NEW HORIZON COLLEGE OF ENGINEERING

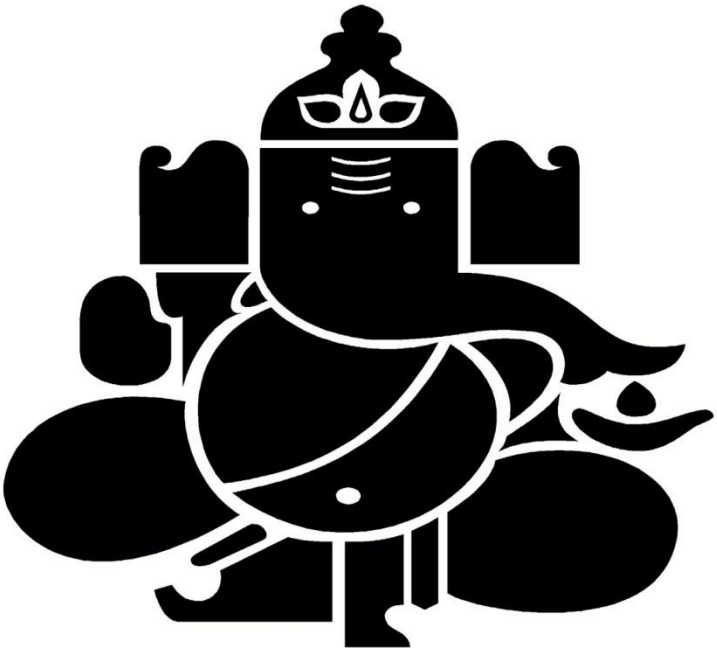
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2016
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

Academic year 2018-19

Civil Engineering

Fifth and Sixth Semesters
Scheme and Syllabus



CONTENTS

VISION

To contribute to society by imparting quality education encompassing Technical, Managerial and Entrepreneurial skills

MISSION

1. To create an environment wherein Faculty and Students engage in cutting edge research.
2. To undertake Collaborative projects in order to develop a partnership between Institute and Industry
3. To motivate Entrepreneurship and to imbibe Professional Ethics
4. To promote participation in activities which help in holistic development of students

Program Education objectives (PEOs)

PEO1	Graduates will be able to conceptualize, analyze, design and propose feasible solutions to civil Engineering problems by applying basic principles of mathematics, science and engineering.
PEO2	Graduates will be inculcated with necessary professional skills and ethics, effective communication skills and holistic personality traits in becoming efficient and effective engineers.
PEO3	Graduates will be able to work as a team in intra and interdisciplinary endeavors for the development of new ideas and products for the betterment of the society.
PEO4	Graduates will be able to face challenges of the world economic order by incorporating expertise involving modern tools and techniques in the field of infrastructural development.
PEO5	Graduates will acquire a high level of competence to achieve excellence and outstanding leadership to succeed as engineering professionals, innovators and entrepreneurs.
PEO6	Graduates will also be able to pursue career paths in teaching or research.

PEO to Mission Statement Mapping

Mission Statements	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**	**PEO6**
To create an environment wherein Faculty and Students engage in cutting edge research.	3	3	3	2	2	1
To undertake Collaborativeprojects in order to develop a partnership between Institute and Industry	3	2	3	3	3	3
To motivate Entrepreneurship and to imbibe Professional Ethics	3	3	2	2	3	1
To promote participation in activities which help in holistic development of students.	1	1	2	3	3	3

correlation: 3- High, 2-Medium, 1-Low

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	**PO1:**Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	**PO2:**Identity, formulate, research literature and analyze complex engineering problems reaching substantiated conclusion using first principles of mathematics and engineering sciences.
3	Design and Development of Solutions	**PO3:**The ability to make analysis and design study of the complexities of the various elements.
4	Investigation of Problem	**PO4:**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	**PO5:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	Engineer and society	**PO6:** 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	**PO7:**Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8	Ethics	**PO8:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual & team work	**PO9:**Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	**PO10:**Communicate effectively on complex engineering activities with the engineering community and with 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	Lifelong learning	**PO11:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
12	Project management and finance	**PO12:**Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Mapping of POs TO PEOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	2	1	1	2	2	2	2	2
PEO2	2	2	2	2	3	3	1	3	2	2	2	2
PEO3	1	2	2	2	2	3	3	3	2	2	3	3
PEO4	3	3	2	3	2	2	2	2	1	1	2	3
PEO5	3	3	3	2	3	2	2	2	2	2	1	2
PEO6	3	3	3	2	2	3	3	3	2	2	2	2

Correlation: 3- High, 2-Medium, 1-Low

New Horizon College of Engineering
Department of Civil Engineering
Scheme of Fifth Semester B.E Program

FIFTH SEMESTER												
Sl No	**Course Code**	**Course**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
				L	**P**	**T**	**S**			**CIE**	**SEE**	**Total**
1	CIV51	Concrete Technology	CIV	3	2	0	0	5	7	75	75	150
2	CIV52	Design of RCC Structural Elements	CIV	3	0	0	0	3	3	50	50	100
3	CIV53	Highway Engineering	CIV	3	0	0	0	3	3	50	50	100
4	CIV54	Analysis of Indeterminate Structures	CIV	2	1	1	0	4	5	75	75	150
5	CIV55	Basics of Geotechnical Engineering	CIV	3	2	0	0	5	7	75	75	150
6	CIV56*	Professional Elective-I	CIV	2	0	0	1	3	3	50	50	100
7	CIV57*	Professional Elective-2	CIV	2	0	0	1	3	3	50	50	100
Total								**26**	**31**	**425**	**425**	**850**

Professional Elective- GROUP 1		**Professional Elective- GROUP 2**	
Course Code	**Course**	**Course Code**	**Course**
CIV561	Advance Surveying	**CIV571**	Traffic Engineering
CIV562	Pavement Materials & Construction	**CIV572**	Alternative Building Materials
CIV563	Construction Management & Engineering Economics	**CIV573**	Open Channel Hydraulics
CIV564	Rock Mechanics	**CIV574**	Hydrology & Irrigation Engineering
CIV565	Mechanization in construction	**CIV575**	Construction Quality and safety
CIV566	Retrofitting and Rehabilitation of structures	**CIV576**	Pre fabricated structures

New Horizon College of Engineering
Department of Civil Engineering
Scheme of Sixth Semester B.E Program

SIXTH SEMESTER												
Sl No	**Course Code**	**Course**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
				L	**P**	**T**	**S**			**CIE**	**SEE**	**Total**
1	CIV61	Environmental Engineering-I	CIV	3	2	0	0	5	7	75	75	150
2	CIV62	Design and Detailing of RC Structural Elements	CIV	3	2	0	0	5	7	75	75	150
3	CIV63	Design of Pre Stressed Concrete Structure	CIV	3	0	0	0	3	3	50	50	100
4	CIV64	Applied Geotechnical Engineering	CIV	3	0	0	0	3	3	50	50	100
5	CIV65*	Professional Elective-III	CIV	3	0	0	1	4	3	50	50	100
6	NHOPXX	Open Elective-I	CIV	3	0	0	1	4	3	50	50	100
7	CIV67	Mini project (Extensive survey)	CIV	0	4	0	0	4	8	50	50	100
Total								**28**	**34**	**400**	**400**	**800**

