RashtreeyaSikshanaSamithi Trust

R.V COLLEGE OF ENGINEERING

(Autonomous Institution affiliated to VTU, Belagavi)

R.V. Vidyaniketan Post, Mysuru Road
Bengaluru – 560 059

SCHEME & SYLLABUS

3rd to 4thSemesters

B.E-Civil Engineering

(2016 Scheme)

Departmentvision

Excel in Education, Research and Consultancy in Civil Engineering with emphasis on Sustainable Development

Department mission

- Disseminating and integrating the knowledge of civil engineering and allied fields.
- Enhancing industry-institute interaction leading to interdisciplinary research.
- Imbibing wide-range of skills in cutting-edge technology for sustainable development.
- Motivate entrepreneurship and professional ethics to serve the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO	Description
PEO1	Successfully address technological and managerial challenges
PEO2	Professionally design and execute Civil Engineering projects
PEO3	Pursue advanced education, research and continue life-long learning process to remain active professionals
PEO4	Play key roles in addressing societal needs through interdisciplinary approach

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with t h e 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.

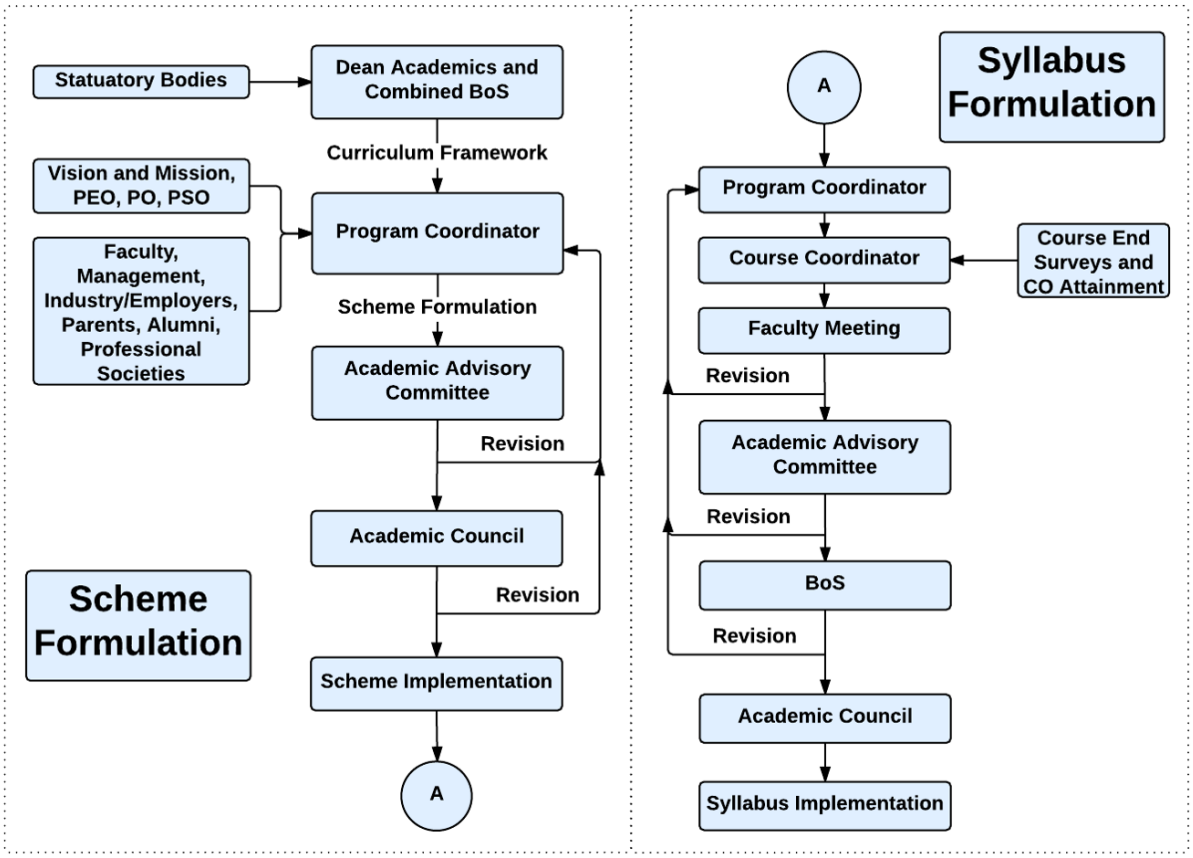
12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

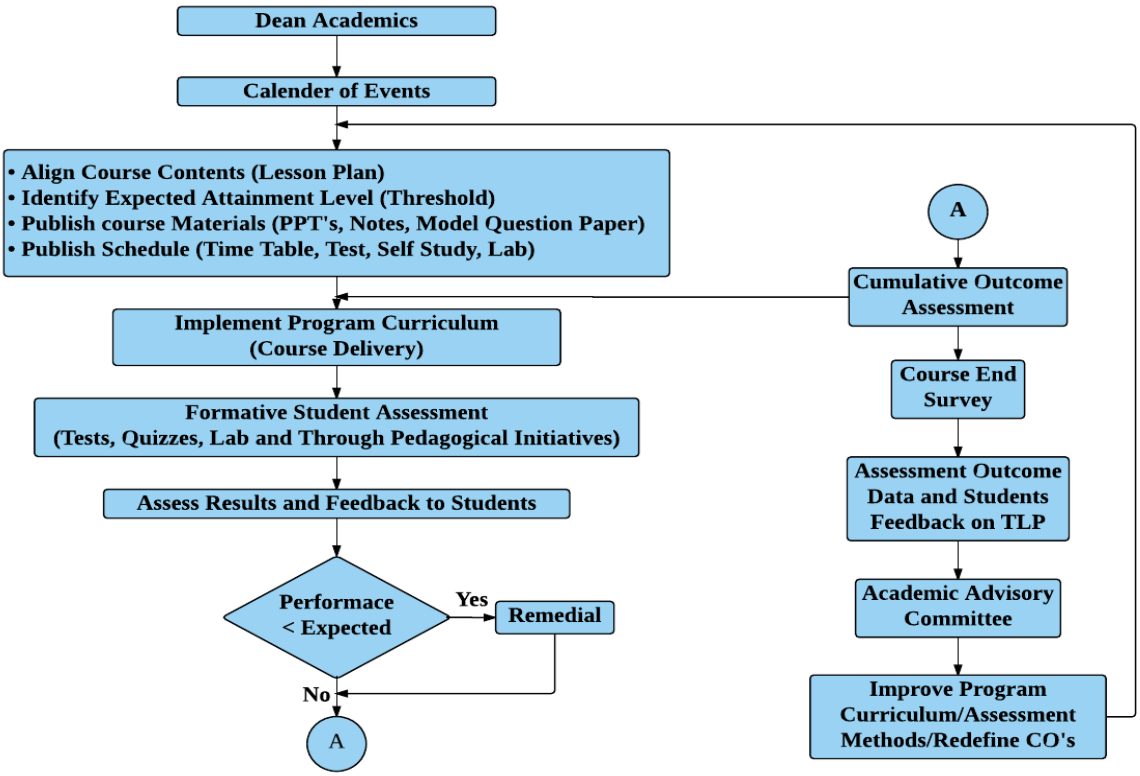
PSO	Description
PSO1	Apply knowledge of fundamental aspects to analyze and design civil engineering structures
PSO2	Provide sustainable solutions to civil engineering problems
PSO3	Employ codal provisions to arrive at comprehensive solutions to address societal needs
PSO4	Exhibit communication and teamwork skills

Lead Society: American Society of Civil Engineers (ASCE)

