DEPARTMENT OF
CIVIL ENGINEERING

Periyar Nagar, Vallam,Thanjavur - 613 403, Tamil Nadu, India
Phone : +91 - 4362 - 264600 Fax : +91- 4362 – 264660
Email : headce@pmu.edu Web: www. pmu.edu

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
PMIST

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

Board of Studies in Civil Engineering

CURRICULUM (From I – VIII Semesters)

& SYLLABUS (From I –IV Semesters)

(For the candidates admitted from 2018-19 onwards

Based on Outcome Based Education)

FOR

B.Tech (Civil Engineering)

DEGREE PROGRAMME

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 relation 2- Medium relation 3 – High relation

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 relation 2 – Medium relation 3-High relation

GRADUATE ATTRIBUTES

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization 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
PSO1	Capably plan, analyse and design the civil engineering structures.
PSO2	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)

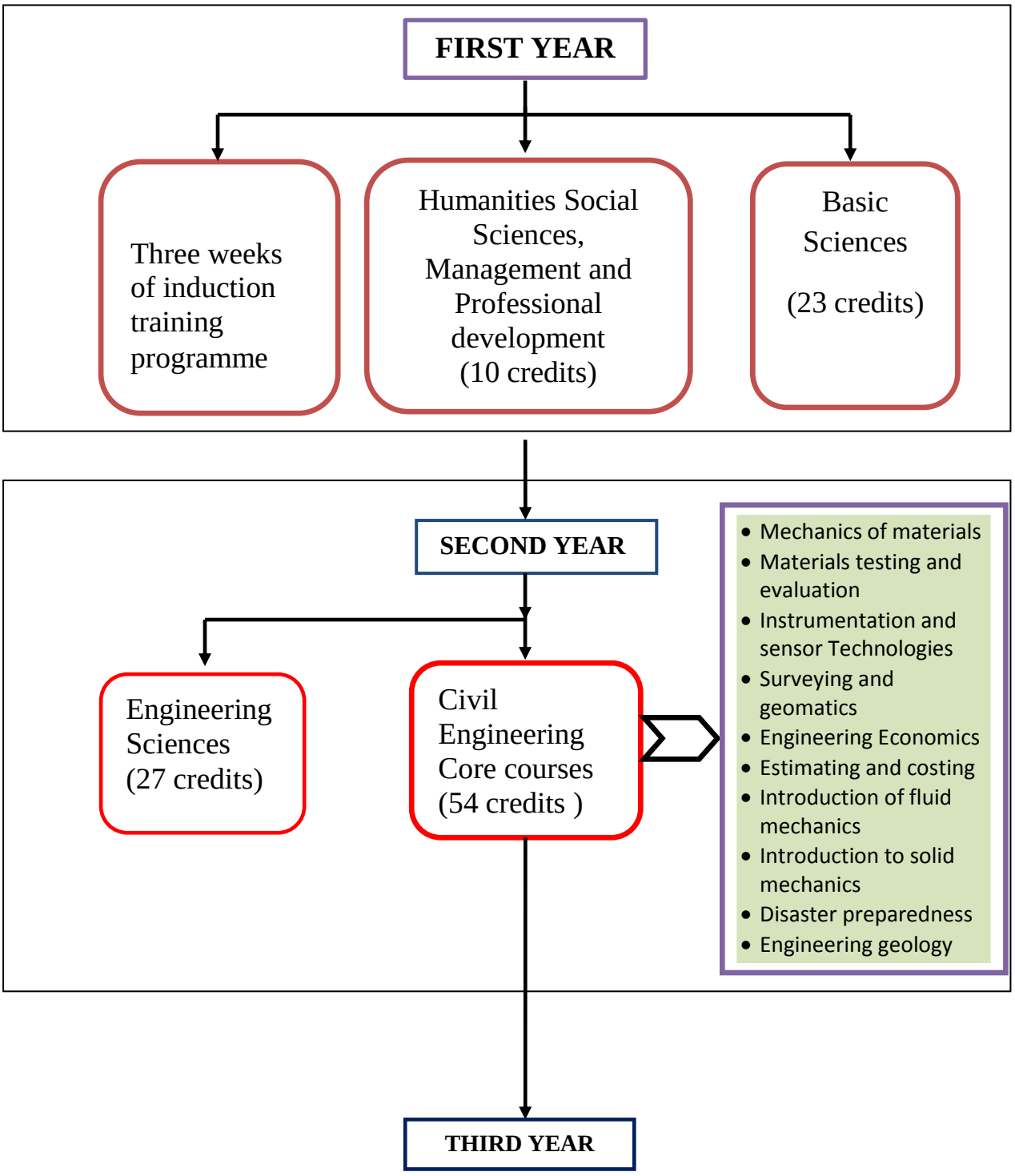
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
PEO 1	3	2	2	1	1	2	-	-	-	1	2	-	3	-
PEO 2	1	3	2	3	2	1	1	-	-	2	1	1	-	2
PEO 3	-	1	3	2	3	-	2	1	1	2	1	2	1	1
PEO 4	-	1	2	2	-	1	3	1	1	1	1	1	-	1
	4	**7**	**9**	**8**	**6**	**4**	**6**	**2**	**2**	**6**	**5**	**4**	**4**	**4**