Professional Elective, GROUP 3		**Open Elective, GROUP I**	
Course Code	**Course**	**Course Code**	**Course**
CIV651	Theory of Elasticity	**NHOP01**	Big Data Analytics using HP Vertica- 1
CIV652	Ground Improvement Techniques	**NHOP02**	VM Ware virtualization Essentials - 1
CIV653	Advance Concrete Technology	**NHOP03**	Adobe Experience manager – 1
CIV654	Water Resources Engineering	**NHOP04**	Big Data Analytics using HP Vertica – 2
CIV655	Urban Transport Planning	**NHOP05**	VM Ware virtualization Essentials – 2
CIV656	Structural Dynamics	**NHOP06**	Adobe Experience manager – 2
		NHOP07	SAP
		NHOP08	Schneider – Industry Automation
		NHOP09	Cisco – Routing and Switching – 1
		NHOP10	Data Analytics

FIFTH SEMESTER SYLLABUS

CONCRETE TECHNOLOGY

Course Code	**: CIV51**	**Credits**	**: 05**
L: P: T: S	**: 3:2:0:0**	**CIE Marks**	**: 50+25**
Exam Hours	**: 3+3 Hours**	**SEE Marks**	**: 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand basic properties of various ingredients concrete.
CO2	Understand the properties of fresh concrete.
CO3	Understand the behavior of hardened concrete.
CO4	Design different types of concrete.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Contents of Module**	**Hrs**	**Cos**
1	**A. CONCRETE INGREDIENTS** **Cement**: Chemical composition, Hydration of cement, Types of cement, manufacture of Ordinary Portland Cement by wet and dry process (flow charts only) Testing of cement. **Fine aggregate**: Grading analysis, Specific gravity, Bulking, Moisture content, Deleterious materials. **Water**: Qualities of water, Use of sea water for mixing concrete.	**09**	

	B. CONCRETE INGREDIENTS (cont'd) **Coarse aggregate**: Importance of size, shape and texture. Grading of aggregates - Sieve analysis, Specific gravity, Flakiness Index and Elongation Index, Crushing, Impact and Abrasion tests. **Admixtures:** Chemical admixtures –plasticizers, accelerators, retarders and air entraining agents. Minerals admixtures – fly ash, GGBS, silica fumes and rice husk ash.		**CO1**
	List of experiments: **Cement:** Normal consistency, Setting time, Soundness by Autoclave method, Compression strength test, Air permeability test for fineness and Specific gravity of cement. **Aggregates:** 1. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking 2. Tests on Coarse aggregate – Absorption, Moisture content, Specific gravity, Bulk density, Sieve analysis, Shape tests (Flakiness Index, Elongation Index, Angularity number) **Admixture:** Marsh cone test. .		
2	**A.FRESH CONCRETE** **Workability**: Factors affecting Workability, Measurement of workability – Slump test, Flow tests, Compaction factor and Vee-Bee Consistometer tests, Segregation and Bleeding.	**09**	**CO 2**
	B.FRESH CONCRETE (cont'd) **Process of manufacturing of concrete**: Batching, Mixing, Transporting, Placing, Compaction, Curing. Concept of RMC, methods of curing.		
	List of experiments: **Workability –** Slump Test, Compaction factor and Vee Bee tests.		
3	**A. HARDENED CONCRETE** **Properties:** Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, relation between compressive strength and tensile strength, bond strength, modulus of rupture, Testing of hardened concrete.	**09**	**CO3**
	B. HARDENED CONCRETE (cont'd) **Properties:** Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson , Ratio, Shrinkage - plastic shrinkage and drying shrinkage, Factors affecting shrinkage, Creep - Measurement of creep, factors affecting creep, effect of		

	creep		
	List of experiments: Compression strength and Split Tensile Tests, Flexural strength of beams.		
4	**A.DURABILITY OF CONCRETE** **Durability:** Definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, construction joints.	**09**	**CO3**
	B. DURABILITY OF CONCRETE (cont'd) **Factors contributing to cracks in concrete**: Physical, chemical & biological factors. Non-destructive testing of concrete – Schmid's hammer, UPV, pullout test,		
	List of Experiments: Ultrasonic pulse velocity test. Rebound hammer test.		
5	**A.MIX DESIGN** Concept of Concrete Mix design, Factors affecting mix design, exposure conditions, Procedure of mix design as per IS 10262-2009, Numerical examples of Mix Design.	**09**	**CO4**
	B.SPECIAL CONCRETES Properties and applications of fibre reinforced concrete, self compacting concrete, high performance concrete.		
	List of experiments: Self-compacting concrete: Slump flow test, V-funnel test, l-box test, U-box test, fill box test.		

TEXT BOOKS:

1. Properties of Concrete, A M Neville, ISBN-13: 978-0273755807, 5th edition ELBS, London.
2. Concrete Technology - Theory and Practice, M.S. Shetty, ISBN: 9788121900034, 1st edition,S.Chand and Company, New Delhi.
3. Concrete Technology - Theory and Practice,M L Gambhir , ISBN-13: 978-1259062551,5th edition, McGraw Hill Education

REFERENCE BOOKS:

1. Design of concrete mixes, N Krishna Raju, ISBN-13: 978-8123902180, 4th edition, CBS Publisher
2. "Concrete Manual", Gambhir M.L, 4th edition, Dhanpat Rai & Sons, New Delhi
3. Highway Materials & Pavement Testing, Sk Khanna, Ceg Justo, A Veeraragavan, ISBN-13: 9788185240213, Nem Chand & Brothers publishers
4. Current literature

CIE- Continuous Internal Evaluation (Theory 50 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**	**Curricular/ Co-curricular activities**
Marks (out of 50)	**25**	**10**	5	**10**
Remember	5			5
Understand	10	5	5	5
Apply	5	5		
Analyze	5			
Evaluate	-			
Create	-			

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	**Marks**
Remember	5
Understand	5
Apply	10
Analyze	5
Evaluate	-
Create	-

SEE – Semester End Examination (Theory 50 Marks)

Bloom's Category	Tests
Remember	10
Understand	15
Apply	20
Analyze	5
Evaluate	-
Create	-

SEE – Semester End Examination (Practical 25 Marks)

Bloom's Category	Marks
Remember	5
Understand	5
Apply	10
Analyze	5
Evaluate	-
Create	-

Percentage Evaluation of Various Blooms' levels

Bloom's Category	CIE	SEE	TOTAL	%
Remember	15	15	30	20
Understand	30	20	50	33.3
Apply	20	30	50	33.3
Analyze	10	10	20	13.4
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**75**	**75**	**150**	**100**

DESIGN OF RC STRUCTURAL ELEMENTS

Course Code: CIV52	**Credits 3**
L: P: T: S : 3:0:0:0	**CIE Marks 50**
Exam Hours: 03	**SEE Marks :50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand philosophy of different methods of RCC design.
CO2	Design of flanged & rectangular sections for flexure, shear & torsion.
CO3	Apply the limit state concepts in analysis and design of columns & footings
CO4	Apply the limit state concepts in analysis and design of staircases.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Contents of Module	Hrs	Cos
1	**A. Introduction:** Objectives of structural Design, Structural systems, Mutual relationship between Structural Analysis and Design. **B. Basic Design concepts –** working stress method, load factor method – limit state method, partial safety factors, stress-strain characteristics for concrete and steel importance of different limit states	**8**	**CO1**

2	**A. Ultimate Strength of Reinforced Concrete Sections** : Introduction to stress block parameters for limit state of collapse and limit state of serviceability. Ultimate flexural strength of Singly and doubly reinforced rectangular sections	**10**	**CO1**
	B. Serviceability Limit States : Deflection and cracking – code provision, deflection control in design. Limit state design of beams – Design of rectangular sections - singly and doubly reinforced, design for shear and development length.		
3	**A. Limit State Design of Beams :** Ultimate flexural design of flanged & rectangular sections. Torsion shear stress – reinforcement for torsion, calculation of short and long term deflection in beams.	**10**	**CO2**
	B. Limit State Design of Slabs : Limit state design of one way and two way slabs for various boundary conditions.		
4	**A. Limit State Design of Columns :** Limit state design of axially loaded short R.C. column. Design of columns with uniaxial bending - using SP16.	**9**	**CO3**
	B. Limit State Design of Footings: Design of isolated square & rectangular footing for axial load and uni-axial moment		
5	**A. Design of Staircase:** Design of staircase with waist slab/ folded plate – dog legged & open well	**8**	**CO4**
	B. Detailing of RC elements – beams, slab, columns, footing & staircase.		