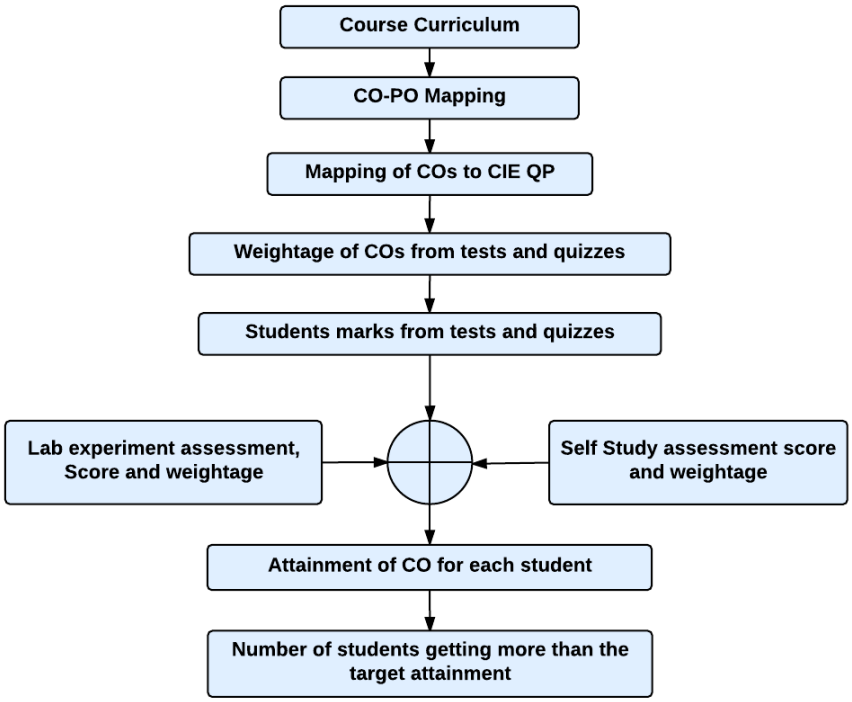
Curriculum Design Process



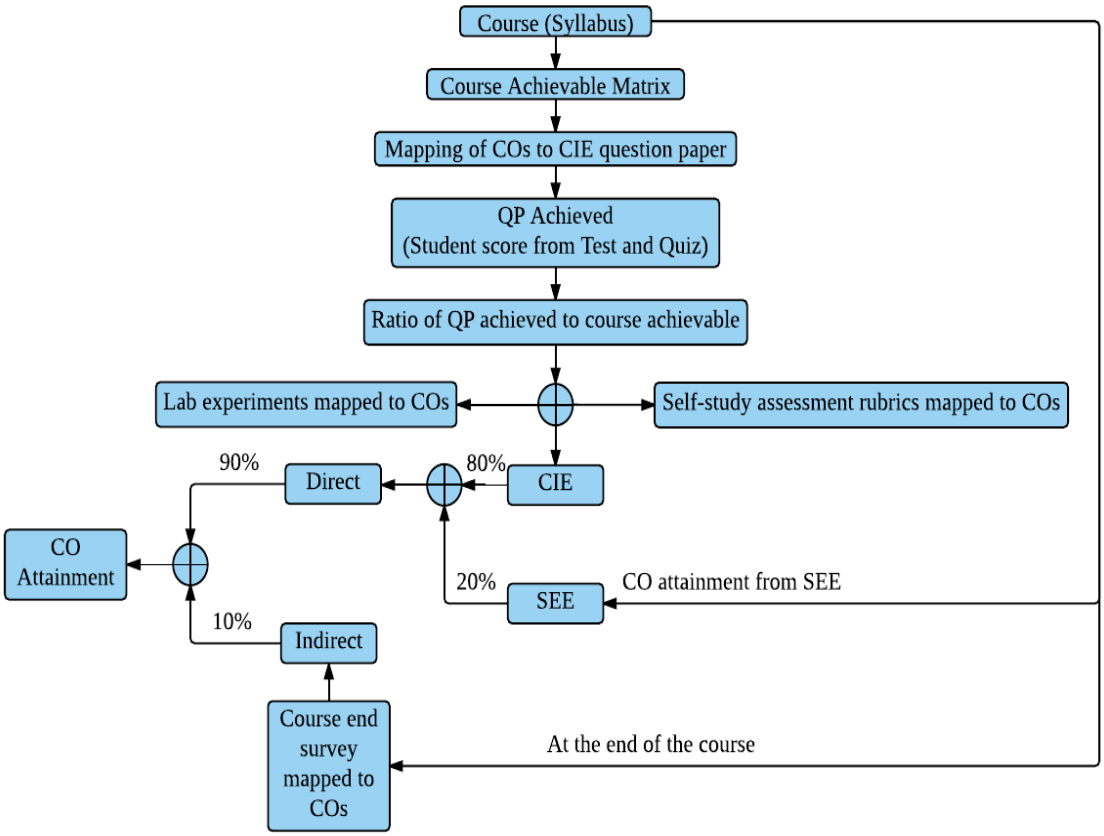
Academic Planning and Implementation



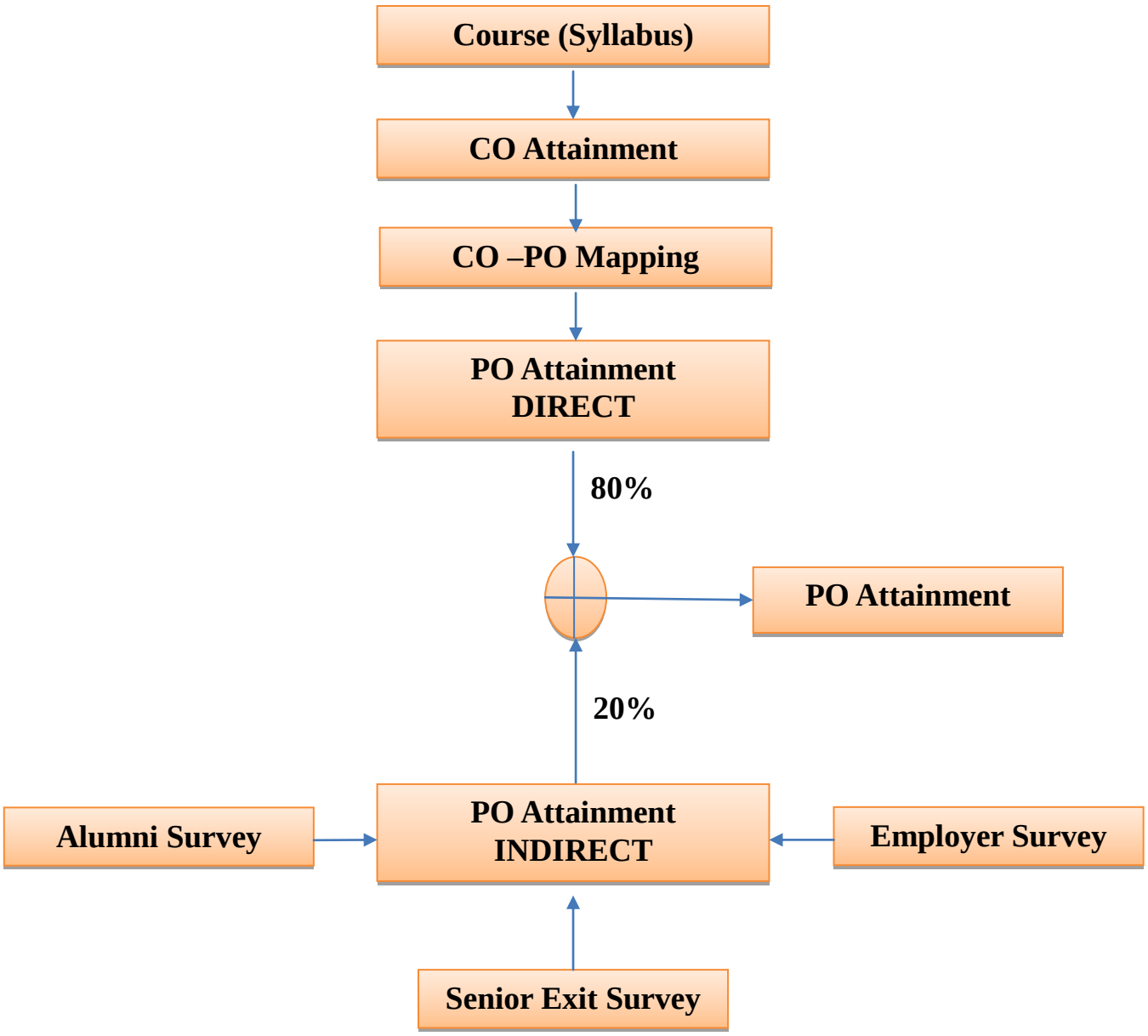
PROCESS FOR COURSE OUTCOME ATTAINMENT



Final CO Attainment Process



Program Outcome Attainment Process



Guidelines for Fixing Targets

- The target may be fixed based on last 3 years' average attainment

Credits Distribution as per UGC/VTU

Sl. No.	Category	Percentage (%)	Minimum No. of credits	2016 scheme	
				Without Mini Project	With Mini Project
1	Humanities	5-10	10	9+2	9+2
2	Basic Science	15-20	30	30	30
3	Engineering Science	15-20	30	30	30
4	Professional Core Courses (PC)	30-40	60	78+3=81 (3 credits core in place of Minor project in 7th semester)	81-3=78 (3 Credits for minor project in 7th semester)
5	Professional Elective Courses	10-15	20	20	20
6	Other Electives	5-10	10	10	10
7	Project Work	10-15	20	16+2 Major project +Tech. Seminar	16+2+3 Major project +Tech. Seminar +Mini Project
				200	200

R. V. COLLEGE OF ENGINEERING, BENGALURU – 59.

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DEPARTMENT OF CIVIL ENGINEERING

SCHEME OF TEACHING AND EXAMINATION

THIRD SEMESTER								
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**SS (EL)**	
1	16MA31C	Applied Mathematics-III	Maths	3	1	0	0	4
2	16EM32A	Engineering Materials	CV	2	0	0	0	2
3	16CV33	Strength of Materials	CV	3	0	1	0	4
4	16CV34	Concrete Technology	CV	3	0	1	1	5
5	16CV35	Fluid Mechanics	CV	3	0	1	1	5
6	16CV36	Water supply and Treatment Engineering	CV	3	0	0	1	4
7	16DMA37	Bridge Course Mathematics*	Maths	2	0	0	0	0
		Total No. of Credits						24
		No. of Hrs.		17+2	2	6	12**	25

*Mandatory Audit course for lateral entry diploma students

** Non-contact hours

1Hr. Theory= 1 credit **2Hrs. Practical=1credit** **2Hrs. Tutorial=1 credit** **4Hrs. SS(EL) = 1 Credit**

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DEPARTMENT OF CIVIL ENGINEERING

SCHEME OF TEACHING AND EXAMINATION

FOURTH SEMESTER								
Sl. No	Course Code	Course Title	BOS	Credit Allocation				Total Credits
				Lecture	Tutorial	Practical	SS (EL)	
1	16MA41C	Applied Mathematics IV	Maths	3	1	0	0	4
2	16ET42	Environmental Technology	BT	2	0	0	0	2
3	16CV43	Theory of Structures	CV	3	0	0	1	4
4	16CV44	Building Construction and Planning	CV	3	0	1	1	5
5	16CV45	Surveying	CV	3	0	1	0	4
6	16CV46	Waste Water Engineering	CV	3	0	1	1	5
7	16HS47	Professional Practice-II (Communication Skills and Professional Ethics) $	HSS	0	0	0	0	1
8	16DCS48	Bridge Course C Programming *	CSE	2	0	0	0	0
9	16CV49	Water Resources Engineering	CV	3	0	0	0	3
		Total No. of Credits						28
		No. of Hrs.		20+2	2	6	12**	28

*Mandatory Audit course for lateral entry diploma students **Non contact hours

$ 3 days (18 Hrs) in 3RD semester and 3 days (18 Hrs) in 4th semester, in the event of student not able to take the regular allotment, may have to complete this credit by attending other branch program.

1Hr. Theory= 1 credit **2Hrs. Practical=1credit** **2Hrs. Tutorial=1 credit** **4Hrs. SS(EL) = 1 Credit**

Semester: III		
APPLIED MATHEMATICS – III (ASE,BT,CH,CV,IEM,ME)		
Course Code: 16MA31C		**CIE Marks: 100**
Credits: L:T:P:S: 3:1:0:0		**SEE Marks: 100**
Hours: 40		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	Identify and solve initial value problems, physically interpret the solution using Laplace Transforms and Inverse Laplace transforms.
2	Evaluate extremal of integrals involving functional with applications to physical situations.
3	Understand the basics of Matrix theory, Eigenvalues and Eigenvectors, solution of system of linear equations.
4	Analyze the given set of experimental data and fit suitable approximating curves.

UNIT-I	
LAPLACE TRANSFORM Existence and uniqueness of Laplace Transform (LT), Transform of elementary functions, RoC. Properties of LT: Linearity, change of scale and first shifting. Transform of function multiplied by tn, division by t, derivatives and integral. LT of periodic function, Heaviside unit step function, Unit impulse function. Heaviside shift (second shift) theorem.	**09 Hrs**
UNIT–II	
INVERSE LAPLACE TRANSFORM Definition, properties of inverse Laplace transform, evaluation using different methods. Convolution theorem, problems. Application to solve ordinary linear differential equations and simultaneous differential equations.	**09 Hrs**
UNIT-III	
CALCULUS OF VARIATION Introduction of variation of functions, extremal of a functional, Euler's equation-special cases-problems. Geodesics-problems, Hanging cable problem and Brachistochrome problem.	**09 Hrs**
UNIT-IV	
LINEAR ALGEBRA Rank of matrices-rank of matrix by Echelon form, consistency of system of linear equations- homogeneous and non-homogeneous equations, Gauss elimination, Gauss Jordan, Gauss Seidel methods, Eigen values and Eigen vectors-properties, largest Eigen value by Power method.	**09 Hrs**
UNIT-V	
STATISTICS Curve fitting by method of least squares, fitting of curves-linear, parabolic, exponential, power functions. Correlation and Regression analysis – problems.	**09 Hrs**

Course outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental concepts of - Laplace and inverse Laplace transforms variation of functions, elementary transformation of matrices and method of least squares.
CO2:	Demonstrate - the properties of Laplace and inverse Laplace transforms knowledge of extremal of functional, Eigen values, Eigen vectors and correlation.

CO3:	Apply - Laplace and inverse Laplace transform technique to solve differential equations, Euler's equation to solve variational problems, matrix methods to solve system of linear equations, regression analysis for curve fitting.
CO4:	Analyze and interpret- solution of IVP and BVP, solution of functional, solution of linear systems, statistical data occurring in Engineering problems.

