersion of pollutants in the atmosphere	C & A
CO3	Select suitable equipment for air pollution control	C
CO4	Implement town planning rules and regulation with respect to air pollution	C
CO5	Assess the ill effects of noise pollution	C& A

COURSE CONTENT

UNIT-I **SOURCES AND EFFECTS OF AIR POLLUTANTS10 hrs**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution -Source inventory – Effects of air pollution on human beings, materials, vegetation, animals –global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling –Source and ambient sampling – Analysis of pollutants – Principles

UNIT –II **DISPERSION OF POLLUTANTS 10 hrs**

Meteorology and Air Pollution: Factors influencing air pollution, Wind rose, Mixing Depths, Lapse rates and dispersion - Atmospheric stability, Plume rise and dispersion, Prediction of air quality, Box model - Gaussian model - Dispersion coefficient - Application of tall chimney for Pollutant dispersion**.**

UNIT-III **AIR POLLUTION CONTROL** **10 hrs**

Control of Particulate Pollutants: Properties of particulate pollution - Particle size distribution - Control mechanism - Dust removal equipment - Design and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP.

UNIT -IV **AIR QUALITY MANAGEMENT10 hrs**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion –Pollution control for specific major industries.

UNIT -V NOISE POLLUTION **5hrs**

Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

L – 45 hrs Total – 45 hrs

Text books

1. Fundamentals of Air Pollution- Daniel Vallero(2009)
2. Air Pollution- M.N.Rao,H.V.N.Rao&David H.F. Liu, Bela G. Liptak (2000)
3. Air Pollution Control: A Design Approach- F. C. Alley, C. David Cooper
4. Air Pollution Prevention And Control: Bioreactors And Bioenergy- Christian kennes, Maria.Cveiga(2002)
5. Environmental Noise Pollution- Enda Murphy and Eoin King

References

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai,2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi,1996.
4. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark,1997.
5. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill PublishingCompany, New Delhi, 1991.
6. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGrawHill, New Delhi, 1985.

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1				3		2	3		3					
CO2			2	3			3		3					2
CO3	1		1	3			3		3	1			1	1
CO4	1			3	2		3	2	3		1		1	1
CO5				3			3	3	3		1			
	2		3	15	2	2	15	5	15	1	2		2	4

1 - Low, 2 – Medium, 3 – High

Semester **VIII**

Subject Name **URBAN AND REGIONAL PLANNING – FUTURE TRENDS**

Subject Code **XCE803B**

Prerequisite **NIL**

L –T –P –C	**C:P:A**	**L –T –P –H**
3- 0 – 0- 3	**2:1:0**	**3- 0 – 0- 3**

Course Outcome: After the completion of the course, students will be able to		**Domain** C or P or A
CO1	Explain the serviceable fundamentals for urban and regional planning – future trends.	C
CO2	Distinguish the rural and urban concepts and developments.	P
CO3	Make out the methods of gathering and generating new modern transportation.	C
CO4	Appreciate the techniques and methods used in Modern Planning Concepts and Role of Information Technology In Regional Planning.	C

COURSE CONTENT

UNIT-I INTRODUCTION TO LAND USE PLANNING AND PRINCIPLES9 hrs

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 CONCEPTS9hrs

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 CITIES9 hrs

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 9hrs

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 UTOPIA9 hrs

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

L- 45 hrs Total – 45 hrs

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's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	1													
CO2	1	2												
CO3	1				2							1	1	1
CO4	1		3				2			**1**	1	1	1	1
CO5	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 **VIII**

Subject Name **CONTRACT LAWS AND REGULATIONS**

Subject Code **XCE803C**

Prerequisite **NIL**

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0- 3	2:1:0	3- 0 – 0- 3

Course Outcome: After the completion of the course, students will be able to		**Domain** C or P or A
CO1	Analyze sets of facts presented in the form of case, identify and examine the relevant law and provide solution.	C&A
CO2	Present and critically discuss the content of legal rules.	C
CO3	Distinguish types of contracts in construction,	C
CO4	Possess knowledge of arbitration procedures and relevant legal aspects.	C

COURSE CONTENT

UNIT-I CONSTRUCTION CONTRACTS9 hrs

Indian Contracts Act-Elements of Contracts-Types of contracts-Features-Suitability-Design of Contract Documents-International contract document-Standard contract Document-Law of Torts.

UNIT –II TENDERS9hrs

Prequalification-Bidding-Accepting-Evaluation of Tender from Technical, Contractual and commercial points of view-contract formation and interpretation-Potential contractual problems- World Bank Procedures and Guidelines.