TEXT BOOKS

1. Reinforced Concrete Design, S. Unnikrishna Pillai & Devadas Menon, ISBN 10: 007014110X / ISBN 13: 9780070141100, 3rd edition -2017, TMH Education Private Limited, New Delhi.
2. Limit state design of reinforced concrete, P.C. Varghese, 2, 2008, ISBN-10: 8120320395 ISBN-13: 978-8120320390, 2nd edition-2016, PHI Learning Private Limited, New Delhi.
3. Design of RCC Structural Elements, S.S. Bhavikatti, 2017, ISBN No. : 9788122440515,2017 edition, New Age International, New Delhi.

REFERENCE BOOKS

1. Fundamentals of Reinforced concrete Design, 3rd Edition, 2006, ISBN-10: 812033048X, PHI Learning Pvt Ltd.
2. Reinforced concrete Design, ISBN No. 9780070473324, -by S.N.Shinha, 2nd Edition,
3. IS-456-2000 and SP-16

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**	**Curricular/ Co-curricular activities**
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5			5
Understand	5	5		5
Apply	10	5	5	
Analyze	5	-		
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	-

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	%
Remember	10	10	20	20
Understand	15	15	30	30
Apply	20	15	35	35
Analyze	5	10	15	15
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

HIGHWAY ENGINEERING

Course Code	**: CIV53**	**Credits**	**: 03**
L: P: T: S	**: 3:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3 Hours**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the principles of Transportation system.
CO2	Apply the principles of highway geometric design for highways.
CO3	Identify the pavement materials & construction methodology.
CO4	Design Flexible and Rigid pavement as per IRC codes.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A. Introduction to Transportation engineering:** Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute. **B. Highway Development Planning** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.	09	CO1
2	**A. Highway Alignment:** Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance. **B. Surveys :** Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects	09	CO1
3	**A. Geometric Elements:** Importance of highway geometric design – highway Cross sectional elements. Sight distances- elements of horizontal and vertical alignments. B. **Introduction to Traffic Engineering:** Scope of traffic engineering, traffic characteristics, volume studies, speed studies, origin & Destination studies, PCU and Traffic Capacity.	09	CO2
4	A. **Pavement Materials:** Subgrade soil – Desirable properties-HRB soil classification-determination of CBR and modulus of subgrade	09	

	reaction-Examples on CBR and Modulus of subgrade reaction, Aggregates- Desirable properties and list of tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-List of tests on bituminous materials		CO3
	B. Pavement Construction: Earthwork –cutting-Filling, Preparation of subgrade, Specification and construction of Granular Sub base, WBM Base, WMM base, Bituminous Macadam, Dense Bituminous Macadam Bituminous Concrete, Dry Lean Concrete sub base, PQC and Concrete roads		
5	**A. PAVEMENT DESIGN:** Pavement types, component parts of flexible and rigid pavements and their functions, design factors, ESWL and its determination-Examples, **Flexible pavement**-Design of flexible pavements as per IRC;37-2012-Examples.	09	CO4
	B. Rigid pavement- Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC: 58-2015. Introduction to white topping.		

TEXT BOOKS:

1. Highway Engineering, S.K.Khanna, C.E.G.Justo, A.Veeraragavan, ISBN: 9788185240800 10th edition , Nem Chand Bros, Roorkee.
2. Principles and Practices of Highway Engineering, L R Kadiyali, ISBN-13: 978-8174091659 4thedition, 2005, Khanna Publishers, New Delhi
3. Transportation Engineering, K P Subramanium, ISBN:978-8174092205 2nd edition, 2011, Scitech Publications, Chennai
4. Introduction to Transportation Engineering, James H Banks, ISBN-13: 978-0070702462 2nd edition, 2004, Mc. Graw. Hill Pub. New Delhi

REFERENCE BOOKS:

1. **IRC:37-2012, IRC:58-2015,** IRC, New Delhi
2. **Specifications for Roads and Bridges,** MoRT&H, IRC, New Delhi.
3. **Transportation Engineering,** C. JotinKhisty, B. Kent lal ISBN: 9788120322127, 3rd edition,2009, PHI Learning Pvt. Ltd. New Delhi.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	**Curricular/ Co-curricular activities**
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	05	-	-	05
Understand	10		05	05
Apply	05	05		
Analyze	05	05	-	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	-

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	%
Remember	10	10	20	20
Understand	20	15	35	35
Apply	10	15	25	25
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ANALYSIS OF INDETERMINATE SRUTURES

Course Code : CIV54 **Credits 04**

L:P:T:S : 2:1:1:0 **CIE Marks : 50+25**

Exam Hours : 3+3 Hours **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concept of classical and matrix methods of analysis
CO2	Analyse continuous beams& frames using classical methods
CO3	Analyse continuous beamsusing matrix methods
CO4	Understand the basic concepts of structural dynamics & finite element method

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A. Slope deflection method**: Introduction, Sign convention, Development of slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)	**09**	**CO1**
	B. Analysis of rigid jointed plane framessway, members assumed to be axially rigid and kinematic redundancy up to 3 by slope deflection method.		
	List of Experiments: Modeling & analysis of different types of beams using software		
2	**A. Moment Distribution Method:** Introduction, Definition of terms- Distribution factor, Carry over factor, Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)	**09**	**CO1**
	B. Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid and kinematic redundancy up to 3) by moment distribution method		
	List of Experiments: Modeling & analysis of portal frames using software		
3	**A. Kanis Methods:** Introduction, Basic Concept, Analysis of Continuous beams and single bay two storey portal frame with and without sway.	**09**	**CO2**
	B. Clapeyron's theorem of three moments – Up to three span continuous beams with & without sinking of supports.		
	List of Experiments: Modeling & analysis of 2D frames using software.		
4	**A.Flexibility Matrix Method**: Introduction, Development of flexibility matrix for beams and axially rigid plane framed		

	structural elements	09	CO3
	B. Stiffness Matrix Method: Introduction, Development of stiffness matrix for beams and axially rigid plane framed structural elements.		
	List of Experiments: Modeling of the multi storied building using software.		
5	**A. Basic Principles of Dynamics:** Basic principles of Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion. Period and frequency. Forced and Free Vibration, Damping and Equations of Single Degree of Freedom System with and without damping	09	CO4
	B. Introduction to Finite Element Method: type of finite elements, Displacement functions, Beam element, Truss element, Plane Stress, Plane Strain, Modeling Concepts.(Without numerical problems)		
	List of Experiments: Analysis of the multi storied building using software.		

TEXT BOOKS

1. Structural Analysis II, Bhavikatti SS, (ISBN 13: 9788125942696) 4th Edition, 2011, Vikas Publishers New Delhi.
2. Structural Analysis, Thandavamoorthy TS, (ISBN-13: 978019806918-8) 3rd Edition, 2012, Oxford University Press
3. Theory of structures, Ramamrutham S, (ISBN: 9789384378103), 9th Edition, 2014 Dhanpat Rai Publications.
4. Finite Element Method and Computational Structural Dynamics, Manish S, ISBN-13: 978-8120349957, 1st Edition, 2012 PHI Publications

REFERENCE BOOKS

1. Basic Structural Analysis, Reddy C.S.(1259084094, 9781259084096) – 2nd Edition, 2011, Tata McGraw Hill Publication Company Ltd.
2. Theory of Structures Vol. 2 –S.P. Gupta, G.S. Pandit and R. Gupta,(9780074634981) 1st Edition, 1999,Tata McGraw Hill Publication Company Ltd..