Reference Books	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007, ISBN: 81-7409-195-5.
2.	B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2008, ISBN: 13-978-07-063419-0; ISBN: 10-0-07-063419-X.
3.	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2007, ISBN: 978-81-265-3135-6.
4.	Introduction to Probability and Statistics by Lipshutz and Schiller (Schaum's outline series), ISBN:0-07-038084-8

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Assignment/ Experiential Learning
Quiz -1	10
Test -1	50
Quiz -2	10
Quiz -3	10
Test -2	50
Experiential Learning	10
Final Evaluation	Quiz 10+10+10=30; Test 50+50=100, reduced to 60, Experiential Learning:10

Note:

- **All the three tests and quiz are compulsory**

Semester End Evaluation Theory (100)	
Part- –A **Objective type questions**	**20**
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	15	Answer Scripts	80%	100%	90%
		Test		Two	30				
		Assignment		2 phases	05	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	50	Answer Scripts	20%		
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**-**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Low-1 Medium-2 High-3

Semester: III		
Course Title: ENGINEERING MATERIALS		
Course Code:16EM32A		**CIE Marks: 50**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 50**
Hours: 24		**SEE Duration: 2 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the behaviour and properties of Engineering materials
2	Recognize various types of engineering materials used in construction industry
3	Compare behaviour of various engineering materials in construction industry
4	Describe properties of engineering materials in civil engineering

UNIT-I	
Stones: Physical properties of minerals, major rock forming minerals, occurrence and use of minerals. Introduction to major rock types (Igneous, sedimentary and metamorphic rocks); their genesis, classification and structures; Engineering properties of rocks, advantages and disadvantages of different rock types at constructions sites. Common building stones in India and its uses.	**05 Hrs**
UNIT-II	
Coarse and Fine Aggregates: Properties of Coarse and Fine Aggregates,Source of sand , classification of Coarse and Fine Aggregates ,bulking of sand, properties of good Coarse and Fine Aggregates.	**05 Hrs**
UNIT-III	
Timber, Classification of timber, qualities of good timber, common timbers used for building work, Types of plywood **Building blocks**, Bricks, concrete block. and hollow concrete block types, manufacturing process, properties, classification..	**05 Hrs**
UNIT-IV	
Metals: Types and properties of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminium.	**04 Hrs**
UNIT-V	
Materials: Clay products, ceramics –Refractories Fibre Textiles – Geosynthetics for Civil Engineering applications, Polymers in Civil Engineering, Recycling of waste material as building material	**05 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the properties of engineering materials
CO2:	Select suitable various types of engineering materials to be used in construction industry
CO3:	Examine the behaviour of various engineering materials in construction industry
CO4:	Illustrate the properties of engineering materials in civil engineering

Reference Books	
1.	Parbin Singh, Engineering and General Geology, Katson Publication House, 1987.
2.	Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005
3.	Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998

4.	SateesgGopi "Basic civil engineering" Pearson publication ISBN 9788131729885

Continuous Internal Evaluation (CIE) (Theory – 50 Marks)	
Evaluation method	Course with Assignment
Quiz -1	05
Test -1	30
Quiz -2	05
Quiz -3	05
Test -2	30
Assignment	05
Final Evaluation	Quiz 05+05+05=15; Test 30+30=60; Reduced to 30, Assignment:05

Semester End Evaluation Theory (50)	
Part- –A Objective type questions	**10**
Part –B There should be five questions from five units. Each question should be for maximum of 08 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**40**
Total	**50**

	What		**To whom**	**Frequency of conduction**	**Max Marks**	**Evidence**	**Contribution to Course Outcome**		
Direct Assessment Methods	CIE	Quiz	Students	Three	15	Answer Scripts	80%	100%	90%
		Test		Two	30				
		Assignment		2 phases	05	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	50	Answer Scripts	20%		

Indirect Assessment methods	Course End Survey	Students	End of course		Questionnaire Based on COs	10%

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	1	-	-	-	-	1
CO2	3	2	-	-	-	-	1	-	-	-	-	1
CO3	3	2	-	-	-	-	1	-	-	-	-	1
CO4	3	2	-	-	-	-	1	-	-	-	-	1

Low-1 Medium-2 High-3

Semester: III		
Course Title: STRENGTH OF MATERIALS		
Course Code:16CV33		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:0		**SEE Marks: 100+50**
Hours: 36		**SEE Duration: 3 Hrs+3 Hrs**

Course Learning Objectives: The students will be able to	
1	Determine the two dimensional stress systems and analyze the Shear force and bending moment for beam elements
2	Evaluate the behaviour of column and strut under compression
3	Compare the behaviour of solid and hollow shaft under various loading condition
4	Examine the mechanical properties of various materials under tensile, compressive, torsion and impact loading

UNIT-I	
Bending moment and shear force: shear force and Bending moment for Statically determinate beams,, Sign conventions, Relationship between loading, shear force and bending moment. S.F and B M diagrams for cantilever, simply supported and over hanging beams subjected to point load, UDL, UVL, moment, Couple and combinations - Numerical problems.	**07 Hrs**
UNIT-II	
Bending stress and shear stress in beams: Introduction, Assumptions in simple bending theory, Derivation of Bernoulli's equation, modulus of rupture, section modulus, flexural rigidity, expression for horizontal shear stress in beam, variation of bending stress and shear stress diagram for cross-sections-rectangular, T and I sections - Numerical problems.	**07 Hrs**
UNIT-III	
Deflection of determinate Beams: Introduction, Elastic curve –Derivation of differential equation of flexure, Sign convention, Slope and deflection using double integration method and Macaulay's method for beams subjected to point loads ,UDL, moment, couple and their combinations. Numerical problems.	**07 Hrs**
UNIT-IV	
Analysis of columns and struts: Introduction, short and long columns, radius of gyration, slenderness ratio, buckling load, effective length, Euler's theory of columns, Derivation of Euler's Buckling load for columns with different end conditions, Limitations of Euler's theory, Rankine's formula. Numerical problems on solid and hollow column section.	**07 Hrs**
UNIT-V	
Two Dimensional Stress Systems: Introduction, Stress components on inclined planes, Principal Stresses, principal planes- Analytical and Mohr's circle methods of stress computations - Numerical problems. Temperature Stresses of homogeneous materials – Numerical problems. **Torsion:** Assumptions in theory of pure torsion, Torsion equation, Torsional rigidity and modulus of rupture, power transmitted, Comparison of solid and hollow circular shafts. Numerical problems.	**08 Hrs**

PART-B(Laboratory)	
1. Dimensionality of bricks, Water absorption, Initial rate of absorption 2. Fineness modulus of Fine and Coarse aggregate 3. Compressive strength tests on building blocks (brick, solid blocks and hollow blocks) 4. Tension test on Mild steel and HYSD bars 5. Compression test on HYSD, Cast iron 6. Torsion test on Mild Steel circular sections – solid sections. 7. Bending Test on Wood under two point loading. 8. Shear Test on Mild steel – single and double shear 9. Impact test on Mild Steel (Charpy & Izod) 10. Vickers Hardness tests	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the mechanical behaviour of various elements
CO2:	Apply the basic concepts of mechanics in determining the stress developed in the materials
CO3:	Evaluate the behaviour of materials under various loading condition
CO4:	Examine the mechanical properties of various materials under different loading conditions

Reference Books	
1.	R. C. Hibbler "Mechanics of Materials" Eight Edition, Pearson Publications, ISBN 13: 978-0-13-602230-5
2.	Timoshenko and Young "Elements of Strength of Materials", Affiliated East-West Press
3.	F.P.Beer and R.Johnston, "Mechanics of Materials", McGraw-Hill Publishers, 2006 ISBN 9780073529387
4.	S.Ramamrutham, R.Narayanan"Strength of Materials", DhanapathRai Publishing company, New Delhi ,2012 ISBN 818743354X

Continuous Internal Evaluation (CIE) (Theory and Laboratory – 150 Marks)				
(Theory – 100 Marks)		**(Laboratory- 50 Marks)**		**Total (150)**
Evaluation method	**Course with assignment**			
Quiz -1	10	Performance of the student in the laboratory, every week	40	
Test -1	50			
Quiz -2	10			
Quiz -3	10	Test at the end of the semester	10	
Test -2	50			
Assignments	10			
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100 Reduced to 60, Assignment 10	**Total**	**50**	**150**

Semester End Evaluation (SEE) (Theory and Laboratory – 150 Marks)				
Theory (100 Marks)		**Laboratory (50 Marks)**		**Total (150)**
Part- –A **Objective type questions**	**20**	**Experiment Conduction with proper results**	40	
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1, UNIT-4 and UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**	**Viva**	10	
Total	**100**	**Total**	**50**	**150**

	What		**To whom**	**Frequency of conduction**	**Max Marks**	**Evidence**	**Contribution to Course Outcome**		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	60				
		Assignment		2 phases	10	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	1	2	-	-	-	-	-	-	-	1
CO3	-	1	-	3	-	-	-	-	-	-	-	-
CO4	-	-	2	3	-	-	-	-	-	-	-	-

Low-1 Medium-2 High-3

Semester: III		
Course Title: CONCRETE TECHNOLOGY		
Course Code:16CV34		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:1		**SEE Marks: 100+50**
Hours: 35		**SEE Duration: 3Hrs + 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Outline the manufacturing and types of cements and concrete and its application.
2	Assess the methods of measuring properties of concrete
3	Describe various strength of concretes and enhancing the properties of concrete using admixture
4	Analyze the methods of mix proportion and importance of ready mix concrete

UNIT-I	
Cement: Manufacturing of cement (dry and wet process), Hydraulic Cement, Bogue's compounds, Types of cement, Hydration, product of hydration and its importance, importance of water cement ratio, Transition zone, brief description of fieldand laboratory testing of cement. Water and its Quality, Gel space ratio (Numerical problems)	**07 Hrs**
UNIT-II	
Concrete: Manufacturing Concrete: Mixing, Transporting, Placing, Compaction and Curing, Segregation, Bleeding. Workability: Factors affecting workability, Measurement by various tests, Recommendations of IS: 456-2000 - Sampling procedure, Acceptance criteria.	**07 Hrs**
UNIT-III	
Admixtures: Chemical admixtures. Action of plasticizers, Water reducers, superplasticizers, accelerators, retarders, air entraining admixtures. Mineral admixtures: GGBS, fly ash, metakaolin, silica fume Significance of Durability in concrete – Cracking, chemical attack, Alkali aggregate reaction, Permeability, water absorption, Sorptivity.	**07 Hrs**
UNIT-IV	
Strength Compressive Strength Factors affecting, Abrams' law, Importance of Strength development with age, Maturity concept (Numerical Problems), accelerated curing, Relation between compressive and tensile strength, Flexural strength, Methods of finding the strength. Importance of Nondestructive tests, Rebound hammer test, Ultra sonic pulse velocity test. Procedure to conduct tests – Penetration and pull out test	**07 Hrs**
UNIT-V	
Concrete mix Design: Significance and objectives of concrete mix proportioning, General Considerations, Mix proportioning using IS 10262 : 2009 method (Numerical problems) **RMC**-Advantages, components of RMC plant, Concrete specifications, Distribution and transport, Conditions of sale and product liability.	**07 Hrs**
Experiential learning	
Compatibility of cement and admixture, Bulking of sand Different types of concrete,	
Laboratory	
1. Bulking of sand and water absorption of coarse aggregate. 2. Specific gravity of cement, Fine and Coarse aggregate 3. Consistency of Cement, Initial and final setting time of cement, 4. Compressive Strength of cement	