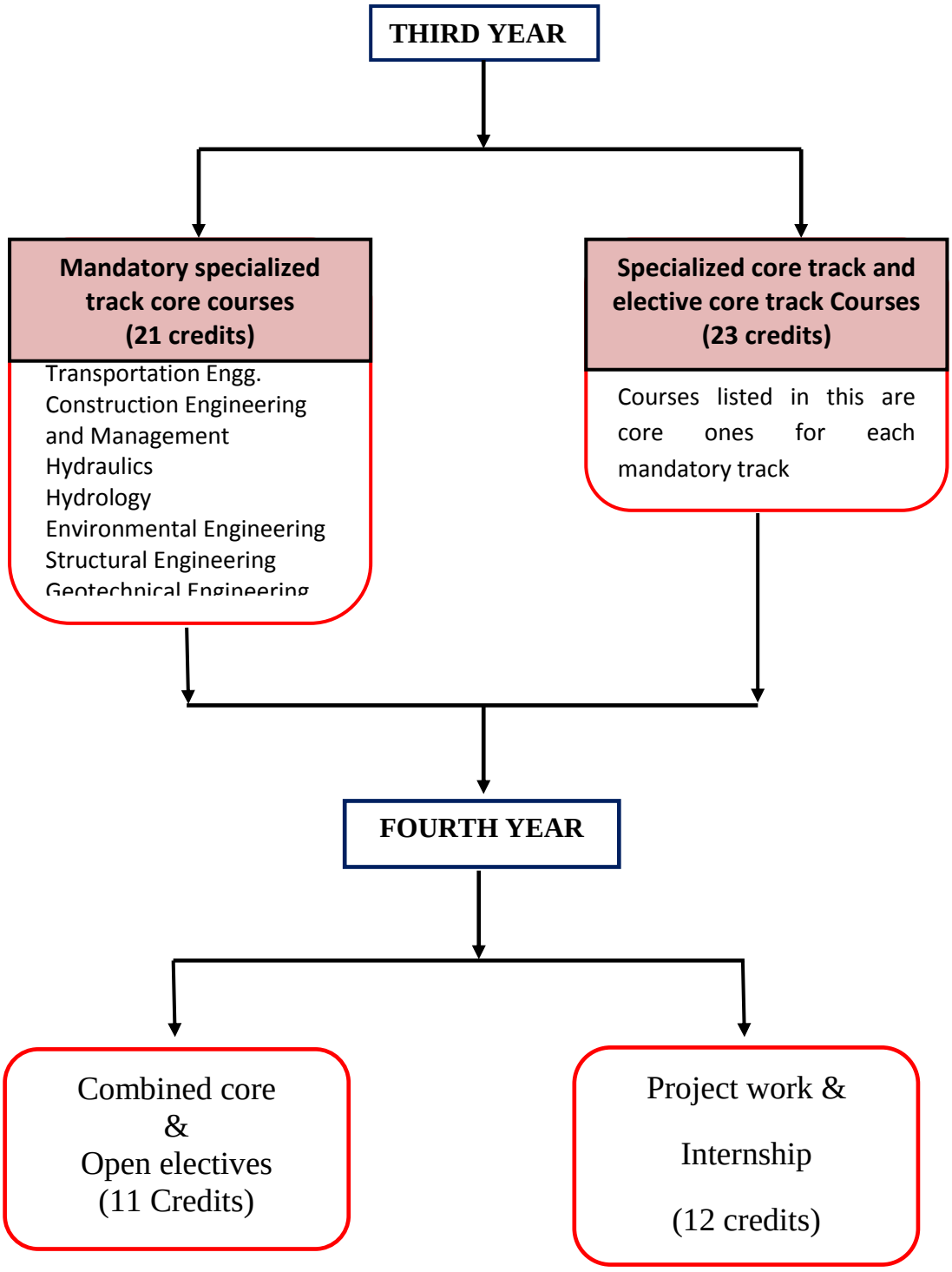
1 – Low relation **2 – Medium relation** **3 – High relation**

STRUCTURE OF B.Tech CIVIL ENGINEERING PROGRAMME

S.No	Topic	Symbol	Credits
1.	Humanities and Social Sciences including Management	**HSMC**	**10**
2.	Basic Sciences	**BSC**	**23**
3.	Engineering Sciences including workshop, drawing, basics of Electrical/mechanical/computer etc.	**ESC**	**27**
4.	Professional Subjects: Subjects relevant to chosen specialization/branch	**PCC-CE**	**54**
5.	Professional Elective courses relevant to chosen specialization/branch	**PEC-CE**	**23**
6.	Open Subjects: Electives from other technical and/or emerging subjects	**OEC**	**11**
7.	Project work, seminar and internship in industry or elsewhere	**PROJ-CE**	**12**
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution /Essence of Indian Traditional Knowledge]	**MC**	**0**
	Total		**160**

FLOW CHART FOR THE ENTIRE PROGRAMME




THIRD YEAR
Mandatory specialized track core courses (21 credits)
Transportation Engg.
Construction Engineering and Management
Hydraulics
Hydrology
Environmental Engineering
Structural Engineering
Specialized core track and elective core track Courses (23 credits)
Courses listed in this are core ones for each mandatory track
FOURTH YEAR
Combined core & Open electives (11 Credits)
Project work & Internship (12 credits)

SEMESTER-WISE STRUCTURE OF CURRICULUM

REGULATIONS – 2018

(Applicable to the students admitted from the Academic year 2018-19)

SEMESTER I

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XMA101	BSC	Mathematics – I (Calculus and Linear Algebra)	3	1	0	4
XES102	MAN	Environmental Studies	2	0	0	0
XBE103	ESC	Basic Electrical Engineering	3	1	2	5
XAP104	BSC	Applied Physics for Engineers	3	1	4	6
XEG105	ESC	Engineering Graphics and Design	2	1	0	3
XCEE**		NCC/NSS/NSO / YRC	0	0	0	0
	TOTAL		**13**	**4**	**6**	**18**

SEMESTER II

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XMA201	BSC	Mathematics – II (Differential Equations)	3	1	0	4
XCP202	ESC	Programming for Problem Solving	3	0	4	5
XGS203	HSM	English	2	0	2	3
XAC204	BSC	Applied Chemistry for Engineers	3	1	2	5
XBW205	ESC	Workshop/Manufacturing Practices	1	0	4	3
	TOTAL		**12**	**2**	**12**	**20**

SEMESTER III

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XMA301	BSC	Mathematics-III (Transform & Discrete Mathematics)	**2**	**0**	**0**	**2**
XBE302	BSC	Basic Electronics	**1**	**0**	**2**	**2**
XCE303	PCC	Disaster Preparedness & Planning	1	1	0	2
XCE304	ESC	Computer Aided Civil Engineering Drawing	1	0	2	2
XCE305	ESC	Engineering Mechanics	3	1	0	4
XCE306	ESC	Energy Science and Engineering	1	1	0	2
XCE307	PCC	Surveying – I	2	0	2	3
XCE308	HSM	Introduction to Civil Engineering	2	0	0	2
XGS309	HSM	Effective Technical Communication	**3**	**0**	**0**	**3**
XCEM**		Minor Course	0	0	0	0
	TOTAL		**16**	**3**	**6**	**22**

SEMESTER IV

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE401	ESC	Mechanical Engineering	**2**	**1**	**0**	**3**
XCE402	PCC	Instrumentation & Sensor Technologies for Civil Engineering Applications	2	0	2	3
XCE403	PCC	Engineering Geology	1	0	2	2
XCE404	PCC	Mechanics of Fluids	2	0	2	3
XCE405	PCC	Mechanics of Solids	2	0	2	3
XCE406	PCC	Geotechnical Engineering	2	0	2	3
XCE407	PCC	Surveying – II	2	0	2	3
XCE408	PCC	Materials Testing & Evaluation	2	0	2	3
XMG409	HSM	Management I (Organizational Behavior)	**3**	**0**	**0**	**0**
	TOTAL		**18**	**1**	**14**	**23**

SEMESTER V

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE501	PCC	Mechanics of Materials	3	0	0	3
XCE502	PCC	Hydraulic Engineering	2	0	2	3
XCE503	PCC	Structural Analysis	2	1	0	3
XCE504	PCC	Hydrology & Water Resources Engineering	2	2	0	3
XCE505	PCC	Environmental Engineering	2	0	2	3
XCE506	PCC	Transportation Engineering	2	0	2	3
XCE507	PCC	Construction Engineering & Management	2	1	0	3
XMG508	HSM	Professional Practice, Law & Ethics	2	0	0	2
XCI509	HSM	Constitution of India	2	0	0	0
XCEM**		Minor Course	0	0	0	0
	TOTAL		**19**	**4**	**6**	**23**

SEMESTER VI

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCE601	PCC	Structural Engineering	2	1	0	3
XCE602	PCC	Engineering Economics, Estimation & Costing	2	1	4	5
XCEE**	PEC	Elective-I	3	0	0	3
XCEE**	PEC	Elective-II	3	0	0	3
XCE605	PEC	Elective-III	3	0	0	3
XCE606	PEC	Elective-IV	3	0	0	3
	OEC	Open Elective-I	3	0	0	3
	TOTAL		**19**	**2**	**4**	**23**