UNIT-III ARBITRATION9 hrs

Comparison of Actions and Laws-Agreements ,subject matter-Violations-Appointmentof Arbitrators-Conditions of Arbitrations-Powers and duties of Arbitrator-Rules of Evidence- Enforcement of Award-costs.

UNIT IV LEGAL REQUIREMENTS9 hrs

Insurance and Bonding-Laws Governing Sale, Purchase and use of Urban and Rural land-Land Revenue codes-Tax Laws-Income Tax, Sales Tax, Excise and customs duties and their influence on construction costs-Legal requirements for planning-Property Law-Agency Law-Local Government Laws for Approval-Statutory Regulations.

UNIT V LABOUR REGULATION9 hrs

Social Security-Welfare Legislation-Laws relating to wages, Bonus and Industrial Disputes, Labor Administration-Insurance and Safety Regulations-Workmen's Compensation Act-Other Labor laws

L- 45 hrs Total – 45 hrs

Text books

1. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M.Tripathi.
2. John G.Betty., "*Engineering Contracts"*, McGraw Hill,2003.
3. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.
4. Sanjiva Row ,"The Indian Contract Act,1872 and Tenders,2015

References

1. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001
2. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers andArchitects, McGraw Hill, 2000.
3. M.L.Bhargava ,"Law relating to Indian Contract Act,1872.2009

Mapping of COs with POs

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

1 - Low, 2 – Medium, 3 – High

Semester	**VIII**
Subject Name	**DOCKS, HARBOUR AND AIRPORT ENGINEERING**
Subject Code	**XCE 803D**
Prerequisite	**Transportation Engineering**

L –T –P –C	**C:P:A**	**L –T –P –H**
3 – 0 –0–3	**1.5:0:1.5**	**3 – 0 – 0 – 3**

Course Outcome: After the completion of the course, students will be able to		**Domain C or P or A**
CO1	Get clear picture on airport components and requirements.	C
CO2	Plan and design airports successfully.	C & A
CO3	Understand and follow the airport operations and control.	C & A
CO4	Plan Water transportation system components.	C & A
CO5	Effectively take coastal protection measures to prevent coast erosion.	C & A

COURSE CONTENT

UNIT I **INTRODUCTION TO AIR TRANSPORT9 hrs**

Air Transportation: Aircraft Characteristics - Airport Planning: Airport surveys, Site selection, Airport Obstructions, layouts, zoning laws, Environmental considerations - Airport classification: utility airports, transport airports, Geometric Design of the Airfield - ICAO and FAA design standards; Aprons: holding aprons, terminal, Terminal Area - Passenger terminal system and its components, Apron gate system: number of gates, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft. Terminal Buildings: Site selection, facilities.

UNIT II **RUNWAY AND TAXIWAY9 hrs**

Runways: runway configurations, runway orientation, wind rose, estimating runway length, sight distance and longitudinal profile, transverse gradient, Taxiways and taxilanes: widths and slopes, taxiway and taxilane separation requirements, sight distance and longitudinal profile, location of exit taxiways, design of taxiway curves and intersections, end-around taxiways.

UNIT III **AIRPORT VISUAL AIDS AND AIR TRAFFIC CONTROL9 hrs**

Requirements of visual aids - Airport Lighting, Marking, and Signage - Control tower visibility requirements., - approach lighting system configurations, visual approach slope aids, threshold lighting, Runway and taxiway lighting and marking, airfield signage. Air Traffic Control: Control Tower, VFR, IFR. Hangars, Helicopters – helipads.

UNIT IV **WATER TRANSPORTATION9 hrs**

Water Transportation: - water transportation in India - Types of water transportation - Requirements - Introduction to Inland water transport in India - tides , waves, erosion, beach drift, littoral drift, sand bars - coast protection - ship characteristics, classification of ports and harbours, Port facilities: general layout, development, planning, facilities, terminals.

UNIT V **DOCKS AND HARBOUR 9 hrs**

Harbour works: breakwaters, jetties, fenders, piers, wharves, dolphins, etc. - Docks, Dredging, Coastal Erosion and Protection - Docks and repair facilities: design, dry docks, wet docks, slipways, Locks and lock gates: materials, size, Dredging: classification, dredgers, uses of $_{\text{dredged}}$ materials, Coastal erosion and protection: seal wall, revetment, and bulkhead. Navigational aids: types, requirements, light house, beacon lights, buoys.

L - 45 hrs Total – 45 hrs

Text books

1. Khanna, S. K., Arora, M. G. and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
2. Dock and Harbor Engineering – Oza ,sixth edition, Chartor publishing House pvt limited, 2011.