5. Mix Design and Workability tests on fresh concrete (Slump Test, Compaction Factor Test and Vee-Bee consistometer) 6. Tests on Hardened concrete Properties(Compressive Strength, Split Tensile Strength) 7. Demonstration Experiment • Soundness test • Flexural Strength • Flow test on cement mortar • Non Destructive Testing of concrete	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the properties of cement and concrete
CO2:	Assess the quality of ingredients of concrete
CO3:	Identify the concrete for specific application
CO4:	Proportion the concrete mix for a particular requirement

Reference Books	
1.	Shanthakumar.A.R, Concrete technology, Oxford University Press, New Delhi, 2007,ISBN 978 0195671537
2.	Shetty. M.S., Concrete Technology Theory and Practice, S.Chand& Co Ltd., New Delhi, 2007 **ISBN-13:** 978-8121900034
3.	Kumar Mehtha.P and Paulo J M Monteiro., Concrete Microstructre, Properties and Materials, Indian Edition, Indian Concrete Institute, Chennai, 1997 **ISBN-13:** 978-9339204761 **Publisher:** McGraw Hill Education; 4 edition (1 April 2014)
4.	Neville. A.M, Properties of concrete V Edition,(2012) Peaerson Education, Inc, and Dorling Kindersley Publishing Inc. **ISBN-13:** 978-8131791073
5.	Gambhir M L., Concrete Technology theory and Practice, Fifth Edition, Tata McGraw Hill Education private Ltd, New Delhi. 2013 **ISBN-13:** 978-1259062551
6	IS 10262 : 2009, Concrete Mix proportioning guidelines, First Revision.2009. IS 456:2000 Plain and Reinforced Concrete

Continuous Internal Evaluation (CIE) (Theory and Laboratory – 150 Marks)				
(Theory – 100 Marks)		**(Laboratory- 50 Marks)**		**Total (150)**
Evaluation method	**Course with assignment**			
Quiz -1	10	Performance of the student in the laboratory, every week	40	**150**
Test -1	50			
Quiz -2	10			
Quiz -3	10	Test at the end of the semester	10	
Test -2	50			
Experiential Learning	20	**Total**	**50**	
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 50, Experiential Learning 20			

<table>
<tr><th colspan="5">Semester End Evaluation (SEE)
(Theory and Laboratory – 150 Marks)</th></tr>
<tr><th colspan="2">Theory (100 Marks)</th><th colspan="2">Laboratory (50 Marks)</th><th>Total (150)</th></tr>
<tr><td>Part- –A
Objective type questions</td><td>20</td><td rowspan="2">Experiment Conduction with proper results</td><td>40</td><td rowspan="3"></td></tr>
<tr><td rowspan="2">Part –B
There should be five questions from five units. Each question should be for maximum of 16 Marks.

The UNIT-1, UNIT-4 and UNIT-5 should not have any choice.

The UNIT-2 and UNIT-3 should have an internal choice.
Both the questions should be of the same complexity in terms of COs and Bloom’s taxonomy level.</td><td rowspan="2">80</td></tr>
<tr><td>Viva</td><td>10</td></tr>
<tr><td>Total</td><td>100</td><td>Total</td><td>50</td><td>150</td></tr>
</table>

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	2	3	-	2	2	2	3	1	-	-
CO2	2	2	1	2	-	1	3	2	3	2	-	-
CO3	2	2	2	-	-	1	3	2	3	2	-	-
CO4	2	2	-	1	-	2	3	1	3	2	-	-

Low-1 Medium-2 High-3

Semester: III		
Course Title: FLUID MECHANICS		
Course Code:16CV35		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:1		**SEE Marks: 100+50**
Hours: 36		**SEE Duration: 3Hrs + 3 Hrs**

Course Learning Objectives: The students will be able to

1	Describe fundamental properties of fluids and its applications.
2	Analyze hydrostatic laws and its applications to solve practical problem.
3	Apply the principles of Kinematics and Hydro-Dynamics for practical applications
4	Examine basic flow rate measurement techniques.

UNIT-I	
Fluid Properties: Definition of fluid properties and fluid characterization for its usage. **Fluid Pressure and its measurement:** Pascal's Law, Variation of pressure in fluids; Absolute and Gauge pressure and their relationship; Measurement of pressure using simple and differential Manometer, Numerical problems. **Hydrostatic Forces on surfaces:** Calculation of Force on submerged planes (vertical and inclined planes), Definition of Centre of pressure and its determination.	**08 Hrs**
UNIT-II	
Kinematics of fluid flow: Classification of flows; Steady and unsteady, uniform and non-uniform, laminar and Turbulent- Rotational and Irrotational flow. **Dynamics of fluid flow:** Laws of Mass, Energy and Momentum, continuity equation (one dimensional), Euler's equation, Bernoulli's equation, modified Bernoulli's equation limitations and its application, Numerical problems.	**07 Hrs**
UNIT-III	
Flow through pipes: Major loss, minor loss, Darcy-Weisbach Equation, Hydraulic gradient line, Total Energy Line. Series and parallel network of pipes, numerical problems. **Orifice and mouth piece:** Hydraulic coefficients, concept of orifice and mouth piece (no numerical problems). **Notches and Weirs:** Definition of Notch, Weir, Flow through V-notch, Rectangular weir, corrections for velocity of approach, end contractions, Cippoletti weir, Notch Sensitivity, numerical problems.	**07 Hrs**
UNIT-IV	
Flow through Open Channel: Calculation of velocity using Chezy and Manning's experiments, Hydraulic efficient channels: Rectangular and Trapezoidal channel, numerical problems. Specific energy, critical depth, Froude's number, specific Energy diagram, subcritical and supercritical flows, Alternative depths, Hydraulic jump, numerical problems.	**07 Hrs**
UNIT-V	
Impact of Jet on Vanes: Impact of Jet on Vanes on straight & curved vane without & with motion. Velocity triangles, its application in vane analysis numerical problems.	**07 Hrs**
PART-B(Laboratory)	
1. Calibration of 90^0 V-notch	

2. Calibration of Rectangular notch 3. Calibration of Cippoletti notch 4. Calibration of Ogee weir 5. Calibration of Venturimeter 6. Calibration of Orificemeter 7. Calibration of water meter 8. Determination of Hydraulic coefficients for orifice. 9. Determination of Hydraulic coefficients for Mouthpiece. 10. Determination of friction factor for a pipe. 11. Impact of jet on vanes 12. Determination of loss of energy in sudden expansion, contraction and Bends in a pipe.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Describe the different properties of fluids, for the flow characterization and measurements.
CO2:	Explain the behavior of the fluids under static and dynamic conditions.
CO3:	Apply continuity equation and energy equation in solving problems on flow through conduits.
CO4:	Distinguish and examine various flow measuring techniques.

Reference Books	
1.	P.N.Modi and S.M.Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House 2002, New Delhi, 14th edition, ISBN- 8190089374, 9788190089371.
2.	K. Subramanya "Flow in open Channels" Tata McGraw Hill, III Edition 2009, ISBN-0070086958, 9780070086951
3.	Frank M White "Fluid Mechanics" TATA McGraw Hill, New Delhi,8th Edition 2016. ISBN-10: 9385965492, ISBN-13: 978-9385965494
4.	Streeter: "Fluid Mechanics" 9th Edition, Tata McGraw Hill Publications.2010, ISBN-13:978-0-07-070140-3
5.	Dr.A.K.Jain, "Fluid Mechanics including Hydraulic Machines", Khanna Publishers, 12th Edition, ISBN-13-978-81-7409-194-7, ISBN 10 -81-7409-194-7.

Continuous Internal Evaluation (CIE) (Theory and Laboratory – 150 Marks)				
(Theory – 100 Marks)		**(Laboratory- 50 Marks)**		**Total (150)**
Evaluation method	**Course with Self - Study**			
Quiz -1	10	Performance of the student in the laboratory, every week	40	
Test -1	25			
Quiz -2	10			
Quiz -3	10	Test at the end of the semester	10	
Test -2	25			
Experiential Learning	20			
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100,	**Total**	**50**	**150**

	Reduced to 50, Experiential Learning 20			

Semester End Evaluation (SEE) **(Theory and Laboratory – 150 Marks)**				
Theory (100 Marks)		**Laboratory(50 Marks)**		**Total (150)**
Part- –A **Objective type questions**	**20**	**Experiment Conduction with proper results**	40	
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1, UNIT-4 and UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**	**Viva**	10	
Total	**100**	**Total**	**50**	**150**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	2	-	-	-	-	-	3	-	1
CO2	2	-	-	2	-	2	2	-	-	-	2	-
CO3	3	2	-	-	2	1	-	-	-	-	2	1
CO4	3	-	2	3	2	-	-	-	2	2	-	1

Low-1 Medium-2 High-3

Semester: III		
Course Title: WATER SUPPLY AND TREATMENT ENGINEERING		
Course Code:16CV36		**CIE Marks: 100**
Credits: L:T:P:S: 3:0:0:1		**SEE Marks: 100**
Hours: 36		**SEE Duration: 3Hrs**

Course Learning Objectives: The students will be able to	
1	To analyze the variation of water demand and to estimate water requirement for a community
2	To evaluate the sources and conveyance systems for raw and treated water
3	To study drinking water quality standards and to illustrate qualitative analysis of water
4	To design physical, chemical and biological treatment methods to ensure safe and potable water Supply

UNIT-I	
Introduction: Human activities and environmental pollution, Requirement of water for various beneficial uses. Need for protected water supply. **Demand of Water**: Types of water demands -domestic demand, institutional and commercial, public use, fire demand. Factors affecting percapita demand.Population forecasting - different methods with merits and demerits. Variations in demand of water. Peak factor, Design period and factors governing design period. Numerical problems.	**07 Hrs**
UNIT-II	
Quality of Water: Objectives of water quality management, Concept of safe water, wholesomeness and palatability.Water borne, water based, water washed and vector diseases. **Examination of Water**:- Sampling - Objectives, Methods, Preservation techniques. Physical, Chemical and Microbiological Examinations, (IS: 3025and IS: 1622) using analytical & Instrumental techniques. Drinking water BIS, ICMR standards & WHO guidelines, Health significance of Fluoride, Nitrates, Hardness and Heavy metals like Mercury and Cadmium. **Sources:** surface and subsurface sources -suitability with regard to quality and quantity.	**06 Hrs**
UNIT-III	
Collection and Conveyance of Water: Intake structures -different types of intakes – river, canal and reservoir intake. Design of the economical diameter for the rising main; Pipe appurtenances. Pipe materials: different materials with advantages and disadvantages. **Pumps:** Types of pumps with working principles. Numerical Problems**.** **Water Treatment:** Objectives, Treatment flow chart – significance of each unit	**07 Hrs**
UNIT-IV	
Aeration : Principle of working and types of aerators, Design of cascade aerator **Screening:** Types and design of bar screen. **Sedimentation** -theory, settling tanks, types, design. **Coagulation aided sedimentation**-types of coagulants, chemical feeding, flash mixing, flocculators -design of all units **Filtration:** mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Design of slow	**08 Hrs**

and rapid sand filter without under drainage system.	
UNIT-V	
Disinfection: Theory of disinfection, methods of disinfection, chlorination, chlorine demand, residual chlorine, break point chlorination. **Miscellaneous Treatment**: Softening, Fluoridation and De-fluoridation, Activated carbon treatment. **Distribution system:** Methods- Gravity, Pumping, Combined gravity and pumping system. Layouts : Dead end, Radial, Grid iron, Circular system. Network analysis in distribution system – Hardy cross method, Hazen- Williams formula.	**08 Hrs**