SEMESTER VII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE**	PEC	Elective V	3	0	0	3
XCEE**	PEC	Elective-VI	3	0	0	3
	OEC	Open Elective-II	3	0	0	3
XCE704	Project	Project – I	0	0	10	5
		Inplant Training	0	0	0	1
	TOTAL		**9**	**0**	**10**	**15**

SEMESTER VIII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE**	PEC	Elective VII	3	0	0	3
XCEE**	PEC	Elective VIII	2	0	0	2
	OE	Open Elective-III	3	0	0	3
	OE	Open Elective-IV	3	0	0	2
XCE805	Project	Project – 2	0	0	12	6
	TOTAL		**11**	**0**	**12**	**16**

TOTAL CREDITS - 160

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

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

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

Track I

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

Track II &Track V

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

Track III

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

Track IV

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

Track VI

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

Track VII

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

Track VIII

Sub. Code	Category	Name of the Course	Hours per week			C
			L	T	P	
XCEE27	PEC	Environmental Law and Policy	2	0	0	2
XCEE28	PEC	Solid and Hazardous Waste Management	2	0	0	2
XCEE29	PEC	Air and Noise Pollution and Control	2	0	0	2
XCEE30	PEC	Environmental Impact Assessment	2	0	0	2

MINOR COURSES

Sub. Code	Name of the Course	Hours per week			C
		L	T	P	
XCEMO1	Real Estate and Valuation	1	0	0	0
XCEMO2	Digital Land Surveying and Mapping	0.5	0	0.5	0
XCEMO3	General repairs and Remedial Water proofing	0.25	0	0.75	0
XCEMO4	Building Regulations and Approval Process	1	0	0	0
XCEMO5	Computational skills for Geotechnical Applications	0.25	0	0.75	0
XCEMO6	Structural Quality Assessment	0.25	0	0.75	0
XCEMO7	Plumbing and Sanitary Installations	0.25	0	0.75	0

Note

L – Lecture, T – Tutorial, P – PRACTICAL, C - Credit

COURSE CODE **XMA 101**

COURSE NAME **Mathematics I (Calculus and Linear Algebra)**

L	T	P	C
3	1	0	4

C	P	A
3	0.5	0.5

L	T	P	H
4	1	0	5

PREREQUISITE: Differentiation and Integration

COURSE OUTCOMES:

Course outcomes:		**Domain**	**Level**
CO1	**Apply** orthogonal transformation to reduce quadratic form to canonical forms.	Cognitive	Remembering Applying
CO2	**Apply** power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series.	Cognitive Psychomotor	Applying Remembering Guided Response
CO3	**Find** the derivative of composite functions and implicit functions Euler's theorem and Jacobian	Cognitive Psychomotor	Remembering Guided Response
CO4	**Explain** the functions of two variables by Taylors expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence.	Cognitive Affective	Remembering Understanding Receiving
CO5	**Apply** Differential and Integral calculus to notions of curvature and to improper integrals.	Cognitive	Applying

UNIT 1: MATRICES **15**

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

UNIT 2: SEQUENCES AND SERIES **15**

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

UNIT 3: MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION **15**

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

UNIT 4: MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS **15**

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

UNIT 5: DIFFERENTIAL AND INTEGRAL CALCULUS **15**

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

L	T	P	Total
60	15	0	75

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Cos Versus GA mapping

Table 1: Mapping of Cos with GAs:

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

COURSE CODE **XES 102**

COURSE NAME **ENVIRONMENTAL SCIENCES**

L	T	SS	P	C
3	0	0	0	0

C	P	A
1.4	0.3	0.3

L	T	SS	P	H
3	0	0	0	3

COURSE OUTCOMES

		DOMAIN	LEVEL
CO1	***Describe*** the significance of natural resources and ***explain*** anthropogenic impacts.	Cognitive	Remember Understand
CO2	***Illustrate*** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	***Identify*** the facts, consequences, preventive measures of major pollutions and ***recognize*** the disaster phenomenon	Cognitive Affective	Remember Receive
CO4	***Explain*** the socio-economic, policy dynamics and ***practice*** the control measures of global issues for sustainable development.	Cognitive	Understand Apply
CO5	***Recognize*** the impact of population and the concept of various welfare programs, and ***apply*** the modern technology towards environmental protection.	Cognitive	Understand Analysis

UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY **12**

Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource, land degradation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT – II ECOSYSTEMS AND BIODIVERSITY **7**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III ENVIRONMENTAL POLLUTION **10**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

UNIT –IV SOCIAL ISSUES AND THE ENVIRONMENT **10**

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

UNIT –V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.

L	T	SS	P	Total
45	0	0	0	45

E RESOURCES

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

Table:1 Mapping of CO's with B.Tech GA's:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3											1
CO2	2					2	1			1		1
CO3	2	1	3			3	1		2	1		1
CO4	1	1	2			3	2	3				1
CO5	2	1	1			3						1
	10	**3**	**6**			**11**	**4**	**3**	**2**	**2**		**5**
Scaled to 0,1,2,3 scale	**2**	**1**	**2**			**3**	**1**	**1**	**1**	**1**		**1**

1 - Low, 2 – Medium, 3 – High

COURSE CODE **XBE 103**

COURSE NAME **Basic Electrical Engineering**

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

PREREQUISITE: Physics

COURSE OUTCOMES:

Course outcomes:		**Domain**	**Level**
CO1	***Define, Relate,*** the fundamentals of electrical parameters and***build*** and ***explain***AC, DC circuits by Using measuring devices	Cognitive Psychomotor	Remember Understand Mechanism set
CO2	***Define and Explain*** the of operation of DC and AC machines.	Cognitive	Remember Understand
CO3	***Recall and Illustrate*** various semiconductor devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive Psychomotor	Remember Understand Mechanism
CO4	***Relate and Explain the*** number systems and logic gates. ***Construc***t the different digital circuit.	Cognitive Psychomotor	Remember Understand Orgination
CO5	***Label and Outline the*** different types of microprocessors and their applications.	Cognitive	Remember Understand

UNIT I- FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS **9 +9 +12**

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 **9+6+0**

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 +8**

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+10**

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+ 6+0**

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

LIST OF EXPERIMENTS :

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

L	T	P	Total
45	30	30	105

TEXT BOOKS:

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

E- REFERENCE:

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

Table:1 Mapping of CO's with B.Tech GA's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	1			1	1	1			
CO 2	3	3	1	1	1	1			1	1	1			
CO 3	2	2	2	1	2	2	1	1	1	1	1			
CO 4	2	2	1	1	1	1	1	1	1	1	1			
CO 5	2	2	1	1	1	1	1	1	1	1	1			
Total	12	12	6	5	6	6	3	3	5	5	5			
Scaled value	3	3	2	1	2	2	1	1	1	1	1			

1-5 → 1, 6-10 → 2, 11-15 → 3

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

COURSE CODE	**XAP 104**	**L**	**T**	**P**	**C**
COURSE NAME	**APPLIED PHYSICS FOR ENGINEERS**	**3**	**1**	**2**	**6**
C:P:A	**2.8:0.8:0.4**	**L**	**T**	**P**	**H**
PREREQUISITE:	**Basic Physics in HSC level**	**3**	**1**	**3**	**7**