References

1. Ashford, N. J., Mumayiz, S. A., and Wright, P. H. Airport Engineering: Planning, Design and Development of 21st Century Airports, Fourth Edition, John Wiley & Sons, New Jersey, USA, 2011.
2. Kazda, A., and Caves, R. E. Airport Design and Operation, Second Edition, Elsevier, Oxford, U.K., 2007.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1													3	
CO2										3	1		3	**2**
CO3					1		3	1	1	3	1		3	3
CO4	1				1	1	1	2	1	3	3		3	3
CO5	1	1					1	1		3			3	3
	2	1			2	1	5	4	2	15	5		13	11

1 - Low, 2 – Medium, 3 – High

OPEN ELECTIVES

Semester VI

Subject Name REMOTE SENSING AND GIS

Subject Code OE1

Prerequisite NIL

L –T –P –C	C:P:A	L –T –P –H
3- 0 – 0 - 3	2.5:0:0.5	3- 0 – 0 - 3

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

COURSE CONTENT

UNIT-I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL9 hrs

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

UNIT –II PLATFORMS AND SENSORS9 hrs

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

UNIT-III IMAGE INTERPRETATION AND ANALYSIS 9 hrs

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

UNIT -IV GEOGRAPHIC INFORMATION SYSTEM 9 hrs

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

Management Systems (DBMS).

UNIT - V DATA ENTRY, STORAGE AND ANALYSIS 9 Hrs

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

L=45 hrs Total – 45 hrs

Text books

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

References

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

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2		1	1		1		1				1	
CO2		2		2						1	1	1		1
CO3	1	1	2			1		1						
CO4					1				1			1		1
CO5		1		1			1				1		1	
	2	6	2	4	2	1	2	1	2	1	2	2	2	2

1 - Low, 2 – Medium, 3 – High

Semester

Subject Name **Building Services**

Subject Code **OE 2**

Designed by **Department of Civil Engineering**

Prerequisite

L –T –P –C	**C-P-A**	**L-T-P-H**
3- 0 – 0- 3	**3-0-1**	**3-0-0-3**

Pre-requisite: NIL

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

COURSE CONTENT

UNIT I **Water Supply Systems** **9**

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

UNIT II **Principles of illumination and design** **9**

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

UNIT III **Ventilation and its importance** **9**

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant –fan coil systems-water piping – cooling load –air conditioning systems for different types of buildings –protection

against fire to be caused by A.C.Systems.

UNIT IV Safety Regulations 9

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

UNIT V Intelligent Buildings 9

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

L = 45 hrs

Text books

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

References

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

Mapping of course outcomes with program outcomes

Course outcomes	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1			1									
CO2												
CO3	1			3		1						
CO4								1				
CO5	1				2					1	1	1
	2		1	3	2	1				1	1	1

1 - Low, 2 – Medium, 3 – High

Semester	**VIII**		
Subject Name	**IT IN ENGINEERING CONSTRUCTION**		
Subject Code	**OE 3**		
Designed by	**Department of Civil Engineering**		
L –T –P –C **3 - 0 – 0- 3**		**C : P : A** **1.5 : 1 : 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**
CO 1	Illustrate the basic capabilities of IT in construction	C
CO 2	Prepare Drawings using AutoCAD	C & P
CO 3	Prepare designs and estimates of facilities.	C & P
CO 4	Analysis the construction networks with respect to cost, time and quality.	C & P
CO 4	Attempt developing new IT packages for improving present construction practices by collecting and collating informations.	A

COURSE CONTENT		
UNIT-I	**INTRODUCTION TO IT**	**9 hrs**
	Functions of system software and operating systems - Basics of Programming – Flow charts – algorithms -Identify input and output devices to meet the needs of users – creation, installation and maintenance of software Describe different types and purposes of productivity software.	
UNIT –II	**DRAWINGS OF FACILITIES**	**9 hrs**
	Drawing lines – curves – Dimensioning – Captioning – Preparation of layouts, plans and sections.	
UNIT-III	**DESIGN PACKAGES**	**9 hrs**
	RCC – Steel components of buildings and services.	
UNIT -IV	**ESTIMATION**	**9 hrs**
	Quantity estimating and rate analysis for buildings and services.	
UNIT V	**CONSTRUCTION MANAGEMENT**	**9 hrs**
	Preparation analysis of networks – bidding – Finance and material management.	**L=45 hrs**

Text Books

1.AnitaGoel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2.Reema Thareja, "Data Structures Using C", Oxford University Press, 2011
3.C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4. PankajJalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

Reference Books

1. PradipDey, ManasGhosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
3.Relevant software manuals

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2													
CO2				3									3	
CO3	1		1	1		1						1		
CO4											3			1
CO5	1	1	1	1		1						1		
	4	1	2	5		2					3	2	3	1