3. Structural Analysis, Devdos Menon, (9788173197505),1st Edition, 2014, Narosa Book Distributors Pvt ltd-New delhi.

CIE Continuous Internal Evaluation (Theory 50 Marks)

Blooms Category	Test	Assignment	Quiz	Curricular/ Co-curricular activities
Marks out of 50	**25**	**10**	**05**	**10**
Remember	2	1		5
Understand	5	2	3	5
Apply	8	2	2	
Analyse	10	5		
Evaluate	-	-	-	
Create	-	-	-	

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	Marks
Remember	2.5
Understand	2.5
Apply	10
Analyze	10
Evaluate	-
Create	-

SEE-Semester End Examinations (Theory 50 Marks)

Blooms Category	Marks
Remember	5
Understand	10
Apply	15
Analyze	20
Evaluate	-
Create	-

SEE – Semester End Examination (Practical 25 Marks)

Bloom's Category	Marks
Remember	2.5
Understand	2.5
Apply	10
Analyze	10
Evaluate	
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10.5	7.5	18	12
Understand	17.5	12.5	30	20
Apply	22	25	47	31.3
Analyze	25	30	55	36.7
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**75**	**75**	**150**	**100**

BASICS OF GEOTECHNICAL ENGINEERING

Course Code: CIV55	**Credits: 5**
L: P: T: S : 3:2:0:0	**CIE Marks: 50+25**
Exam Hours: 03 + 03	**SEE Marks:50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the nature of Soil, its functional relationships and index properties
CO2	Study of classification of soil and clay mineralogy
CO3	Learn Engineering properties of Soil such as permeability and shear strength of soil
CO4	Understand compaction and compressibility of soil and their determination

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Content of Module**	**Hrs**	**Cos**
1	**INTRODUCTION TO SOIL MECHANICS:** **A. Nature of Soil and Functional relationships**: Definition of Soil Mechanics, Origin and formation of soil. Phase Diagrams, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Water content, Specific Gravity of soil solids and soil mass, Densities and Unit weights - Bulk, Dry, Saturated, Submerged and their inter relationships. Relative density.	**09**	**CO1**

	B. Determination of Index properties of soil: Determination of Water content (Oven drying method), Specific gravity (Pycnometer and Density bottle method). Determination of field density (Core cutter method and Sand replacement method). Particle size distribution (Dry Sieve analysis), Particle size distribution Curve. Consistency limits - Liquid Limit (Casagrande's method), Plastic limit and Shrinkage limit and indices -. Activity, Sensitivity and Thixotropy of Clay.		
	List of experiments: **1.** Tests for determination of Specific gravity (for coarse and fine grained soils) **2.** Consistency Limits – Liquid Limit (Casagrande's Method), plastic limit and shrinkage limit. **3.** Determination of In situ density by core cutter and sand replacement methods.		
2	**CLASSIFICATION OF SOIL AND CLAY MINEROLOGY** **A. Classification and identification of soils:** Need for soil classification, Field identification of soils, IS classification (theory) - Plasticity chart . **B. Soil Structure and Clay Mineralogy:** Single grained, honey-combed, flocculent and dispersed structures, primary and secondary bonds, Diffused double layer, adsorbed water, Base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.	**09**	**CO2**
	List of experiments: 1. Field identification of fine grained soils 2. Grain size analysis of soil sample (sieve analysis).		
3	**PERMEABILITY AND COMPACTION** **A. Flow of Water through Soils:** Darcy's law- assumptions, validity and limitations, discharge velocity, seepage velocity, percolation, Coefficient of permeability and its determination (Laboratory methods), Factors affecting permeability, Permeability of	**09**	**CO3**

	stratified deposits. **B. Compaction of soil**: Definition, Standard and Modified proctor's compaction tests, Factors affecting compaction, Effect of compaction on soil properties, Field compaction control - Proctor's needle method. Field compaction equipments and their suitability.		
	List of experiments: 1. Standard Proctor Compaction Test and Modified Proctor Compaction Test. 2. Coefficient of permeability by constant head and variable head methods		
4	**COMPRESSIBILITY AND CONSOLIDATION OF SOIL** **A. Consolidation of Soils:** Definition, difference between compaction and consolidation, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumptions and limitations (no derivation). Consolidation characteristics of soil (c_c, a_v, m_v and c_v). Normally consolidated, under consolidated and over consolidated soils. Pre-consolidation pressure and its determination. **B. Laboratory determination of consolidation of soil**: Laboratory one dimensional consolidation test, Consolidation test results, e – log p curve. Determination of consolidation characteristics of soils - compression index and coefficient of consolidation by square root of time fitting method and logarithmic time fitting method.	**09**	**CO3**
	List of experiments: 1. Consolidation test – determination of compression index and coefficient of consolidation(Demonstration only)		

5	**EFFECTIVE STRESS AND SHEAR STRENGTH OF SOIL** **A. Effective Stress Principle**: Definition and importance of effective stress. Effective Stress in soil mass under different hydrostatic conditions. Quick sand condition (Boiling of sand), critical hydraulic gradient. **B. Shear strength**: Shear strength parameters - Mohr Coulomb strength theory. Determination of shear strength parameters using triaxial shear tests under three drainage conditions namely UU, CU & CD tests, direct shear test, unconfined compressive strength and vane shear tests.	**09**	**CO4**
	List of experiments: 1. Determination of shear Strength parameters - Triaxial test, Direct Shear Test, Unconfined Compression Test, Laboratory vane shear test. Demonstration of miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter. 2. Demonstration of Hydrometer Test. 3. Demonstration of Free Swell Index 4. Demonstration of determination of relative density of sands. 5. Preparing a consolidated report of index properties and three engineering properties namely permeability, compressibility and shear strength of soils.		

TEXT BOOKS:

1. "Soil Mechanics and Foundation Engineering", Dr. Arora K. R, Standard Publishers and Distributors, (ISBN: 978-8180141126) 3rd edition 2009.
2. "Soil Mechanics and Foundation Engineering", B.C. Punmia, Laxmi Publications Co, (ISBN:978-8170087915) 16th edition, 2016.

REFERENCE BOOKS:

1. "Basic and Applied Soil Mechanics", Gopal Ranjan & A.S.R Rao, New Age International Pvt Ltd, (ISBN: 978-81-224-4039-3), 3rd Edition, 2016.
2. "Principles of Geotechnical Engineering", Braja M Das, (ISBN-13: 978-1133108665), CL Engineering, 8th Edition, 2013.
3. "Principles of Soil Mechanics and Foundation Engineering", V.N.S. Murthy, (ISBN 9780824708733), CRC Press, 2004.