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

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

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

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

UNIT -II ELECTROMAGNETIC THEORY **9+3+3**

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

UNIT –III OPTICS, LASERS AND FIBRE OPTICS **9+3+12**

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

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

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

UNIT –IV SEMICONDUCTOR PHYSICS **9+3+6**

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

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

UNIT –V QUANTUM PHYSICS **9+3+0**

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

TEXT BOOKS

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

REFERENCE BOOKS

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

E RESOURCES

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

LABORATORY

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

REFERENCE BOOKS

1. Samir Kumar Ghosh, "A text book of Advanced PRACTICAL Physics", New Central Agency (P) Ltd, 2008.
2. Arora C.L., "PRACTICAL Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.
4.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	**45**	**15**	**30**	**90**

Table 1: Mapping of CO's with PO:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS1	PS2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
CO4	3	2	2	2	1	-	-	-	1	-	-	1		
CO5	3		2			-	-	-		-	-	1		
Total	**15**	**6**	**9**	**6**	**4**				**3**			**5**		
Scaled to 0,1,2,3 scale	**3**	**2**	**2**	**2**	**1**				**1**			**1**		

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

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

Table 2: Mapping of CO's with GA's:

	GA 1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3	2	2	2	1	-	-	-	1	-	-	1
CO2	3		1		1	-	-	-		-	-	1
CO3	3	2	2	2	1	-	-	-	1	-	-	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1
CO5	3		2			-	-	-		-	-	1
Total	**15**	**6**	**9**	**6**	**4**				**3**			**5**
Scaled to 0,1,2,3 scale	**3**	**2**	**2**	**2**	**1**				**1**			**1**

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

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

COURSE CODE		**XEG105**	**L**	**T**	**P**	**C**
COURSE NAME		**Engineering Graphics and Design**	**2**	**0**	**1**	**3**
C	**P**	**A**				
1.75	**1**	**0.25**	**L**	**T**	**P**	**H**
			2	**0**	**2**	**4**

PREREQUISITE: NIL

COURSE OUTCOMES:

	Course outcomes:	Domain	Level
CO1	*Apply* the national and international standards, *construct* and *practice* various curves	Cognitive, Psychomotor and Affective	Applying, Guided response and Responds to Phenomena
CO2	*Interpret*, *construct* and *practice* orthographic projections of points, straight lines and planes.	Cognitive, Psychomotor and Affective	Understanding, Mechanism and Responds to Phenomena
CO3	*Construct Sketch* and *Practice* projection of solids in various positions and true shape of sectioned solids.	Cognitive, Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena
CO4	*Interpret*, *Sketch* and *Practice* the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive, Psychomotor and Affective	Understanding, Complex Overt Response and Responds to Phenomena
CO5	*Construct sketch* and *practice* isometric and perspective views of simple and truncated solids.	Cognitive, Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena

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

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

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

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

UNIT –II PROJECTION OF POINTS, LINES AND PLANE SURFACES 6+6

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

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

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

UNIT –IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS 6+6

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+6

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

THEORY 30 PRACTICAL 30 TOTAL HRS 60

TEXT BOOKS

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

REFERENCES

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

E RESOURCES

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

Table 1: Mapping of CO's with PO'S:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	2	3	1	1	2	3	3	3	-
CO2	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO3	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO4	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO5	3	3	3	1	3	1	3	1	1	1	2	3	3	-
Total	15	15	15	6	15	6	15	5	5	6	11	3	3	-
Scaled	3	3	3	2	3	2	3	1	1	2	3	3	3	-

0 - No relation 1- Low relation 2- Medium relation 3- High relation

1-5 → 1, 6-10 → 2, 11-15 → 3

XCE 201

COURSE CODE **XCP202**

COURSE NAME **PROGRAMMING FOR PROBLEM SOLVING**

PREREQUISITES **L T P C**

C:P:A

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

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

Theory

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

PRACTICAL

1. Program to display a simple picture using dots.
2. Program for addition of two numbers
3. Program to swap two numbers
4. Program to solve any mathematical formula.

UNIT II CONTROL STRUCTURE AND ARRAYS **9+6**

Theory

Control Structures – Conditional Control statements: Branching, Looping - Unconditional control structures: switch, break, continue, goto statements – Arrays: One Dimensional Array – Declaration – Initialization – Accessing Array Elements – Searching – Sorting – Two Dimensional arrays - Declaration – Initialization – Matrix Operations – Multi Dimensional Arrays - Declaration – Initialization. Storage classes: auto – extern – static. Strings: Basic operations on strings.

PRACTICAL

1. Program to find greatest of 3 numbers using Branching Statements
2. Program to display divisible numbers between n1 and n2 using looping Statement
3. Program to remove duplicate element in an array.
4. Program to perform string operations.
5. Performing basic sorting algorithms

UNIT III FUNCTIONS AND POINTERS **9+6**

Theory

Functions: Built in functions – User Defined Functions - Parameter passing methods - Passing arrays to functions – Recursion - Programs using arrays and functions. Pointers - Pointer declaration - Address operator - Pointer expressions & pointer arithmetic - Pointers and function - Call by value - Call by Reference - Pointer to arrays - Use of Pointers in self-referential structures-Notion of linked list(no implementation).

PRACTICAL

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

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

Theory

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

PRACTICAL

1. Program to read and display student mark sheet Structures with variables
2. Program to read and display student marks of a class using Structures with arrays
3. Program to create linked list using Structures with pointers

UNIT V FILES **9+6**

Theory

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

1. Program for copying contents of one file to another file.
2. Program using files using structure with pointer

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	**45**	**0**	**30**	**75**

TEXT BOOKS/ REFERENCES

1. Byron Gottfried, "Programming with C", III Edition, (Indian Adapted Edition), TMH publications, 2010
2. Yeshwant Kanethker, “Let us C”, BPB Publications, 2008
3. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. 2005
4. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001
5. Johnson baugh R. and Kalin M., “Applications Programming in ANSI C”, III Edition, Pearson Education India, 2003
6. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Table 1: COs Versus POs Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2			3						2	3	2	
CO2	3	2			2						2	3	2	
CO3	2	2	1	2	2						2	2	2	
CO4	2	2	1	2	2						2	2	2	
CO5	2	2	1		2			1		2	2	2	2	
Total	**12**	**10**	**3**	**4**	**11**			**1**		**2**	**10**	**12**	**10**	
Scaled Value	3	2	1	1	3			**1**		1	2	3	2	

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

COURSE CODE	**XGS203**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**English**	**2**	**0**	**1**	**0**	**3**
Pre-requisites (if any)		**L**	**T**	**P**	**SS**	**H**
C: P: A	**2.6:0.4:0**	**2**	**0**	**2**	**0**	**4**

COURSE OUTCOMES:		**Domain**	**Level**
CO1	***Ability*** to recall the meaning for proper usage	Cognitive	Remember
CO2	***Apply*** the techniques in sentence patterns	Cognitive	Apply
CO3	***Identify*** the common errors in sentences	Cognitive	Remember
CO4	***Construct*** the Nature and Style of sensible Writing	Cognitive	Create
CO5	***Practicing*** the writing skills	Psychomotor	Guided Response
CO6	***Grasping*** the techniques in learning sounds and etiquettes	Psychomotor	Adapting

UNIT I - Vocabulary Building **9**

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4 Synonyms, antonyms, and standard abbreviations.