Course Outcomes: After completing the course, students will be able to	
CO1:	Estimate average and peak water demand for a community.
CO2:	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
CO3:	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
CO4:	Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

Reference Books	
1.	S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
2.	Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.
Reference Books	
3.	B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
4.	Howard S. Peavy, Donald R. Rowe, George T, Environmental Engineering - McGraw Hill International Edition. New York, 2000
5.	CPHEEO Manual on water supply and treatment engineering,Ministry of Urban Development, Government of India, New Delhi.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Experiential Learning
Quiz -1	10
Test -1	25
Quiz -2	10
Quiz -3	10
Test -2	25
Experiential Learning	20
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 50, Experiential Learning 20

Semester End Evaluation Theory (100)	
Part- –A **Objective type questions**	**20**
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100 %	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	-	-	-	1	-	-	-	-	1
CO2	2	3	1	-	-	2	1	2	-	-	-	1
CO3	3	2	1	1	-	2	1	3	-	-	-	1
CO4	3	3	3	-	-	2	2	1	-	-	-	1

Low-1 Medium-2 High-3

Semester: III		
Course Title: BRIDGE COURSE MATHEMATICS		
Course Code:16DMA37		**CIE Marks: 100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 30 (Audit Course)		**SEE Duration: 3Hrs**

Course Learning Objectives: The students will be able to

1	Understand the existence of polar coordinates as possible 2-D geometry, approximate a function of single variable in terms of infinite series.
2	Gain knowledge of multivariate functions, types of derivatives involved with these functions and their applications.
3	Recognize linear differential equations, apply analytical techniques to compute solutions.
4	Acquire concepts of vector functions, vector fields and differential calculus of vector functions in Cartesian coordinates.
5	Explore the possibility of finding approximate solutions using numerical methods in the absence of analytical solutions of various systems of equations.

Prerequisites :

Hyperbolic functions, Trigonometric identities, methods of differentiation and basic techniques of integration, reduction formulae, vector algebra.

UNIT-I	
DIFFERENTIAL CALCULUS Taylor and Maclaurin's series for function of single variable. Partial derivatives – Introduction, simple problems. Total derivative, Composite functions, Jacobians- simple problems	**06 Hrs**
UNIT-II	
MULTIPLE INTEGRALS Evaluation of double and triple integrals – direct problems, change of order in double integral, change of variables to polar, cylindrical and spherical coordinate systems.	**06 Hrs**
UNIT-III	
DIFFERENTIAL EQUATIONS Higher order linear differential equations with constant coefficients, Complementary function and Particular integral, problems. Equations with variable coefficients – Cauchy and Legendre differential equations, problems.	**06 Hrs**
UNIT-IV	
VECTOR DIFFERENTIATION Introduction, simple problems in terms of velocity and acceleration. Concepts of Gradient, Divergence- solenoidal vector function, Curl- irrotational vector function and Laplacian, simple problems.	**06 Hrs**
UNIT-V	
NUMERICAL METHODS Algebraic and transcendental equations – Regula-Falsi method, Newton-Raphson method. Ordinary Differential Equations – Taylor's, modified Euler's and 4^{th} order Runge-Kutta methods. Numerical Integration – Simpson's $1/3^{rd}$, $3/8^{th}$ and Weddle's rules.	**06 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the understanding of the basics of polar coordinates, partial differentiation, multiple integrals, vector differentiation, classification and types of solutions of higher order linear differential equations, requirement of numerical methods and few basic definitions.
CO2:	Solve problems on total derivatives of implicit functions, double integrals by changing order of integration, homogeneous linear differential equations, velocity and acceleration vectors.
CO3:	Apply acquired knowledge to find infinite series form of functions, multiple integrals by changing order, solution of non-homogeneous linear differential equations, numerical solution of equations.
CO4:	Evaluate multiple integrals by changing variables, different operations using del operator and numerical solutions of differential equations and numerical integration.

Reference Books	
1.	B.S. Grewal; Higher Engineering Mathematics; Khanna Publishers; 40th Edition; 2007; ISBN: 81-7409-195-5.
2.	R. K. Jain & S.R.K. Iyengar; Advanced Engineering Mathematics; Narosa Publishing House; 2002; 817319-420-3; Chapters: 1, 2, 8, 15;
3.	N.P Bali & Manish Goyal; A Text Book of Engineering Mathematics; Lakshmi Publications; 7th Edition; 2010; ISBN: 978-81-7008-992-6; Chapters: 6, 18, 16, 8, 26;
4.	Erwin Kreyszig; Advanced Engineering Mathematics; John Wiley & Sons; 9th Edition; 2007; ISBN: 978-81-265-3135-6; Chapters: 6, 10, 12;

Scheme of Continuous Internal Evaluation:

CIE consists of Two Tests each for 50 marks (20 marks for Quiz + 30 marks for descriptive questions)

Scheme of Semester End Examination:

The question paper consists of Part A and Part B. Part A will be for 20 marks covering the complete syllabus and is compulsory. Part B will be for 80 marks and shall consist of five questions (descriptive, analytical, problems or/and design) carrying 16 marks each. All five questions from Part B will have internal choice and one of the two have to be answered compulsorily.

IV- Semester		
APPLIED MATHEMATICS – IV (ASE, CH, CV, ME)		
Course Code:16MA41C		**CIE Marks: 100**
Credits: L:T:P:S: 3:1:0:0		**SEE Marks: 100**
Hours: 45		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	Analyze the periodic phenomena using the concept of Fourier series.
2	Compute the solution of linear partial differential equations that arise in physical situations.
3	Evaluate the approximate solutions of partial differential equations using numerical methods.
4	Use probability to solve random physical phenomena and implement the proper distribution model.

UNIT-I	
FOURIER SERIES Introduction to periodic functions-even, odd functions, properties.Special wave forms-square wave, half wave rectifier, saw-tooth wave, triangular wave. Dirichlet conditions for Fourier series, Fourier series expansion of continuous and discontinuous functions. Half range-sine and cosine series. Complex Fourier series-problems.	**09Hrs**
UNIT -II	
PARTIAL DIFFERENTIAL EQUATIONS - I Formation of partial differential equations by elimination of arbitrary constants/functions, solution of Lagrange's linear equation. Solution of partial differential equations by method of separation of variables. Solution of Wave and Heat equations in one dimension and Laplace equation in two dimensions by the method of separation of variables-problems.	**09Hrs**
UNIT -III	
PARTIAL DIFFERENTIAL EQUATIONS – II Classification of second order partial differential equations-parabolic, hyperbolic, elliptic. Finite difference approximation to derivatives. Solution of Laplace equation in two dimension,Heat and wave equations in one dimension (explicit methods).	**09 Hrs**
UNIT -IV	
PROBABILITY AND DISTRIBUTIONS Baye's rule, random variables-discrete and continuous.Probability distribution function, cumulative distribution function. Binomial, Poisson, Exponential and Normal Distributions.	**09Hrs**
UNIT -V	
JOINT PROBABILITY DISTRIBUTION AND MARKOV CHAIN Joint Distribution of random variables-Expectation, Co-variance and Correlation. Markov chain-Stochastic matrices, Regular stochastic matrices. Probability vector, Higher dimension probabilities.	**09Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand - the fundamental concepts ofperiodic phenomena, formation and classification of PDEs, basics of probability.
CO2:	Demonstrate - the concept of Dirichlet's condition to obtain Fourier series of continuous and discontinuous functions, finite differences for partial derivatives, random variables to describe probability functions.
CO3:	Apply - Euler's formula to obtain half range series, method of separation of variables to solve PDE's, probability and distribution to un-deterministic situations.
CO4:	Analyze and interpret - complex Fourier series, PDEs, and various distributions occurring in Engineering problems.

Text Books	
1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007, ISBN: 81-7409-195-5.
2	B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2008, ISBN: 13-978-07-063419-0; ISBN: 10-0-07-063419-X.
3	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2007, ISBN: 978-81-265-3135-6.
4	Probability, Statistics and Random Process by T.Veerarajan, 3rd edition, ISBN: 978-0-07-066925-3

In case of a course having only theory, the following minimum guidelines may be followed.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Assignment/ Experiential Learning
Quiz -1	10
Test -1	30
Quiz -2	10
Quiz -3	10
Test -2	30
Experiential Learning (EL)	10
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 60, Experiential Learning 10

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**-**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Low-1 Medium-2 High-3

Semester: IV		
ENVIRONMENTAL TECHNOLOGY		
Course Code:16ET42		**CIE Marks: 50**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 50**
Hours: 25		**SEE Duration: 1.5 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the various components of environment and the significance of the sustainability of healthy environment.
2	Recognize the implications of different types of the wastes produced by natural and anthropogenic activity
3	Learn the strategies to recover the energy from the waste.
4	Design the models that help mitigate or prevent the negative impact of proposed activity on the environment.

UNIT-I	
INTRODUCTION: Environment - Components of environment, Ecosystem – Types and structure of ecosystem. Impact of agriculture, mining, transportation and anthropogenic activities on environment and their assessment in sustainable development. Environmental acts & regulations, Role of government, legal aspects, role of nongovernmental organizations (NGOs), environmental education & women empowerment, ISO 14000, Environmental Impact Assessment.	**05 Hrs**
UNIT-II	
ENVIRONMENTAL POLLUTION: Air, noise, land pollution, public health aspects. Global environmental issues – Population growth, urbanization, land management, water & waste water management. Air pollution – point and non point sources of air pollution, global warming, acid rain & ozone depletion and their controlling measures (particulate and gaseous contaminants). Solid waste management, e waste management & biomedical waste management – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes.	**06 Hrs**
UNIT-III	
WATER POLLUTION: Water resources – availability and quality aspects, water borne diseases & water induced diseases, heavy metals & fluoride problems in drinking water and ground water contamination. Eutrophication, advanced waste water treatment, nutrient removal. Energy – Different types of energy, conventional sources &non conventional sources of energy, solar energy, hydro electric energy, wind energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	**05 Hrs**
UNIT-IV	
GREEN TECHNOLOGY: Green buildings, green materials, soilless cultivation (hydroponics), sustainable manuring technology, organic oriented farming, use of biofuels, carbon foot prints, Opportunities for green technology markets, carbon capture and storage.	**04 Hrs**
UNIT-V	
RESOURCE RECOVERY SYSTEM: Processing techniques, materials recovery systems, biological conversion (composting and anaerobic digestion). Thermal conversion products (combustion, incineration, gasification, pyrolysis, use of Refuse Derived Fuels).	**05 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify the components of environment and exemplify the detrimental impact of anthropogenic activities on the environment.
CO2:	Differentiate the various types of wastes and suggest appropriate safe technological methods to manage the waste.
CO3:	Aware of different renewable energy resources and can analyse the nature of waste and propose methods to extract clean energy.
CO4:	Adopt the appropriate recovering methods to recover the essential resources from the wastes for reuse or recycling.