CIE- Continuous Internal Evaluation (Theory 50 Marks)

Bloom's Category	Test	Assignment	Quiz	**Curricular/ Co-curricular activities**
Marks (out of 50)	**25**	**10**	**05**	**10**
Remember	5	2		05
Understand	12	2	2	05
Apply	5	5	3	
Analyze	3	1		
Evaluate				
Create				

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	Marks
Remember	4
Understand	5
Apply	6
Analyze	8
Evaluate	2
Create	-

SEE – Semester End Examination (Theory 50 Marks)

Bloom's Category	**Tests**
Remember	8
Understand	20
Apply	18
Analyze	4
Evaluate	
Create	

SEE – Semester End Examination (Practical 25 Marks)

Bloom's Category	Marks
Remember	4
Understand	5
Apply	6
Analyze	8
Evaluate	2
Create	-

Percentage Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	**CIE**	**SEE**	**Total**	**%**
Remember	16	12	28	19
Understand	26	25	51	34
Apply	19	24	43	28
Analyze	12	12	24	16
Evaluate	2	2	4	3
Create	-	-	-	
Total	**75**	**75**	**150**	**100**

ADVANCE SURVEYING

Course Code	**: CIV561**	**Credits**	**: 3**
L: P: T: S	**: 2:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concepts in Field Astronomy
CO2	Understand the probability distribution function
CO3	Use and application of modern equipments to obtain geo spatial data
CO4	Adopting principles of Electromagnetic Energy

Mapping of Course Outcomes to Program Outcomes:

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

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	Content of Module	Hrs	Cos
1	**A. Field Astronomy**: Earth, celestial sphere, earth and celestial coordinate systems.	09	CO1
	B. Field Astronomy (Cont'd): Spherical triangle, astronomical triangle, Napier's rule.		CO1

2	**A.PROBABILITY**: Probability distribution and function density function normal distribution. RMS error-measure of precision	09	CO2
	B. **PROBABILITY**(Cont'd): Rejection of observations-principles of least squares-Normal equations		CO2
3	**A. METHOD OF CORRELATES**: Triangulation, Triangulation adjustment. Angle adjustment.	09	CO3
	B. METHOD OF CORRELATES(Cont'd): Station adjustment and figure adjustment		CO3
4	**A. ELECTRONIC DISTANCE MEASUREMENT (EDM):** Introduction, Electro Magnetic (EM) Waves. Phase comparison and modulations	09	CO3
	B. ELECTRONIC DISTANCE MEASUREMENT (EDM(Cont'd): Instruments – Geodimeter – Tellurimeter – Distomat – Range finders, Radars.		CO3
5	**A. ADVANCED INSTRUMENTS** ;Introduction and application GPS and GIS, AND Total station	09	CO4
	B. REMOTE SENSING: Introduction Remote sensing, Basic principles, Electromagnetic Energy, Characteristic of solar radiation, Application of Remote sensing		CO4

Text Books

1. Surveying Vol I, Punmia. B.C, 2016, Lakshmi Publications, New Delhi. ISBN :8170088534, EDITION: 2016.

2. Surveying Vol II, Punmia. B.C, 2017, Lakshmi Publications, New Delhi. ISBN : 9788170088837, EDITION: 2017.

3. Surveying Vol III, Punmia. B.C, 2016, Lakshmi Publications, New Delhi. ISBN: 9788170088257, EDITION: 2016.

4. Surveying Vol I, Duggal S.K, 2013, Tata Mc Graw-Hill publishing Co. ISBN: 9781259028991, EDITION: 2013.

5. Surveying Vol II, Duggal S.K, 2013, Tata Mc Graw-Hill publishing Co. ISBN: 9781259029837, EDITION: 2013.

Reference Books

1. Plane and Geodetic Surveying for Engineers II, David Clark 2004, CBS publishers and distributors, New Delhi. ISBN: 9788123911724.

2. Higher Surveying, A.M. Chandra, 2015, New Age International Publishers, New Delhi**.** ISBN : 978-81-224-3812-3.

Assessment Pattern

CIE- Continuous Internal Evaluation

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks	25	10	05	10
Remember	5	2		05
Understand	10	3	3	05
Apply	10	5	2	
Analyze				
Evaluate				
Create				

SEE – Semester End Examination (50)

Bloom's Category	**Tests (Theory)**
Remember	10
Understand	15
Apply	25
Analyze	
Evaluate	
Create	

Percentage Evaluation of Various Bloom's levels (50)

	Theory			
Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	12	10	22	22
Understand	21	15	36	36
Apply	17	25	42	42
Analyze				
Evaluate				
Create				
TOTAL	50	50	100	100

PAVEMENT MATERIALS & CONSTRUCTION

Course Code : CIV562 **Credits :03**
L: P: T: S : 2:0:0:1 **CIE Marks :50**
Exam Hours : 03 **SEE Marks :50**

Course outcome **At the end of the Course, the student will be able to:**

CO1	Understand the properties of pavement materials.
CO2	Design the different bituminous mixes.
CO3	Identify the different types of road construction equipments.
CO4	Understand the construction method of flexible and Rigid pavements and quality control in road construction.

Mapping of Course Outcome to Program Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	**3**	**2**	**2**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**2**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**1**
CO3	**3**	**2**	**2**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**1**
CO4	**3**	**2**	**2**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**1**

Module No	Module Contents	Hrs	CO'S
1	**A. AGGREGATES:** Origin, classification, requirements, properties and tests on road aggregates,	9	CO1
	B. AGGREGATE GRADATION: concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.		CO1
2	**A. BITUMEN AND TAR:** Origin, preparation, properties and chemical constitution of bituminous road binders; requirements. Basic tests on bitumen	9	CO1
	B. **BITUMINOUS EMULSIONS AND CUTBACKS**: Preparation, characteristics, uses Basic tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.		CO1
3	**A. BITUMINOUS MIXES:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, without Hveem Stabilometer & Hubbar – Field Tests.	**9**	CO2
	B. MIX DEISGN: Types of bituminous mix, design methods using Rothfuch's Method only and specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.		CO2
4	**A. EQUIPMENT IN HIGHWAY CONSTRUCTION:** Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.	9	CO3

	B. **SUBGRADE:** Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests		CO3
5	**A. FLEXIBLE PAVEMENTS:** Specifications of materials, construction method and field control checks for various types of flexible pavement layers.	9	CO4
	B. CEMENT CONCRETE PAVEMENTS: Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.		CO4

Text Books

1. **Highway Engineering**, S K Khanna , C E G Justo, ISBN: 9788185240800 10th Edition, 2014, Nem Chand and Bros. Roorkee.
2. **Bituminous Road construction In India**, Prithvi Singh Kandhal, ISBN-13: 978-8120352582 Ist Edition, 2016, PHI Learning.
3. **Construction Equipment and its Management**", S C Sharma, ISBN-13: 978-8174092670 Revised, 2008, Khanna Publishers.

Reference Books:

1. **"Soil mechanics for Road Engineers", ISBN** 978-0115502781, RRL DSIR, Ist edition 1952 HMSO Publications.
2. **"Bituminous Materials in Road Construction",** ISBN 978-012973433, RRL DSIR, Ist edition 1962 HMSO Publications.
3. MORTH Specification (5th Revision).