UNIT II - Basic Writing Skills **9**

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

UNIT III - Identifying Common Errors in Writing **9**

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions

3.6 Redundancies

3.7 Clichés

UNIT IV - Nature and Style of sensible Writing **9**

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

4.5 Writing introduction and conclusion

UNIT V - Writing Practices **9**

5.1 Comprehension

5.2 Précis Writing

5.3 Essay Writing

Unit VI - Oral Communication

(This unit involves interactive practice sessions in Language Lab)

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

Suggested Readings:

(i) PRACTICAL English Usage. Michael Swan. OUP. 1995

(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007

(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001

(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006

(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011

(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Table 1: Mapping of Cos with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
Scaled Value	2	0	0	0	0	0	2	0	1	0	0	0	0	0
	1	0	0	0	0	0	1	0	1	0	0	0	0	0

1-5= 1, 6-10 = 2, 11-15= 3 0-No Relation, 1- Low Relation, 2 – Medium Relation, 3- High Relation

COURSE CODE	**XAC204**	**L**	**T**	**P**	**C**
COURSE NAME	**Applied Chemistry for Engineers**	**3**	**1**	**1**	**5**
PREREQUISITES	**Nil**	**L**	**T**	**P**	**H**
C:P:A	**3.5:1.0:0.5**	**3**	**1**	**2**	**6**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Identify*** the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. ***Describe*** the various water quality parameters like hardness and alkalinity.	Cognitive Psychomotor	Remember Perception
CO2	***Explain*** *and* ***Measure*** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understand Set
CO3	***Interpret*** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Apply Mechanism Receive
CO4	***Describe, Illustrate*** *and* ***Discuss*** the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remember Analyze Perception Respond
CO5	***Apply, Measure*** and ***Distinguish*** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remember Apply Mechanism

Theory Part

UNIT – I PERIODIC PROPERTIES AND WATER CHEMISTRY 8+3+6

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

UNIT–II USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

12+3+6

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

UNIT–III ATOMIC AND MOLECULAR STRUCTURE

10+3+6

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

Intermolecular forces and potential energy surfaces

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

UNIT-IV SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

7+3+6

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

UNIT–V STEREOCHEMISTRY AND ORGANIC REACTIONS

8+3+6

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

Organic reactions and synthesis of a drug molecule

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

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	**45**	**15**	**30**	**90**

TEXT BOOKS

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.
3. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
7. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd. New Delhi, 1977.
8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

REFERENCE BOOKS

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

E Resources - MOOCs:

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/

Laboratory Part **30 hrs**

Experiments :

1. Determination of chloride ion present in the water sample by Argentometric method.	**CO1**
2. Determination of total, temporary and permanent hardness of water sample by EDTA method.	**CO1** **CO2** **CO2**
3. Determination of cell constant and conductance of solutions.	**CO3**
4. Potentiometry - determination of redox potentials and emfs.	**CO3** **CO4**
5. Determination of surface tension and viscosity.	**CO4**
6. Adsorption of acetic acid by charcoal.	**CO5**
7. Determination of the rate constant of a reaction.	**CO5**
8. Estimation of iron by colorimetric method.	
9. Synthesis of a polymer/drug.	
10. Saponification/acid value of an oil.	

REFERENCE BOOKS

1. Mendham, Denney R.C,. Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.
2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8tl Ed.; McGraw-Hill: New York, 2003.

E Resources - MOOCs:

1. http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011
3. http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

Table 1 : Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	0	0	0	0	0	2	3	3
CO2	2	0	0	0	0	0	1	2	2
CO3	3	0	0	0	0	0	2	3	3
CO4	8	0	0	0	0	0	3	3	3
CO5	3	0	0	0	0	0	2	2	3

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

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

SUB CODE	SUB NAME	L	T	P	C
XBW205	Workshop/Manufacturing Practices	1	0	2	3

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

PREREQUISITE:

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

COURSE CONTENT

EXP.NO	TITLE	CO RELATION
1	Introduction To Machining Process	CO1
2	Plain Turining Using Lathe Operation	CO1
3	Introduction To CNC	CO1
4	Demonstration Of Plain Turning Using CNC	CO1
5	Study Of Metal Casting Operation	CO2
6	Demonstration Of Moulding Process	CO2
7	Study Of Smithy Operation	CO2
8	Study Of Carpentry Tools	CO3
9	Half Lap Joint – Carpentry	CO3
10	Mortise And Tenon Joint – Carpentry	CO3
11	Study Of Fitting Tools	CO3
12	Square Fitting	CO3
13	Triangular Fitting	CO3
14	Study Of Welding Tools	CO4
15	Square Butt Joint - Welding	CO4
16	Tee Joint – Welding	CO4
17	Introduction To House Wiring	CO5
18	One Lamp Controlled By One Switch	CO5
19	Two Lamps Controlled By Single Switch	CO5
20	Staircase Wiring	CO5

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay

2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.

2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi

3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.

4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES

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

Mapping of CO's with PO'S:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1			1	1		1	2
CO2	2	1	2	2	1			1	1		1	2
CO3	2	1	2	2	1			1	1		1	2
CO4	2	1	2	2	1			1	1		1	2
CO5	2	1	2	2	1			1	1		1	2
Total												
Scaled												

0- No relation 1- Low relation 2- Medium relation 3- High relation

301

302

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
III	XCE 303	DISASTER PREPAREDNESS & PLANNING	1	1	0	2

Course Outcome:		Domain C or P or A
CO1	To Understand basic concepts in Disaster Management	C
CO2	To Understand Definitions and Terminologies used in Disaster Management and able to Analyzing Relationship between Development and Disasters	C&P
CO3	Ability to understand Categories of Disasters	C & A
CO4	To Understand the Challenges posed by Disasters	C & A
CO5	To understand Impacts of Disasters Key Skills	C

COURSE CONTENT

UNIT I **INTRODUCTION** **3 hrs**

Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation).

UNIT II **DISASTERS** **6 hrs**

Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability, profile of India, mountain and coastal areas, ecological fragility

UNIT III **DISASTER IMPACTS** **6 hrs**

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV **DISASTER RISK REDUCTION (DRR)** **10hrs**

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V DISASTERS, ENVIRONMENT AND DEVELOPMENT 5hrs

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery;
reconstruction and development methods

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	**45**	**15**	**30**	**90**

TEXT BOOKS

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of HomeAffairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
7. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

CO vs PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1			2	1	1	2	2	3	2	1	1	1	2	2
CO2	1	1	3	2	3	1		2		2				
CO3					2	1	2	2	2	2				
CO4	1	1	2	2	2	2	1	2	1	2	1	1	1	**1**
CO5	2	3		2	3	2		1	1	2		2		
	4	5	7	7	11	8	5	10	6	9	2	4	3	**3**

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C	H
III	XCE 304	COMPUTER AIDED CIVIL ENGINEERING DRAWING	1	0	2	2	
			1	0	4		5

Course Outcome:

		Domain C or P or A
CO1	Develop Parametric design and the conventions of formal engineering drawing	C&P
CO2	Draw and interpret 2D & 3D drawings.	C&P
CO3	Communicate a design idea/concept graphically/ visually	C & A
CO4	Examine a design critically and with understanding of CAD	C & A
CO5	Get a Detailed study of an engineering artifact	C

COURSE CONTENT

UNIT I **INTRODUCTION** **3 hrs**

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

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

UNIT II **COMMANDS** **3 hrs**

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

UNIT III **MASONRY BONDS** **3 hrs**

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

UNIT IIV **BUILDING DRAWING** **3 hrs**

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

UNIT V **PICTORIAL VIEW** **3 hrs**

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

30hrs.