Reference Books	
1.	Gilbert, M.M. 2004. Introduction to environmental engineering and science. 2nd Edition, Pearson Education. ISBN: 8129072770
2.	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. 2000. Environmental Engineering, McGraw Hill Series in water resources and Environmental Engg. ISBN: 0070491348
3.	G. Tyler Miller (Author), Scott Spoolman (Author), (2012) Environmental Science – 15th edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
4.	Vijay Kulkarni and T. V. Ramachandra 2009. Environment Management. TERI Press; ISBN: 8179931846, 9788179931844
5	Sven Erik Jørgensen 2002. Integration of Ecosystem Theories: A Pattern Ecology & Environment; Edition 3, Springer; ISBN: 1402007558, 9781402007552
6	Gerald Kiely 1997. Environmental Engineering. McGraw-Hill; ISBN: 9780077091279
7	Linvil Gene Rich 2003. Environmental Systems Engineering, McGraw-Hill; ISBN: 9780070522503
8	Larry Canter 1995. "Environmental Impact Assessment", McGraw-Hill. ISBN: 0070097674

In case of a course having only theory, the following minimum guidelines may be followed.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Assignment/ Experiential Learning
Quiz -1	05
Test -1	30
Quiz -2	05
Quiz -3	05
Test -2	30
Experiential Learning (EL)	10
Final Evaluation	Quiz 05+05+05=15 Test 30+30=60, Reduced to 30, Experiential Learning 05

Semester End Evaluation Theory (50)	
Part- –A **Objective type questions**	**10**
Part –B There should be five questions from five units. Each question should be for maximum of 08 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**40**
Total	**50**

Note: The faculty teaching the course may adapt additional methods for evaluation

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

Low-1 Medium-2 High-3

Semester: IV		
Course Title: THEORY OF STRUCTURES		
Course Code:16CV43		**CIE Marks: 100**
Credits: L:T:P:S: 3:0:0:1		**SEE Marks: 100**
Hours: 36		**SEE Duration: 3Hrs**

Course Learning Objectives: The students will be able to	
1	Identify and Distinguish different forms of structures.
2	Understand the basic concepts of static and dynamic behaviour of structural system.
3	Analyse determinate and indeterminate structures for unknown forces and deformation.
4	Evaluate the behaviour of beams truss arches and cables under different loading condition using force or deformation methods.

UNIT-I	
Structural Systems: Forms of Structures**,** Conditions of equilibrium, Degrees of Freedom. Linear and Non Linear Structures, 1D, 2D and 3D, Structures. Determinate & Indeterminate Structures, Static and Kinematical indeterminacy. **Concept of Vibration & Simple Harmonic Motion:** Derivation of Equation of motion for SDOF (Single Degree of Freedom) –Undammed.Numerical examples on SDOF. **Analysis of Plane Trusses:** Introduction, Assumptions, Analysis by Method of Joints, Analysis by Method of sections.	**08 Hrs**
UNIT-II	
Deflection of Beams: Moment Area Method – Simply supported beams, Cantilever Beam, and Over hanging**,** Conjugate beam Method – Simply supported beams, Cantilever Beam, and Over hanging beams.	**07 Hrs**
UNIT-III	
Three Hinged Arches: Introduction**,** Three Hinged Parabolic Arches at Same levels and different levels**,** Determination of Normal thrust, Radial Shear and bending moment (parabolic arches only) - Problems. **Suspension Cables**: Analysis of Cables at Same levels and different levels – Numerical problems.	**07 Hrs**
UNIT-IV	
Energy Theorems: Introduction: Strain energy in linear elastic system, expression of strain energy due to axial load, Bending moment and shear force – Castigliano's first theorem- Deflection of simple beams and pin jointed trusses.	**07 Hrs**
UNIT-V	
Analysis of Beams: **Consistent deformation method**: Introduction**,** Analysis of Propped Cantilever**,** Analysis of Fixed Beams**.** **Slope Deflection Method**: Introduction; Derivation of Slope-Deflection equations for beams. Analysis of Continuous beam by Slope –Deflection Equations (for beams only)	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Classify different forms of structures and illustrate their basic structural properties.
CO2:	Apply the basic concepts of analysis methods in determining unknown forces in the structures.
CO3:	Analyze the different forms of structural elements by suitable methods of analysis.
CO4:	Evaluate the behavior of structure under various loading conditions.

Reference Books	
1.	R C Hibbler "Structural Analysis"Pearson Publications; 8th edition, **ISBN-13:** 978-0132570534
2.	Norris C.H., Wilbur J.B., "Elementary Structural Analysis", International Student Edition, McGraw Hill International Book Edition.2005, ISBN 0-07-462304-4
3.	S. Ramamrutham, "Theory of Structures", DhanpatRai Publishing Company Private Limited-New Delhi; Ninth edition (2014), ISBN-13: 978-9384378103
4.	Reddy C.S., "Basic Structural Analysis", Tata McGraw Hill Publication Company Ltd., New Delhi , Second Edition , 2005, ISBN 9780070702769

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Experiential Learning
Quiz -1	10
Test -1	25
Quiz -2	10
Quiz -3	10
Test -2	25
Experiential Learning	20
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 50, Experiential Learning 20

Semester End Evaluation Theory (100)	
Part- –A **Objective type questions**	**20**
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	-	2	1	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-

Low-1 Medium-2 High-3

Semester: IV		
Course Title: BUILDING CONSTRUCTION AND PLANNING		
Course Code:16CV44		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:1		**SEE Marks: 100+50**
Hours: 36		**SEE Duration: 3Hrs + 3Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the different building planning and drawing principles and components of a civil engineering structure
2	Distinguish between different forms and types of masonry
3	Relate the concepts of shoring, underpinning and scaffolding and design of types of staircases
4	To gain insights into types of roof, plastering, pointing and painting
5	Understand the basic concepts Green building construction and construction equipment and their application

UNIT-I	
Building Planning: Building Bye-laws, drawing requirements, principles of planning, FAR, Carpet Area, Plinth Area (only concepts) **Foundation**: Bearing Capacity of Soil, Safe Bearing Capacity of Soil, Allowable Bearing Capacity of Soil. Classification of Foundation, Masonry footings, Isolated footings, Combined and strap RCC footings, Raft footing, Grillage foundation, Pile foundations (Friction and Load bearing piles), Foundation in black cotton soils	**08 Hrs**
UNIT-II	
Masonry: Load Bearing and partition walls, Stone-Rubble Masonry, Coursed Rubble Masonry, Un-coursed rubble masonry Random rubble masonry, Ashlar Masonry Bricks-Bonds in Brickwork, English Bond , Flemish Bond, Damp Proof construction, Arches, Classification, Functions. **Lintel and Chajja:** Functions and types **Stairs:** Components, Types-Dog legged and open well stairs, Geometrical design of stairs.	**07 Hrs**
UNIT-III	
Shoring: Raking Shores, Flying Shores, Dead Shores, Underpinning- Pit method, Pile method, **Scaffolding**- Components, Types of Scaffolding. **Form work :**Form work Details, RCC columns, Beams, floors, Slip forming **Roofs:** Flat Roof (RCC) Sloped roof (R.C.C. and tile roof), Lean to roof, Wooden truss (King post and queen post trusses.	**07 Hrs**
UNIT-IV	
Types of flooring: (Materials and method of laying), Granolithic, Mosaic Ceramic, Marble, Polished Granite types and applications, Industrial flooring. **Plastering and Pointing**: Purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering. **Painting :**Purpose, Types, Application of paints to new and old surfaces,Distemper Plastic emulsion, Enamel, painting to walls and iron and steel surfaces, polishing wood surface.	**07 Hrs**

UNIT-V	
Construction equipment: Factors for selecting equipment, Introduction, various earth moving equipment's, Hoisting equipment's Concrete mixer and plants, Conveyors and rollers, Trenching machines. **Green building concepts:** Site selection, design concepts, , materials and different certifications programs **(IGBC AND LEED)**	**07 Hrs**

PART –B

Using Auto CAD software: Prepare working drawing of components of building like

(i) Stepped Wall footing
(ii) Fully Paneled and flush doors
(iii) Partly Paneled and Partly glazed window.
(iv) Doglegged & open well stairs

Functional design of buildings (Residential, public and industrial) – orientation and positioning of various components of buildings- Building standards – Bye laws- set back distances- calculation of carpet area, plinth area and FAR.

Using Auto-CAD software: Development of Plan, Elevation, section, North Line and Schedule of Openings from the given Line diagram of Residential buildings.

(i) Single storey building.
(ii) Two Storey building.
(iii) Residential Building with Pitched roof.

Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for following buildings (i) primary health centre (ii) primary school building (iii)college canteen (iv) office building.

Using AUTO-CAD software, Preparation of Plumbing, sanitary and electrical layouts for a simple residential building (plan being given).

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental of building Planning and construction
CO2:	Apply the various techniques and principles of building construction in Civil engineering
CO3:	Analysis different forms types methods of building construction for various building component
CO4:	Use of modern tools like AutoCad for building planning and drawing

Reference Books

1.	Sushil Kumar, "Building Construction", Standard Publication & Distributors,2006, ISBN8186308024
2.	Punmia B.C., "Building Construction", Lakshmi Publications, New Delhi, 2005, ISBN8170080533
3.	S.G. Rangwala, "Building Construction", Charotar Publishing House Pvt Ltd, India, 2009, ISBN8185594872
4.	Shah.M.H and Kale. C.M "Building Drawing " Tata McGraw Hill Publishing co. Ltd., New Delhi-2011 **ISBN-13:** 978-0071077873
5.	National Building Code, BIS , New Delhi

6.	Building Planning and Drawing – Import, 30 Jun 2014 by S. S. Bhavikatti I K International Publishing House Pvt. Ltd **ISBN-13:** 978-9382332565

Continuous Internal Evaluation (CIE)				
(Theory – 100 Marks)		**(Laboratory- 50 Marks)**		**Total (150)**
Evaluation method	**Course with Experiential Learning**			
Quiz -1	10	Performance of the student in the laboratory, every week	40	
Test -1	50			
Quiz -2	10			
Quiz -3	10	Test at the end of the semester	10	
Test -2	50			
Experiential Learning	20			
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 50, Experiential Learning 20	**Total**	**50**	**150**

Semester End Evaluation (SEE)				
Theory (100 Marks)		**Laboratory(50 Marks)**		**Total (150)**
Part- –A **Objective type questions**	**20**	**Experiment Conduction with proper results**	40	
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1, UNIT-4 and UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**	**Viva**	10	
Total	**100**	**Total**	**50**	**150**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

Note: Individual faculty may adopt various methods for conducting effective quizzes and evaluate the same. The frequency of quizzes may be more than three also.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	1	-	-	-	-	-
CO4	-	1	-	-	3	-	-	-	-	-	-	1

Low-1 Medium-2 High-3

Semester: IV		
Course Title: SURVEYING		
Course Code:16CV45		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:0		**SEE Marks: 100+50**
Hours: 36		**SEE Duration: 3Hrs + 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the concepts of surveying and levelling.
2	Identify the components of surveying and levelling.
3	Interpret the different measurement techniques for various applications.
4	Apply principles of surveying for solving relevant engineering problems.