Assessment Pattern

a. CIE Continuous Internal Evaluation (Theory 50 Marks)

Blooms Category	Tests	Assignments	Quizzes	Self study assessment
	25	10	05	10
Remember	10	4	2	5
Understand	10	4	3	5
Apply	5	2		
Analyse				
Evaluate				
Create				

b. SEE-Semester End Examinations (Theory 50 Marks)

Blooms Category	Questions (50 marks)
Remember	15
Understand	25
Apply	10
Analyse	
Evaluate	
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	%
Remember	21	15	36	36
Understand	22	25	47	47
Apply	07	10	17	17
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

CONSTRUCTION MANAGEMENT & ENGINEERING ECONOMICS

Course Code	**: CIV563**	**Credits**	**: 03**
L: P: T: S	**: 2:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 3 Hours**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the basic principles of Management & Engineering Economics
CO2	Manage Resources Ecnomically
CO3	Use management tools to take decisions
CO4	Estimate costs of projects

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A. Engineering Economics:** Basic principles – Time value of money, quantifying alternatives for decision making, Cash flow , simple numerical problems **B. Comparison of alternatives:** Present, future and annual worth method of comparing alternatives, simple numerical problems	09	CO1, CO2
2	**A. Break Even Analysis:** Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis, simple numerical problems **B. Contracts:** Introduction, Types, Stages of awarding contract, Disputes and arbitrations, Case Study on contracts	09	CO2, CO3

3	**A. Project Management:** Project Organization, Bar Charts, Work Breakdown Structure, Time estimates Applications of CPM and PERT simple numerical problems **B. Material Management:** Introduction to Material Management, ABC analysis- simple numerical problems, Purchase management and inventory control.	09	CO4
4	**A. Equipment Management** : Identification ,Planning of equipment , Selection of Equipment , Equipment Management in Projects, Maintenance Management **B. Equipment Economics :**Equipment cost ,Operating cost, Replacement of Equipment- Replacement Analysis - Buy/Rent/Lease options , simple numerical problems	09	CO5
5	**A. Cost estimating:** Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost, Introduction to Documentation **B .Highway economics:** Highway user benefits, Economic analysis - annual cost method-Benefit Cost Ratio method- simple numerical problems, Highway financing-BOT-BOOT concepts	09	CO6

Text Books:

1. Peurifoy. R L, "Construction Planning, Equipment and Methods"- Mc Graw Hill, (ISBN 978-0070498365)
2. "Construction Project Management, Theory and Practice", by Jha, K. N., Pearson, New Delhi, 2011 (ISBN 9789332542013)
3. "Estimating Construction Costs" by Peurifoy, R. L. and Oberlender, G. D., 5th ed., McGraw- Hill, New Delhi, 2004 (ISBN 9781259002106)
4. http://nptel.ac.in/downloads/105103023/

Reference Books

1. . Courtland A. Collier and William B. Ledbetter,"Engineering Economics and Cost Analysis"- Harper & Ro
2. "Fundamentals of Financial management", by Bose, D. C., 2nd ed., PHI, New Delhi, 2010

   (ISBN 8120340744)
3. "Managing the Construction Process", by Gould, F. E., 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002 (ISBN 9788131766804)
4. "Construction Equipment Management for Engineers, Estimators, and Owners", CRC/Taylor & Francis, Boca Raton, 2006 (ISBN 9780849340376).
5. "Modern Construction Management", by Harris, F. , Mc-Caffer, R. and Edum Fotwe, F., 6thed., Blackwell Publishing, 2006 (ISBN 9780470672174)
6. "Construction Project Management, Theory and Practice", by Jha, K. N., Pearson, New Delhi, 2011 (ISBN 9789332542013)
7. "Engineering Economic Analysis", by Newnan, Donald , 2010 (ISBN 9781490290942)
8. "Construction Cost Analysis and Estimating", by Ostwald, P. F., Prentice Hall, Upper Saddle River, New Jersey, 2001(ISBN 9781490290942).

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	05	10
Remember	05			05
Understand	05	05	05	05
Apply	05	05		
Analyze	05			
Evaluate	05			
Create				

SEE: Semester End Examination (50 Marks)	
Bloom's Category	**Tests**
Remember	10
Understand	10
Apply	15
Analyze	10
Evaluate	05
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	CIE	SEE	Total	%
Remember	10	10	20	20
Understand	20	10	30	30
Apply	10	15	25	25
Analyze	05	10	15	15
Evaluate	05	5	10	10
Create				
Total	50	50	100	100

ROCK MECHANICS

Course Code: CIV564 **Credits : 03**

L: P: T: S : 2: 0: 0: 1 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the basic knowledge of Rock Mechanics, stratigraphy of India, stereographic representation of geological data.
CO2	Analyze the Physico - mechanical properties of Rock and their determination through laboratory and filed tests.
CO3	Understandthe engineering classification of rock masses and strength, modulus & stress-strain behavior of rocks
CO4	Analyzerock slope stability, failure criteria for rock masses, excavations & methods to improve structural defects in rock masses and rock foundations

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs	COs
1	**A. INTRODUCTION**: Definition, Scope and Importance, Historical development of Rock Mechanics. Stratigraphy of India – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks, Paleozoic Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps. **B. STEREOGRAPHIC REPRESENTATION OF GEOLOGICAL DATA** Introduction, Principle of equal area net, plotting a line and plane, construction of pi diagram, uses and limitation of pi diagram.	09	CO1

2	**A. LABORATORY TESTS FORPHYSICO - MECHANICAL PROPERTIES OF ROCKS** Tests for Physico-mechanical properties: Compressive strength, Tensile strength, Direct shear, Triaxial Shear, Slake durability Schmidt Rebound Hardness, Sound Velocity, Swelling pressures and free swell, Void Index, Thermal conductivity **B. FIELD TESTS ON ROCKS AND ROCK MASS** Geophysical methods: Seismic Refraction method, Electrical Resistivity method, Deformability tests– Plate Loading Test (PLT), Plate Jack Test, Goodman Jack Test (GJT), Field shear test - Field PermeabilityTest – Open end Test, Packers Test. In situ stress measurement by Hydrofracture, Overcoring and Flat Jack methods.	09	CO2
3	**A. STRENGTH, MODULUS AND STRESS STRAIN BEHAVIOUR OF ROCKS** Factors influencing rock behavior, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Uniaxial Compressive Strength of Intact Anisotropic Rocks, Compressive strength and modulus from SPT, Stress Strain models – Elastic model, Elasto-plastic model, Visco elastic, Elasto-viscoelastic model.	09	CO3

	B. ENGINEERING CLASSIFICATION OF ROCK AND ROCK MASSES RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRS and RSR System. Classification based on strength and modulus, Clasification based on strength and failure strain, rock discontinuity qualitative description, friction in rocks – Amonton's law of friction.Application of rock mass classification in rock engineering.		
4	**A. ROCK SLOPE STABILITY:** Modes of failure – Rotational, Plane and wedge failures, Plane failure analysis, Wedgefailure Analysis and Toppling failure analysis, Protection against slope failure. **B. FAILURE CRITERIA FOR ROCK AND ROCK MASSES:** Mohr-Coulomb Yield Criterion, Drucker-Prager Criterion, Hoek-Brown Criterion, Tensile Yield Criterion.	09	CO4

5	**A. EXCAVATIONS AND METHODS TO IMPROVE STRUCTURAL DEFECTS IN ROCK MASSES** Drilling, Blasting and underground open excavation, criteria for design of underground excavations, tubular excavations, pillars and ribs support multiple excavations. Structural defects in Rock masses, their improvement by rock bolting, grouting and other methods. Shotcrete and rock support interaction analysis **B. ROCK FOUNDATION** Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Factor of Safety, Sliding stability of dam foundation, Settlement in rocks, Bearing capacity of piles in rock, Measures for strengthening rock mass – Concrete shear keys, Bored concrete piles, Tensioned cable anchors, concrete block at toe.	09	CO4

Text Books:

1. Engineering in Rocks for Slopes foundations and Tunnels – Ramamurthy, T; Prentice Hall India Learning Private Limited, Edition: Second-2010, ISBN: 9788120341685.
2. Introduction to rock mechanics- Goodman; John Wiley & Sons, New York, Edition: Second-1989, ISBN: 978-0471812005.
3. Fundamentals of Rock Mechanics-John Conrad Jaeger, Neville G. W. Cook, Robert Zimmerman; Wiley-Blackwell, Edition: Fourth-2007, ISBN: 9780632057597.
4. Rock mechanics for Underground Mining-Brady B.H.G and Brown E.T, Kluwer academic publishers, Edition: Third-2004, ISBN: 9781402020643.