PRACTICAL

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

L-15 hrs. P-30hrs Total – 45 hrs.

TEXT BOOKS

1. Subhash C Sharma & Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education
4. Venugopal (2007), "Engineering Drawing and Graphics+AUTOCAD", New Age International Pvt. Ltd

REFERENCES

1. Corresponding set of CAD Software Theory and User Manuals.
2. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing KDR building, Calicut,
3. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian
4. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,

CO vs PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1			3	1			2	3	1		3	2	2
CO2				3	3	2		1	3	2	1	1	1	1
CO3		2	1	3	1	3		3	3	1		3	2	
CO4	1		2	3	2	3		2	1			3	1	**2**
CO5		2	1	3	3	1	1	1	2	2		3	2	**2**
	2	4	4	15	10	9	1	9	12	6	1	13	8	**7**

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
III	XCE 305	ENGINEERING MECHANICS	3	1	0	4

Course Outcome:

		Domain C or P or A
CO1	Capability to apply mathematics, science, and engineering	C & A
CO2	Ability to identify, formulate, and solve engineering problems	C & A
CO3	Skill to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.	C & A
CO4	Capacity to design and conduct experiments, as well as to analyze and interpret data	C & A
CO5	Ability to comprehend the thermodynamics and their corresponding processes thati nfluence the behaviour and response of structural components	C & A

COURSE CONTENT

UNIT I **INTRODUCTION TO ENGINEERING MECHANICS** **12hrs**

Introduction - Units and Dimensions - Laws of Mechanics –Coplanar and Non coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility – single equivalent force. Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

UNIT II **CENTROID AND CENTRE OF GRAVITY&MOMENT OF INERTIA** **12hrs**

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT III **FRICTION,MOTION OF BODIES** **20 hrs**

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

UNIT IV **INTRODUCTION TO MECHANICAL VIBRATIONS** **10hrs**

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

UNIT V DYNAMICS **6hrs**

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

L-45 hrs. T-15 hrs Total – 60 hrs.

TEXT BOOKS

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

REFERENCES

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

CO vs PO Mapping

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

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
III	XCE 306	ENERGY SCIENCE AND ENGINEERING	1	1	0	2

Course outcome		Domain
CO1	***List*** and generally ***explain*** the main sources of energy and their primary applications nationally and internationally	Cog(U) & Aff(Res)
CO2	***Understand*** effect of using these sources on the environment and climate	Cog(U)
CO3	***Describe*** the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.	Cog(U)
CO4	***List*** and describe the primary renewable energy resources and technologies.	Cog(U)
CO5	***Quantify*** energy demands and make comparisons among energy uses, resources, and technologies.	Cog(U) &Aff(Res)
CO6	***Understand*** the Engineering involved in projects utilising these sources	Cog(U)

COURSE CONTENT

UNIT I INTRODUCTION TO ENERGY SCIENCE 4 hrs.

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

UNIT II ENERGY SOURCES 5 hrs.

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

UNIT III ENERGY AND ENVIRONMENT 6 hrs.

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

UNIT IV CIVIL ENGINEERING PROJECTS 10 hrs

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

UNIT V ENGINEERINGFOR ENERGY CONSERVATION 5 hrs.

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

TEXT BOOKS /REFERENCE BOOKS

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

REFEENCE BOOKS

1. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
2. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company

CO vs PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	1	1		1	2	2	1	2	1	2	2
CO2	3		3	2		1		2	2	1	3	1	2	2
CO3	3	2	1		2	2	1	3	2	1	1	2	2	**2**
CO4	2	3	2	1				2	2	1	2	1	2	**2**
CO5	3	2		2	1	2		1	2	1	1	1	2	**2**
CO6		3	2	1		1	2	1	2	1	2	2	2	**2**

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
III	XCE 307	SURVEYING - I	2	0	4	6

COURSE OUTCOMES **At the end of this course, the students should be able to**		DOMAIN	LEVEL
CO1	***Identify*** the Principles and functions of various surveying methods	Cognitive Psychomotor	Understanding Manipulation
CO2	***Identify*** the methods of Levelling and ***determine*** the reduced levels	Cognitive Affective Psychomotor	Applying Responding Manipulation
CO3	***Classify*** the methods of Contouring and***d Measure*** the capacity of Reservoir	Cognitive Psychomotor	Understanding Manipulation
CO4	***Describe*** the methods and ***measure*** the angles and distances using Theodolite	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO5	**Understand** the measurement of distance and heights of objects using tachometric principle	Cognitive Psychomotor Affective	Understanding Manipulation Responding

COURSE CONTENT

UNIT I **TRADITIONAL METHODS** **12 Hrs**

Introduction to Plane and Geodetic Surveying, Chain surveying, Instruments used in chain surveying, Ranging and chaining lines, chaining past obstacles, Chaining on sloping ground, Corrections applied, Field book, Trapezoidal and Simpson's rule for computation of areas with irregular boundaries.

Compass Instrument, Measurement of angles and directions, Bearing, WCB & RB, Magnetic declination and its variation, Local attraction, Plotting of compass traverse, Latitude and departure

Plane Table Surveying: Principle, equipment, methods, orientation, two point and three-point problem and their solutions, errors & precautions, advantages and disadvantages of plane tabling.

UNIT II **LEVELLING** **09 Hrs**

Levelling, terms and definitions, Instruments and its parts, Temporary and permanent adjustments, Reduction of level, Height of collimation and Rise and fall methods, Inverted levels, Reciprocal levelling, Longitudinal and cross sectioning, Capacity of reservoirs

UNIT III **CONTOURING** **09 Hrs**

Definition, Contour interval, Characteristics of contours, Types of contours, Steep slope contours, Flat terrain contours, Methods of locating contours, interpolation of contours, Contour gradient, Uses of contour maps, Definition for TIN, DTM, mass points.

UNIT IV **THEODOLITE SURVEYING** **09 Hrs**

Description of theodolite, Measurement of horizontal angles and vertical angles, Methods of repetition and reiteration, Problems of heights and distances by single plane and double plane method.

UNIT V TACHOMETRY 06 Hrs

Tachometry – Tachometric systems – Determination of Instrument Constants-Problems in tachometric survey.