PART A	
UNIT-I	
History of Surveying: Definition of Surveying, Uses of Surveying, Basic principles of surveying, Classification of Surveys, Chain surveying, Compass surveying, Plane table surveying - Accessories required, booking of chain survey work- Field book entries, conventional symbols. Fundamentals of Maps: Maps - types; scales-types; measuring distance; finding direction and use of symbols. Map projection - Latitude, Longitude and time, Topographical survey. Principles of toposheet numbering, Analysis of landforms.	**07 Hrs**
UNIT-II	
Leveling: Principles and basic definitions, Fundamental axes and parts of a dumpy level, types of adjustments and objectives, temporary adjustments of a dumpy level, Types of leveling – Simple leveling, Profile leveling, cross sectioning – fly leveling, Booking of levels – Rise and fall method and height of instrument method – comparison, Arithmetic checks. **Contour Survey:** Contoursand their characteristics, Methods of contouring – direct and indirect methods, Uses of contours.	**07 Hrs**
UNIT-III	
Total Station: Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, data transfer, preparation of maps. **TrignometricLevelling:** Determination of elevation of objects when the base is accessible and inaccessible by single plane and double plane methods.	**07 Hrs**
UNIT-IV	
Curve Setting : Curves- Necessity – types, simple curves – elements – Designation of curves- Methods of setting out simple curves by linear methods and method of Rankine's deflection angle, Compound curve, Reverse Curve.	**08 Hrs**
UNIT-V	
Areas and Volumes: Calculations of area from cross staff surveying. Area calculation by trapezoidal rule and simpsons rules. Computations of volumes by trapezoidal rule and prismoidal rule. **Remote Sensing, GIS & GPS:** Introduction, Principles, Geographical Information System- Definition of GIS, Key Components of GIS, Functions of GIS, Global Positioning system, Applications of Remote Sensing GIS & GPS in Civil Engineering.	**07 Hrs**

PART B (Laboratory)
I. Chain Surveying 1. To measure distance between two points using direct ranging and setting out perpendiculars. 2. Marking central line of a building using grid plan using chain and its accessories.
II. Levelling 3. To determine difference in elevation between two points using differential levelling technique, using height of the instrument method and rise and fall methods. 4. To conduct profile levelling and to draw the longitudinal section and cross section to determine the depth of cut and height of filling for a given formation level using total station.
III. Total station 5. Contour surveying using total station. 6. To determine the elevation of an object. 7. Distance, gradient between two inaccessible points using total station. 8. Traversing using total station.
IV. Curves 9. To set out simple curves using linear methods-perpendicular offsets from long chord and offsets from chord produced methods. 10. To set out compound curves using Rankine's deflection angles method. 11. To set out compound curve by angular method.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Describe fundamental concepts of Surveying, Levelling, total station and application of remote sensing and GIS.
CO2:	Discuss components of all types of surveying.
CO3:	Apply the concepts of measurements in engineering problems.
CO4:	Demonstrate the applications of remote sensing and GIS for solving engineering problems.

Reference Books	
1.	Punmia B.C, "Surveying" Vol.I and Vol.II, Laxmi Publications, (P) Ltd, New Delhi 2010. ISBN 81-7008-853-4
2.	Chandra A.M, "Plane surveying", Newage International (P) Ltd., 2009. ISBN 81-224-1902-X
3.	Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
4.	Duggal S.K, "Surveying", Vol.I& II, Tata Mc Graw Hill Publishing Co., 2009, ISBN 978-0-07-015137-6: ISBN 0-07-015137-7.
5.	Arora K.R, "Surveying", Vol.I& II, Standard Book House, 2009. ISBN 81-89401-23-8

<table>
<tr><th colspan="5">Continuous Internal Evaluation (CIE)</th></tr>
<tr><th colspan="2">(Theory – 100 Marks)</th><th colspan="2" rowspan="2">(Laboratory- 50 Marks)</th><th rowspan="2">Total (150)</th></tr>
<tr><th>Evaluation method</th><th>Course with assignment</th></tr>
<tr><td>Quiz -1</td><td>10</td><td rowspan="3">Performance of the student in the laboratory, every week</td><td rowspan="3">40</td><td rowspan="8"></td></tr>
<tr><td>Test -1</td><td>50</td></tr>
<tr><td>Quiz -2</td><td>10</td></tr>
<tr><td>Quiz -3</td><td>10</td><td rowspan="2">Test at the end of the semester</td><td rowspan="2">10</td></tr>
<tr><td>Test -2</td><td>50</td></tr>
<tr><td>Assignments</td><td>10</td><td rowspan="2">Total</td><td rowspan="2">50</td></tr>
<tr><td>Final Evaluation</td><td>Quiz 10+10+10=30
Test 50+50=100, Reduced to 60,
Assignment 10</td><td>150</td></tr>
</table>

<table>
<tr><th colspan="6">Semester End Evaluation (SEE)</th></tr>
<tr><th colspan="2">Theory (100 Marks)</th><th colspan="2">Laboratory(50 Marks)</th><th>Total (150)</th></tr>
<tr><td>Part- –A
Objective type questions</td><td>20</td><td>Experiment Conduction with proper results</td><td>40</td><td rowspan="3"></td></tr>
<tr><td rowspan="2">Part –B
There should be five questions from five units. Each question should be for maximum of 16 Marks.

The UNIT-1, UNIT-4 and UNIT-5 should not have any choice.

The UNIT-2 and UNIT-3 should have an internal choice.
Both the questions should be of the same complexity in terms of COs and Bloom’s taxonomy level.</td><td rowspan="2">80</td><td>Viva</td><td>10</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Total</td><td>100</td><td>Total</td><td>50</td><td>150</td></tr>
</table>

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	60				
		Assignment		2 phases	10	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	1	-	-	-	-	-	-
CO2	2	2	-	-	1	1	-	-	-	-	-	-
CO3	2	2	1	1	-	1	1	-	-	-	-	1
CO4	1	2	1	-	3	1	1	-	-	-	1	1

Low-1 Medium-2 High-3

Semester: IV		
Course Title: WASTEWATER ENGINEERING		
Course Code:16CV46		**CIE Marks: 100+50**
Credits: L:T:P:S: 3:0:1:1		**SEE Marks: 100+50**
HOurs: 36		**SEE Duration: 3Hrs + 3 Hrs**

Course Learning Objectives: Students will be able to

1	To understand the importance and necessity of scientific collection and disposal systems for wastewater.
2	To analyze flow variation of sewage and storm water and to estimate design flows for a community.
3	To design suitable conveyance systems for sewage and storm water.
4	To study physical, chemical and biological characteristics and treatment methods to ensure safe disposal of wastewater.

PART – A	
UNIT-I	
Introduction: -Necessity of sanitation, types of sewerage systems and their suitability. **Quantity of Sewage:** dry weather flow, factors affecting dryweather flow.Flowvariations and their effects on design of sewerage system; computation of design flow, estimation of storm flow, rational method and empirical formulae for design of storm water drain; Time of concentration, Numerical problems.	**07 Hrs**
UNIT-II	
Design of Sewers. Hydraulic formulae for velocity, effects of flow variations on velocity, self cleansing and nonscouring velocities, Design of hydrau1ic elements for circu1ar sewers flowing full and partially full conditions. Numerical problems. **Sewer Appurtenances:** Inlets**,** catch basins, manholes, storm water regulator, oil and grease traps.	**06 Hrs**
UNIT-III	
Analysis of Sewage: Physical, Chemical and Biological characteristics, concepts of aerobic and anaerobic activity, BOD and COD. Sampling - significance, techniques and frequency. Numerical problems. **Treatment of Sewage.** Flow diagram of municipal sewage treatment plant - Importance of each unit. **Primary treatment**-Screening, Grit chambers, Primary sedimentation tanks – concepts and Design.	**08 Hrs**
UNIT-IV	
Secondary treatment: Trickling filter -theory and operation, types and design. Activated sludge process -principle and flow diagram, methods of aeration, modifications, *F/M* ratio, design of ASP	**08 Hrs**
UNIT-V	
Disposal of Effluents. By dilution, self-purification.phenomenon, oxygen sag curve,zones of purification, sewage farming, sewage sickness, Disposal standards on land and water body. **Anaerobic sludge digestion-** Principles, digestion tanks, Sludge drying	**07 Hrs**

beds.Design. **Miscellaneous Treatment Methods:** Septic tanks and Oxidation Pond –Concept and Design.	
PART – B	
1	Determination of Alkalinity, Acidity and pH.
2	Determination of Calcium, Magnesium and Total Hardness.
3	Determination of Chlorides and Sulphates.
4	Determination of percentage of available chlorine in bleaching powder, Residual Chlorine and Chlorine Demand.
5	Removal of turbidity by Jar test.
6	Determination of Iron.
7	Determination of Fluorides.
8	Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.
9	Determination of DO
10	Determination of BOD and COD.
11	Total Count Test & MPN Determination.

Course Outcomes: After completing the course, students will be able to	
CO1:	Estimate average and peak wastewater from a community and design suitable conveyance system for sewage and storm water.
CO2:	Design a comprehensive wastewater treatment system to achieve required quality standards for safe disposal and reuse of wastewater.
CO3:	Evaluate wastewater quality, suitable small scale treatment option and sludge disposal.
CO4:	Design an effective and efficient waste water disposal system.

Reference Books	
1.	S. K. Garg "Environmental Engineering: Sewage Disposal and Air Pollution Engineering (Volume - 2), 33 Edition, 2015, Khanna Publishers, ISBN: 9788174092304, 8174092307.
2.	B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain "Wastewater Engineering (Including Air Pollution)"(Environmental Engineering II, Laxmi Publications; Second edition (2016), ISBN-10: 8131805964, ISBN-13: 978-8131805961
3.	Water and Waste water Engineering Vol-II -Fair, Gayer and Okun, Willey publishers, New York.2008, ISBN-10: 0470411929, ISBN-13: 978-0470411926
4.	Waste Water Treatment, Disposal and Reuse -Metcalf and Eddy inc, Tata McGraw Hill Publications (2008 Edition), ISBN-10: 0071008241, ISBN-13: 978-0071008242
5.	CPHEEO Manual on "Wastewater Collection, Treatment and Disposal", Ministry of Urban Development, Government of India, New Delhi.

Continuous Internal Evaluation (CIE)				
(Theory – 100 Marks)		**(Laboratory- 50 Marks)**		**Total (150)**
Evaluation method	**Course with Experiential Learning**			
Quiz -1	10	Performance of the student in the laboratory, every week	40	
Test -1	50			
Quiz -2	10			
Quiz -3	10	Test at the end of the semester	10	
Test -2	50			
Experiential Learning	20			
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 50, Experiential Learning 20	**Total**	**50**	**150**

Semester End Evaluation (SEE)				
Theory (100 Marks)		**Laboratory(50 Marks)**		**Total (150)**
Part- –A **Objective type questions**	**20**	**Experiment Conduction with proper results**	40	
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1, UNIT-4 and UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**	**Viva**	10	
Total	**100**	**Total**	**50**	**150**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	50				
		Experiential Learning		2 phases	20	Reports / Record Books			
		Laboratory		Weekly	50				
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
		Semester End Laboratory		End of every semester laboratory	50				
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	2	-	2	2	2	-	-	-	1
CO2	3	1	3	-	-	2	2	2	-	-	-	-
CO3	2	2	2	2	-	2	2	2	-	-	-	1
CO4	3	-	3	-	-	2	2	2	-	-	-	-

Low-1 Medium-2 High-3

Professional Practice – II (III and IV Semester Under Graduate)						
Communication Skills and Professional Ethics						
Course Code	**:**	**16HS47**		**CIE Marks**	**:**	**50**
Hrs/Sem	**:**	**18 hrs/ Semester**		**Credits**	**:**	**01**

Course Learning Objectives:

Students are able to

1. Develop communication style, the essentials of good communication and confidence to communicate effectively.
2. Manage stress by applying stress management skills.
3. Ability to give contribution to the planning and coordinate Team work.
4. Ability to make problem solving decisions related to ethics.

III Semester	**UNIT 1**	**6 Hours**

Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening.
Communication with Confidence & Clarity- Interaction with people, the need the uses and the methods, getting phonetically correct, using politically correct language, Debate & Extempore.