Reference Books:

1. Rock Mechanics and the design of structures in Rock- L. Obert and W.I. Duvall;John Wiley & Sons, Edition: First-1967, ISBN: 9780471652359.
2. Rock Mechanics in engineering practice- Stagg K.G and Ziekiewicz. O.C;John Wiley and sons, Edition: First-1968, ISBN: 9780471819653.
3. Handbook on Mechanical Properties of Rocks - Vutukuri V.S, Lama R. D and Saluja S. S; Trans Tech Publications, Edition: First-1974, ISBN: 0878490108.
4. Engineering Rock Mass Classifications- Bieniawski, Z.T; John Wiley and Sons, Edition: First-1989, ISBN: 9780471601722.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	-	5	5
Understand	10	5	-	5
Apply	5	-		
Analyze	5	5	-	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests (Theory)**
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	15	10	25	25
Understand	20	20	40	40
Apply	5	10	15	15
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

MECHANIZATION IN CONSTRUCTION

Course Code	**: CIV565**	**Credits**	**: 03**
L: P: T: S	**: 3:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3 Hours**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	To understand construction planning, equipment management.
CO2	To decide which type and capacity of construction equipment can be used for a particular job on site.
CO3	To understand the technologies involved in different types of construction
CO4	To understand methods of drilling & blasting, safety and environmental aspects of Mechanization

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Content of Module**	**Hrs**	**COs**
1 A	**Construction Equipment Management** Identification of equipments, construction economy, construction Planning, importance of planning, lack of planning, types of	5	CO1

	planning, equipment management in projects, classification of equipments, selection of construction equipments,		
B	Cost of owing and operation, economic life of equipments, cost Control of equipments, depreciation analysis. Safety Management- Introduction, salient features of safety programs, general safety programs for construction, safety lacunae in Indian Construction Industry.	4	
2 A	Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Globalscenario Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers,scrapers, Excavators, Finishing equipment	5	CO2
B	Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells	4	
3 A	Mechanization in rebar fabrication Mechanization in concrete production and placement	5	CO2
B	Mechanization through construction: formwork and scaffolding-types, materials and design principles.	4	
4 A	Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology.	5	CO3
B	Pile Driving Equipment: Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.	4	
5 A	Definition of terms, bits, Jackhammers, Drifters, wagon drills, chisel drills , Mechanization through construction methods of Drilling, Blasting and Tunneling Equipment :	5	CO4

B	Piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment, drilling pattern. Safety and Environmental issues in mechanization	4	

Text Books:

1. Construction, Planning and Equipements - B.Satyanarayana and S.C.Saxena., Standard Publishers New Delhi. 1985.
2. "Construction Equipment and Management" - Sharma S.C. Khanna Publishers, Delhi, 1988
3. "Construction Planning, Equipment and Methods" - Peurifoy R L, Ledbetter, W.B. and Schexnayder, C ,5th Edition, Mc Graw Hill, Singapore, 1995
4. "Construction Equipment and its Planning and Applications", Mahesh Varma, Metropolitan Book Co.(P) Ltd.,New Delhi. India.

Reference Books:

1. Construction Equipment and Job Planning - Deodhar, S.V., Khanna Publishers, New Delhi, 1988
2. "Construction Review" Published by Civil Engineering and Construction Review,New Delhi, 1991.
3. "Current Literature"

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	5	-	-	5
Understand	10	5	5	5
Apply	10		5	
Analyze	-	-	-	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	15
Understand	20
Apply	15
Analyze	-
Evaluate	-

Percentage Evaluation of Various Blooms levels

Bloom's Category	CIE	SEE	TOTAL	%
Remember	10	15	25	25
Understand	25	20	45	45
Apply	15	15	30	30
Analyze	-		-	-
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

RETROFITTING AND REHABILITATION OF STRUCTURES

Course Code	**: CIV566**	**Credits**	**: 03**
L:P:T:S	**: 2:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 3 hrs**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand causes of deterioration of concrete structures
CO2	Understand basic Concept of Retrofitting and rehabilitation of various types of Structures
CO3	Apply various methods of retrofitting of building components
CO4	Identify and repair cracks in building components

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	**3**	**2**	**1**	**2**	**3**	**2**	**-**	**1**	**2**	**3**	**2**	**1**
CO2	**3**	**2**	**1**	**2**	**3**	**2**	**-**	**1**	**2**	**3**	**2**	**1**
CO3	**3**	**2**	**1**	**2**	**3**	**2**	**-**	**1**	**2**	**3**	**2**	**1**
CO4	**3**	**2**	**1**	**2**	**3**	**2**	**-**	**1**	**2**	**3**	**2**	**1**

Module No	Content of Module	Hrs	COs
1	**A. INTRODUCTION**: Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods	5	CO1
	B. PROPERTIES OF CONCRETE: Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.	4	
2	**A. REPAIR**: Concept of Repairing-Retrofitting-strengthening-rehabilitation-restoration-remoulding; Repair materials/methods-Repair methodology, issues related to material technology- desired properties of repair materials- materials for repair-new repair systems / products.	5	CO1, CO2
	B. DISTRESS AND CRACK REPAIR TECHNIQUES: Distresses in concrete structures-Deterioration of structures-causes and prevention- crack repair techniques-repair techniques/materials for structures- repair of	4	
	structural components		
	A. RETROFITTING OF MASONRY BUILDINGS: Failure mode of masonry buildings- out of plane failure-in plane failure- diaphragm failure-failure of connection	4	

3	**B. METHODS OF RETROFITTING**- cement or epoxy injection- using wire mesh and cement mortar- reconstruction of bulged portion of masonry wall-grouting with cement-pointing with mortar- shotcreting-using FRP fabric- using RC and steel frames- adding reinforcements to masonry-stitching of wall corners- use of tie rods- Prestressing of masonry- external binding or jacketing- splint and bandage technique-inserting new walls- exterior supplemental elements- strengthening of parapets	5	CO3
4	**A. RETROFITTING OF RC STRUCTURE**: Global retrofitting methods-adding new shear walls-adding steel bracing-adding infill walls- non conventional methods – seismic base isolation – supplemental damping devices;	5	CO3
	B. MEMBER OR LOCAL RETROFIT METHODS – jacketing/confinements – jacketing of columns using steel sections – reinforced concrete jacketing- FRP jacketing – beam jacketing – beam column joint jacketing – slab column connection – foundation	4	
5	**A. REPAIR OF CONCRETE FLOORS**: Surface preparation- thin bonded toppings – reinstating joint sealants – crack repair – crack cleaning and resin injection – crack cutting and mortar filling – application of cement/sand screed – use of toppings;	5	CO3, CO4
	B. RETROFITTING OF STEEL STRUCTURE: Rain water protection – drainage in structural members – preparation of surface by sand blasting – protective coatings – cathodic protection – sacrificial metal – concrete jacketing	4	

TEXT BOOKS:

1. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991, ISBN: 9780849349935, 1st edition 1991.
2. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001, ISBN: 9780750659932
3. "Earthquake resistant design of structures" by Pankaj agarwal, Manish shrikande, PHI,

2006, ISBN: 8120328922

REFERENCE BOOKS:

1. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai, ISBN: 9788190003759
2. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India 2002.
3. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Alpha Science International Limited, 2008, ISBN: 9781842654989

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	10	5		5
Understand	15	5	5	5
Apply	-	-	-	
Analyze	-	-	-	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	30
Understand	20
Apply	
Analyze	
Evaluate	-
Create	-