Lecture= 30 Tutorial=0 PRACTICAL= 60 Total= 90 hrs

TEXT BOOKS

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

REFERENCES

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

E-REFERENCES

NPTEL Video Lectures on Surveying

S.No.	List of Experiments
1.	Chain surveying- Distance Measurements
2.	Compass Surveying- Magnetic declination and its variation
3.	Plane Table Surveying-Two point and three-point problem
4.	Levelling-Height of collimation and Rise and fall methods
5.	Levelling- Longitudinal and cross sectioning
6.	Contouring – Radial and Square
7.	Theodolite surveying-Single plane method and double plane method.
8.	Tachometric surveying-Determination of Instrument constants
9.	Stadia Tachometry – Staff held Vertical (Angle of Elevation and Depression)
10.	Tangential tachometry – Both angles of Elevation and Depression

Table 1: COs Versus POs Mapping

	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	2	1	3	3	3	2	1	3	2	3	3	3	3	3

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
III	XCE 308	INTRODUCTION TO CIVIL ENGINEERING	2	0	0	2

Course Outcome:		Domain C or P or A
CO1	Develop Parametric design and the conventions of formal engineering drawing	C (Understanding)
CO2	Produceandinterpret2D&3Ddrawings.	C& A (Understanding)
CO3	Communicate a design idea/concept graphically/ visually	C& A (Understanding)
CO4	Examine a design critically and with understanding of CAD	C (Understanding)
CO5	Get a Detailed study of an engineering artefact	C (Understanding)

COURSE CONTENT

UNIT I **Importance of Civil Engineering and Materials** **5 hrs**

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

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

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

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

UNIT II **Introduction of Architecture, Environmental and Management Studies** **4 hrs**

Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Services; Green Buildings; Development of Smart cities

Basics of Construction Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management

Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Recycling and Sustainability in Construction; Repairs and rehabilitation of structures

UNIT III **Introduction of Geotechnical, Water resource and Ocean Engineering** **5hrs**

Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling

Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Multipurpose reservoir projects

Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports &Harbors and other marine structures

UNIT IV **Introduction of Structural Engineering, Transportation Engineering and Remote Sensing** **8hrs**

Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Power plant structures;

Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbor and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management;

Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR

UNIT V **Computational Methods in Civil Engineering** **8 hrs**

Computational Methods, IT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modeling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,…GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, …)

Tutorials **15 hrs.**

1. Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project
2. Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City.
3. List top five tunnel projects in India and their features; collect and study geotechnical investigation report of any one Metro Rail (underground) project;
4. Visit a construction site and make a site visit report. Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other
5. Collect the history of a major rehabilitation project and list the interesting features

L-30 hrs. P-15hrs Total – 45 hrs.

TEXT BOOKS

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

REFERENCES

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

CO vs PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2
CO1	0	0	1	0	1	2	0	1	3	0	0	2
CO2	0	3	0	0	2	0	0	0	1	1	1	1
CO3	2	0	0	0	2	0	0	2	1	2	2	**2**
CO4	0	0	1	0	3	0	2	1	1	1	2	**0**
CO5	2	2	0	2	0	0	0	1	0	1	1	**1**

1 – Low, 2 – Medium, 3 – High

401

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE 402	INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS	2	0	2	3

Course Outcome:		Domain C or P or A
CO1	***Understand*** the principles of operation and characteristics of instrumentation and integrated sensor systems.	C,P&A
CO2	***Understand*** right use of sensors and instruments for differing applications along with limitations.	C,P&A
CO3	***Recognize*** and ***Apply*** measurement best practice and identify ways to improve measurement and evaluation	C,P&A
CO4	***Solve*** problems in instrumentation and measurement systems.	C,P&A

COURSE CONTENT

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

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

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

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

UNIT III **DATA ANALYSIS AND INTERPRETATION 8hrs**

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

UNIT IV **FREQUENCY DOMAIN SIGNAL PROCESSING AND ANALYSIS 8hrs**

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

PRACTICAL **30hrs**

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

L-30 hrs T-0hrs P-30hrs Total –60hrs

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CO vs PO Mapping

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

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE 403	ENGINEERING GEOLOGY	1	0	2	2

COURSE OUTCOMES		DOMAIN	LEVEL
At the end of this course, the students should be able to			
CO1	Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice	Cognitive Psychomotor	Applying Guided Response
CO2	The fundamentals of the engineering properties of Earth materials and fluids.	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO3	Rock mass characterization and the mechanics of planar rock slides and topples.	Cognitive Affective	Understanding Responding
CO4	Soil characterization and the Unified Soil Classification System.	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO5	The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.	Cognitive Affective	Understanding Responding

COURSE CONTENT

UNIT I GENERAL GEOLOGY 09 Hrs

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

UNIT II PHYSICAL GEOLOGY 09 Hrs

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

UNIT III GEOLOGICAL HAZARDS 09 Hrs

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

UNIT IV ENGINEERING GEOLOGY 09 Hrs

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

UNIT V ROCK MECHANICS 09 Hrs

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

List of experiments:

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. Identification of symbols in maps.

Lecture= 15 Tutorial= 15 PRACTICAL= 15 Total= 45hrs

TEXT BOOKS

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons.
2. Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Engineering Geology, N.Chenna Kesavalu, JNTU College of Engineering, Hydrabad. (2014)
4. Engineering Geology, Subinoy Gangopadhyay,(2016)

REFERENCES

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

E-REFERENCES

NPTEL Video Lectures on Engineering Geology

COs Versus POs Mapping

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

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE 404	MECHANICS OF FLUIDS	2	0	2	3

Course Outcomes		Domain C or P or A
CO1	Understand the broad principles of fluid statics, kinematics and dynamics	C
CO2	Understand definitions of the basic terms used in fluid mechanics	C
CO3	Understand classifications of fluid flow	C & A
CO4	Application of the continuity, momentum and energy principles	C & A& P
CO5	Understanding and analyzing distribution of water through pipe	C & A& P

COURSE CONTENT

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

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

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

UNIT II **FLUID KINEMATICS** **6hrs**

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

UNIT III **FLUID DYNAMICS** **9 hrs**

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

UNIT IV LAMINAR AND TURBULENT FLOW 9 hrs

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

Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow.
Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

UNIT V FLOW THROUGH PIPES 9 hrs

Loss of head through pipes, Darcy-Wisbech equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

LAB EXPERIMENTS 30 hrs

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

L-45 hrs ; P-30hrs; Total – 75 hrs

TEXT BOOKS

1. R.K.Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand & Company Ltd., New Delhi, 2002.
2. Bansal, R. K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 2011.
3. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by P. N. Modi& S. M. Sethi Standard Publishers, New Delhi.
4. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by K. R. Arora, Standard Publishers, New Delhi.