UNIT 2	**6 Hours**

Assertive Communication- Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive.
Presentation Skills- Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation.

UNIT 3.A	**6 Hours**

Team Work- Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behavior to sync with team work Stages of Team Building Features of successful teams.

IV Semester	**UNIT 3.B**	**6 Hours**

Body Language & Proxemics - Rapport Building - Gestures, postures, facial expression and body movements in different situations, Importance of Proxemics, right personal space to maintain with different people.

UNIT 4	**6 Hours**

Motivation and Stress Management: Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. ***Individual Counseling& Guidance, Career Orientation. Balancing Personal & Professional Life-***

UNIT 5	**6 Hours**

Professional Practice - Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behavior at different Hierarchical Levels. Positive Attitude, Self-Analysis and Self-Management.

Professional Ethics - values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects**.** ***Balancing Personal & Professional Life***

Course Outcome:

After going through this course, the students will be able to

CO1: Inculcate skills for life, such as problem solving, decision making, stress management

CO2: Develop leadership and interpersonal working skills and professional ethics.

CO3: Apply verbal communication skills with appropriate body language.

CO4: Develop their potential and become self-confident to acquire a high degree of self-awareness

References

1. Stephen R Covey, "The 7 Habits of Highly Effective People", Free Press, 2004 Edition, ISBN: 0743272455
2. Dale Carnegie, "How to win friends and influence people", General Press, 1st Edition, 2016, ISBN: 9789380914787
3. Kerry Patterson, Joseph Grenny, Ron Mcmillan, "Crucial Conversation: Tools for Talking When Stakes are High", McGraw-Hill Publication, 2012 Edition, ISBN: 9780071772204
4. Ethnus, "Aptimithra: Best Aptitude Book", Tata McGraw Hill, 2014 Edition, ISBN: 9781259058738

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in TWO Phases.

Phase	Activity	Weightage
I	Test 1 is conducted in III Sem for 50 marks (15 Marks Quiz and 35 Marks Descriptive answers) after completion of Unit-1, Unit-2 and Unit -3.A for 18 hours of training sessions.	50%
II	Test 2 is conducted in IV Sem for 50 marks ((15 Marks Quiz and 35 Marks Descriptive answers) after completion of Unit -3B, Unit - 4 and Unit-5 for 18 hours of training sessions.	50%
	At the end of the IV sem Marks of Test 1 and Test 2 is consolidated for 50 marks and grading is done. The final CIE marks is scrutinized by the committee comprising of HSS- Chairman, Training Co-ordinator, respective department Staff Placement co-ordinator before submitting to CoE.	

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	---	___	---	----	H	----	H	H	H	M
CO2	H	M	M	---	---	---	----	H	M	H	M
CO3	---	---	L	---	---	H	---	M	H	M	H
CO4	---	---	___	---	----	H	L	H	H	H	H

Semester: IV		
Course Title: BRIDGE COURSE C PROGRAMMING		
Course Code:16DCS48		**CIE Marks: 100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 24 (Audit Course)		**SEE Duration: 3Hrs**

Course Learning Objectives: The students will be able to	
1	Develop arithmetic reasoning and analytical skills to apply knowledge of basic concepts of programming in C.
2	Learn basic principles of problem solving through programming.
3	Write C programs using appropriate programming constructs adopted in programming.
4	Solve complex problems using C programming.

UNIT-I	
Introduction to Reasoning, Algorithms and Flowcharts Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. Fundamentals of algorithms and flowcharts.	**02 Hrs**
Introduction to C programming Basic structure of C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types.	**01 Hrs**
Handling Input and Output operations Reading a character, Writing a character, Formatted input/output functions, Unformatted input/output functions.	**02 Hrs**
UNIT-II	
Operators and Expressions Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and decrement operators, Conditional operators, Bit-wise operators, Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.	**02 Hrs**
Programming Constructs **Decision Making and Branching** Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '*?:'* operator, The '*goto'* statement. **Decision making and looping** The while statement, the do statement, The 'for' statement, Jumps in loops**.**	**03 Hrs**
UNIT-III	
Arrays One dimensional arrays, Declaration of one dimensional arrays. Initialization of one dimensional arrays, Two dimensional arrays, Initializing two dimensional arrays.	**02 Hrs**
Character Arrays and Strings Declaring and Initializing String Variables, Reading Strings from Terminal, Writing strings to screen, Arithmetic Operations on characters, String operations using with and without String handling functions.	**02 Hrs**
UNIT-IV	
User-defined functions	**03 Hrs**

Need for User Defined Functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Nesting of functions, Functions with arrays, Storage classes.	
Structures and Unions Introduction, Structure definition, Declaring structure variables, Accessing structure members, Structure initialization, Copying and comparing structure variables, Arrays of structure, Arrays within structures, Structures and functions, Unions.	**03 Hrs**
UNIT – V	
Pointers Introduction , Accessing the address of a variable, Declaring and initializing of pointer variables, Accessing a variable using pointers, Chain of pointers, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings.	**03 Hrs**
File Managements in C Basic concepts of files, Defining and opening a file, closing of a file, Input/Output operations on files.	**01 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and explore the fundamental computer concepts and basic programming principles like data types, input/output functions, operators, programming constructs and user defined functions.
CO2:	Analyze and Develop algorithmic solutions to problems.
CO3:	Implement and Demonstrate capabilities of writing 'C' programs in optimized, robust and reusable code.
CO4:	Apply appropriate concepts of data structures like arrays, structures, and files to implement programs for various applications.

Reference Books:	
1.	P. Dey, M. Ghosh, "Programming in C", Oxford University press, 1st Edition, 2007, ISBN -13: 9780195687910.
2.	Kernighan B.W and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 2005, ISBN -13: 9780131101630.
3.	H. Schildt, Turbo C: The Complete Reference, Mcgraw Hill Education, 4th Edition, 2000, ISBN-13: 9780070411838.
4.	Yashavant P. Kanetkar, "Understanding Pointers in C", BPB publications, 4th Edition, 2003,ISBN-13: 978-8176563581.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	**Course with Assignment**
Quiz – 1	10
Test – 1	50
Quiz – 2	10
Quiz – 3	10
Test – 2	50
Assignments	10
Final Evaluation	Quiz 10+10+10=30

	Test 50+50=100, Reduced to 60, Assignments 10

Semester End Evaluation Theory (100)	
Part- –A Objective type questions	**20**
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

Note: The faculty teaching the course may adapt additional methods for evaluation within the total maximum marks.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**M**	**L**	**-**	**-**	**-**	**-**	**M**	**-**	**L**
CO2	**H**	**M**	**M**	**M**	**M**	**-**	**-**	**-**	**M**	**L**	**-**	**L**
CO3	**H**	**M**	**M**	**M**	**M**	**L**	**L**	**-**	**M**	**M**	**L**	**M**
CO4	**H**	**H**	**H**	**M**	**M**	**L**	**L**	**-**	**M**	**M**	**L**	**M**

Course - PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course	**H**	**M**	**M**	**M**	**M**	**L**	**L**	**-**	**M**	**M**	**L**	**M**

Low-1 Medium-2 High-3

Semester: IV		
Course Title: WATER RESOURCES ENGINEERING		
Course Code:16CV49		**CIE Marks: 100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 36		**SEE Duration: 3Hrs**

Course Learning Objectives: The students will be able to	
1	Understand the knowledge of earth science and circulation of water on earth through Hydrologic cycle.
2	Analyze the hydrologic data's such as precipitation and its abstraction through evaporation, infiltration and evapotranspiration, runoff.
3	Analysis of stream flow data and estimation of design flood using Hydrograph theory.
4	Study of Ground water potential, conservation of water through rain water harvesting and artificial recharge.

UNIT-I	
Hydrology: Introduction, Hydrologic cycle (Horton's representation and Engineering Representation), water budget equation, Applications in engineering, sources of Data, numerical problems. **Precipitation:** Forms and types of precipitation, Measurement of rain fall using Symon's and Syphon type of rain gauges, Optimum number of rain gauge stations, Consistency of rainfall data (double mass curve method), Computation of mean rainfall, Estimation of missing data, presentation of precipitation data, numerical problems.	**08 Hrs**
UNIT-II	
Abstractions from Precipitation: **Evaporation:** Process, Factors affecting, measurement using ISI standard Pan, Estimation of evaporation using Empirical formulae, numerical problems. **Infiltration:** Factors affecting infiltration capacity, measurement (double ring infiltrometer), Horton's infiltration equation, infiltration indices, numerical problems.	**07 Hrs**
UNIT-III	
Runoff: Factors affecting runoff, runoff measurement, Estimation of runoff using rational and empirical methods, numerical problems. **Stream Flow Measurement:** Measurement of stage, Measurement of velocity by current meters, Measurement of discharge by Area – Velocity method, Simple stage discharge relation.	**07 Hrs**
UNIT-IV	
Hydrographs: Components of hydrographs, unit hydrograph and its derivation from simple storm hydrograph, base flow separation, preparation of unit hydrographs – from isolated storms, method of superposition, Synthetic Unit Hydrographs (Snyder's Method), Numerical problems.	**07 Hrs**
UNIT-V	
Ground Water Hydrology: Scope and importance, Aquifers, Steady radial flow into wells in unconfined and confined aquifers. **Rainwater Harvesting:** Introduction, small tank rain harvesting, urban rainwater harvesting, methods of ground water recharge.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Describe various hydrological parameters for design of water resources projects.
CO2:	Understand the hydrological aspects of surface and ground water, techniques of stream flow measurement and methods of conservation of water.
CO3:	Determine various hydrological parameters over a catchment and ground water potential.
CO4:	Analyse the hydrological data, stream flow data for design hydraulic structures.

Reference Books	
1.	Subramanya K., 'Engineering Hydrology', Tata McGraw Hill, New Delhi, 4th Edition, 2013, ISBN-10: 1259029972, ISBN-13: 978-1259029974.
2.	K.C. Patra "Hydrology and Water Resources Engineering", Alpha Science International Ltd, 2nd Revised edition, ISBN-10: 1842654217, ISBN-13: 978-1842654217.
3.	VenTe Chow, Applied Hydrology Tata McGraw Hill Edition, 2010, ISBN-13:9780070702424, ISBN-10:007070242X.
4.	Todd, "Ground Water Hydrology", Wiley Eastern Publication, New Delhi, Second edition, reprint 2014, ISBN: 9788126508365.

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Course with Assignment
Quiz -1	10
Test -1	50
Quiz -2	10
Quiz -3	10
Test -2	50
Assignment	10
Final Evaluation	Quiz 10+10+10=30 Test 50+50=100, Reduced to 60, Assignment 10

Semester End Evaluation Theory (100)	
Part- –A **Objective type questions**	**20**
Part –B There should be five questions from five units. Each question should be for maximum of 16 Marks. The **UNIT-1**, **UNIT-4** and **UNIT-5** should not have any choice. The **UNIT-2 and UNIT-3** should have an internal choice. Both the questions should be of the same complexity in terms of COs and Bloom's taxonomy level.	**80**
Total	**100**

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	60				
		Assignment		2 phases	10	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment methods	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	-	-	-	2	2	1	1	-	-	2
CO2	2	2	-	-	-	1	-	-	1	-	-	1
CO3	2	1	1	-	2	2	2	-	1	-	-	2
CO4	2	2	1	-	-	2	-	-	1	-	-	1

Low-1 Medium-2 High-3