REFERENCES

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

CO vs PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1			3	1			2	3	1		3	2	2
CO2				3	3	2		1	3	2	1	1	1	1
CO3		2	1	3	1	3		3	3	1		3	2	
CO4	1		2	3	2	3		2	1			3	1	**2**
CO5		2	1	3	3	1	1	1	2	2		3	2	**2**
	2	4	4	15	10	9	1	9	12	6	1	13	8	**7**

1 – Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE405	MECHANICS OF SOLIDS	2	0	2	3

Course Outcome:	After the completion of the course, students will be able to	**Domain C or P or A**
CO1	Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress	C (Analyse) P (Measure)
CO2	Calculate the shear force and bending moment occurs at various loading conditions.	C (Analyse) A (Response)
CO3	Evaluate the shear stress distribution for beams of various sections	C (Analyse) & P(Measure)
CO4	Calculate the deflection at any point on a beam subjected to a combination of loads	C (Analyse) & P(Measure)
CO5	Evaluate torsion problems in bars and thin walled members.	C (Analyse) & P(Measure)

COURSE CONTENT

UNIT I Simple Stresses and Strains

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

UNIT II Shear Force and Bending moment

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

UNIT III Flexural Stresses and Shear Stresses

Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV **Slope and Deflection**

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams

UNIT V **Torsion and Thin Cylinders**

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures

PRACTICAL

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

TEXT BOOKS

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

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

CO vs PO Mapping

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

1 - Low , 2 – Medium , 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE406	GEOTECHNICAL ENGINEERING	2	0	2	3

COURSE OUTCOMES		DOMAIN	LEVEL
At the end of this course, the students should be able to			
CO1	Carry out soil classification, solve any PRACTICAL problems related to soil stresses estimation, permeability and seepage including flow net diagram	Cognitive Psychomotor Affective	Understanding Observation Responding
CO2	Estimate the stresses under any system of foundation loads solve PRACTICAL problems related to consolidation settlement and time rate of settlement	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO3	Transfer the concept of soil investigation for any civil engineering construction	Cognitive, Psychomotor Affective	Applying Manipulation Valuing
CO4	Analyze earth retaining structures for any kind of soil medium	Cognitive	Analyse
CO5	Evaluate bearing capacity for proper foundations for any kind of shallow foundation system	Cognitive Affective	Understanding Responding
CO6	Assess the pile and pile group capacity for any kind of soil including group efficiency and negative friction	Cognitive Affective	Understanding Responding

UNIT I **Basic Properties and effect of water in soil**

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

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

UNIT II **Stress distribution in soil and Shear strength**

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

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

UNIT III **Compressibility, Consolidation and Compaction**

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

UNIT IV **Soil exploration, Lateral Earth Pressure and Stability of Slopes**

Planning - Augur boring - Soundings - Sampling - Plate load test, static and dynamic penetrations tests - geophysical explorations

Plastic equilibrium - Rankine's theory - Active and passive earth pressure for cohesionless and cohesive soils - Earth pressure at rest - Coloumb's wedge theory - Rebhann's and Culmann's graphical solutions, Stability analysis

Stability of finite slopes -Toe failure, base failure, slip failure - Swedish Circle Method- Friction circle method- Factor of safety with respect to cohesion and angle of internal friction - Stability number - Stability charts

UNIT V **Foundations**

Functions and requisites- Different types - choice of foundation type – general principles of design. Bearing capacity - types of failures - Prandtl's and Terzaghi's bearing capacity analysis - Bearing capacity based on settlement and building codes

Shallow foundation - spread footings - combined footings - trapezoidal and strap footings - Raft foundation - Contact pressure distribution - settlement analysis - Types of settlement, control

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

LAB EXPERIMENTS **30 HRS**

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

L-30 hrs ; P-30hrs; Total – 60 hrs

TEXT BOOKS

1. Arora K. R., Geotechnical Engineering, Standard Publishers, 2006.
2. Purushothamaraj P., Soil Mechanics and Foundation Engineering, Dorling Kindersley(India) Pvt. Ltd., 2013
3. Venkatramaiah, Geotechnical Engg, Universities Press, 2000.
4. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
5. A V Narasimha Rao and C Venkatramaiah, Numerical Problems, Examples and Objective questions in Geotechnical Engineering, Universities Press (India) Ltd., 2000

REFERENCES

1. Gopal Ranjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi, 2002.
2. Murthy, V.N.S., A text book of Soil Mechanics and Foundation Engineering, UBS Publishers Distributors Ltd., New Delhi, 1999
3. Braja M. Das, Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore, 2005.
4. Taylor D.W., Fundamentals of Soil Mechanics, Asia Publishing House, 1948.
5. Terzaghi K. and R. B. Peck, Soil Mechanics in Engineering Practice, John Wiley, 1967.

CO vs PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	3			3				1			1	1	1
CO2	2	3			3				1			2	1	1
CO3	2	2						1					1	1
CO4	3	2			1		1		**1**				1	1
CO5	2	1			1								1	1
CO6	2	1			1								1	1

1 - Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE407	SURVEYING - II	2	0	2	3

COURSE OUTCOMES		DOMAIN	LEVEL
At the end of this course, the students should be able to			
CO1	***Illustrate*** the features of Triangulation system	Cognitive	Applying
CO2	**Understand** the importance of advanced techniques involved in surveying such as Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.	Cognitive	Applying
CO3	**Apply** the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities	Cognitive Psychomotor	Applying Guided Response
CO4	**Translate** the knowledge gained for the implementation of Civil infrastructure facilities	Cognitive Psychomotor Affective	Applying Guided Response Responding
CO5	**Relate** the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.	Cognitive Affective	Understanding Responding

COURSE CONTENT

UNIT I TRIANGULATION AND TRILATERATION 09 Hrs

Triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Intervisibility of height and distances - Trigonometric levelling - Axis single corrections

UNIT II CURVE SETTING 09 Hrs

Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

UNIT III MODERN FIELD SURVEY SYSTEMS 09 Hrs

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

UNIT IV PHOTOGRAMMETRY SURVEYING 09 Hrs

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

UNIT V REMOTE SENSING 09 Hrs

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

Lecture= 15 Tutorial= 15 PRACTICAL= 15 Total= 45hrs

TEXT BOOKS

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

REFERENCES

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

E-REFERENCES

NPTEL Video Lectures on Surveying

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

COs Versus POs Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	3	3	3	2	1	3	2	3	3	3	3	3
CO 2	2	1	3	3	3	2	1	3	2	3	3	3	3	3
CO 3	3	2	3	1	3	2	0	1	1	0	2	3	3	3
CO 4	2	3	2	1	3	3	3	3	1	1	2	3	3	2
CO 5	3	3	1	1	3	2	0	2	2	3	2	3	1	2

1 - Low, 2 – Medium, 3 – High

SEMESTER	COURSE CODE	COURSE NAME	L	T	P	C
IV	XCE 408	MATERIALS TESTING & EVALUATION	2	0	2	3

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

COURSE CONTENT

UNIT I Construction Materials

Brick and Stones, Cements, M-Sand, Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material, geo-textiles, rubber, asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses

UNIT II Introduction to Material Testing

Mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different materials (brittle, quasi-brittle, elastic etc.,) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramics; Internal friction, creep – fundamentals and characteristics; Brittle fracture of steel – temperature transition approach

UNIT III Standard Testing & Evaluation

Mechanical testing and discussion, Naming systems for various irons, steels and nonferrous metals - Elastic deformation; Plastic deformation; Impact test

UNIT IV Fracture mechanics

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

UNIT V Special Concretes

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

PRACTICAL

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

TEXT BOOKS

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

REFERENCES

1. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications
2. E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition
3. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post 2000)
4. Related papers published in international journals

Mapping of CO's with PO's:

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

1 - Low , 2 – Medium , 3 – High