Percentage Evaluation of Various Blooms' levels

Bloom's Category	CIE	SEE	TOTAL	%
Remember	20	30	50	50
Understand	30	20	50	50
Apply	-	-	-	-
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

TRAFFIC ENGINEERING

Course Code : CIV571 **Credits : 03**
L: P: T: S : 2:0:0:1 **CIE Marks : 50**
Exam Hours : 03 **SEE Marks : 50**

Course outcome **At the end of the Course, the student will be able to:**

CO'S	Description
CO1	Understand the traffic characteristics.
CO2	Apply traffic flow principles and their applications.
CO3	The techniques to forecast traffic.
CO4	Identify the importance of signs , regulations and intelligent transport system

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A. INTRODUCTION AND TRAFFIC CHARACTERISTICS:** Definition, objectives of Traffic Engineering and scope of Traffic Engineering, Road user characteristics, vehicular characteristics – static and dynamic. **B.** Characteristics, power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Numerical problems.	09	CO1
2	**A. TRAFFIC STUDIES AND INTERPRETATION:** Various types of traffic engineering studies, data collection, analysis objectives and method of study – Definition of study area – Sample size and analysis. **B.** Classified traffic Volume at mid block and intersections, PCU, origin and destination, spot speed, speed and delay, parking – on street parking, off street parking, Accident – causes, analysis measures to reduce accident – problems on above.	09	CO1
3	**A. TRAFFIC FLOW THEORIES:** Traffic flow theory, Green shield theory – Goodness of fit – correlation **B.** Linear regression analysis – Queuing theory, Car following theory and Numerical problems.	09	CO2
4	**A. STATISTICAL ANALYSIS:** Poisson's distribution and application to traffic engineering. Normal Distribution – Significance tests for observed. **B.** Traffic data, Chi Square test – problems on above. Traffic forecast – simulation technique.	09	CO3

5	**A. TRAFFIC REGULATION AND CONTROL:** Driver, vehicle and road controls – Traffic regulations – one way – Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC Method, traffic rotary elements and designs, traffic operation – Street lighting, Road side furniture, Numerical problems. **B. INTELLIGENT TRANSPORT SYSTEM:** Definition, Necessities, Application in the present traffic scenario.	09	CO4

TEXT BOOKS:

1. Traffic Engineering & Transport Planning, L.R. Kadiyali, ISBN: 978-8174092205 8th , 2011 Khanna Publishers.
2. Highway Engineering, S.K.Khanna, C.E.G.Justo, A.Veeraragavan, ISBN: 978-8185240800 10th, 2015, Nem Chand Bros, Roorkee.
3. Traffic flow theory, Drew, ISBN: 9780070178311 1968 Mc. Graw Hill and Co.

REFERENCE BOOKS:

1. Traffic Engineering, Pignataro, ISBN: 978-01392622031973, Prentice Hall, Highway Capacity Manual, 2000.
2. An introduction to traffic engineering, 3rd edition Jotin Khistey and Kentlal, ISBN: 978-0130335609, 2002, PHI.
3. Traffic Engineering, Mc Shane & Roess, ISBN: 978-0136135739 2010, 4th edition , PHI.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	-		5
Understand	5	5	-	5
Apply	10	5	5	
Analyze	-	-	-	
Evaluate	5	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	15
Apply	15
Analyze	-
Evaluate	10
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	%
Remember	10	10	20	20
Understand	15	15	30	30
Apply	20	15	35	35
Analyze	-	-	-	-
Evaluate	5	10	15	15
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ALTERNATIVE BUILDING MATERIALS

Course Code : CIV572 **Credits: 03**

L: P: T: S : 2:0:0:1 **CIE Marks : 50**

Exam Hours : 3 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Calculate embodied energy in buildings
CO2	Identify & apply of various alternative building materials & technology
CO3	Understand the Mechanism of structural masonry and cost effective constructions.
CO4	Select suitable alternative material & technology for cost effective construction

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Content of Module**	**Hrs**	**Cos**
1 A	**Introduction:** Energy in building materials, building blocks, buildings – Environmental issues concerned to building materials – Global warming and construction industry. Green buildings & concepts of embodied energy.	09	CO1
B	Environmental friendly and cost effective building technologies - Requirements of buildings for different climatic regions.		

2 A	**Alternative Building Materials:** Characteristics of building blocks for walls – Stones and Laterite blocks, Bricks	09	CO1
B	hollow clay blocks – concrete blocks, mud blocks, stabilized mud blocks and steam cured blocks.		
3 A	**Alternative Building Materials (Continued):** Fly ash and Fal G Bricks, Lime – pozzolana cements: raw materials – manufacturing process – properties and uses.	09	CO2
B	**Alternative Building Technologies:** wall construction – types, construction methods, masonry mortars – types, preparation and properties, Ferro cement and ferroconcrete building components – materials and specifications, properties, construction methods and applications.		
4 A	**Alternative Building Technologies (Continued): R**oofing system – concepts, filler slabs, composite beam panel roofs, Masonry vaults and domes.	09	CO3,CO4
B	**Structural Masonry:** Compressive strength of masonry elements, Factors affecting compressive strength, strength of units, prisms / wallettes and walls		
5 A	**Structural Masonry (Continued):** Effect of Bond/joint strength on strength of masonry – Flexure and shear – Elastic properties of masonry materials and masonry – IS 1905 -1987 provisions – Design of masonry elements – axial, eccentric compression and lateral loads.	09	CO3,CO4
B	**Cost effective Construction:** Mass housing – economic construction Planning – need for using precast housing components – usage of alternative materials and technologies for mass construction.		

Text Books:

1. Jagadish.K.S, Venkatarama Reddy.B.V and Nanjunda Rao.K.S. "Alternative Building Materials and Technologies" , New Age Int. Pub. New Delhi – 2008.(Ch.1 to 8)

2. Hendry A.W., "Structural Masonry", 2nd Ed., Palgrave Macmillan Publishers, 1988.(Ch.7 & 8)

Reference books:

1. "Proceedings of workshop on alternative building material and technology" 19th – 20th dec 2003 @ bvb college of engineering & tech, hubli.(ch.3,4 & 5)

2. Manuals published by hudco.9ch. 7 & 8)

3. Relevant is 2250 : 1985, is 3466 : 1999, is 4098 : 1999, is 2116 :1998, is 1095 : 1998**CIE-**

Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5			5
Understand	5	5		5
Apply	10	5	5	
Analyze	5			
Evaluate	-			
Create	-			

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	-

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	**CIE**	**SEE**	**Total**	**%**
Remember	10	10	20	20
Understand	15	15	30	30
Apply	20	15	35	35
Analyze	5	10	15	15
Evaluate	-	-	-	-
Create	-	-	-	-
Total	50	50	100	100

OPEN CHANNEL HYDRAULICS

Course Code : CIV573	**Credits : 03**
L:P:T:S : 2:0:0:1	**CIE Marks : 50**
Exam Hours : 3 Hours	**SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand and analyze the characteristics of various types of open channel flow.
CO2	Understand the concept of gradually and rapidly varied flow and its computation
CO3	Analyze flow profile
CO4	Analyze and apply the concept of hydraulic jump in rectangular and nonrectangular channel.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**POI0**	**POII**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Module No	Content of Module	Hrs	Cos
1 A	**INTRODUCTION:** Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, Numerical	09	CO1
B	**CRITICAL FLOW:** Concept of specific Energy, Critical Depth and its calculation, Section Factor, First Hydraulic exponent M ,Computations		
2 A	**UNIFORM FLOW:** Concepts, uniform flow equations-Chezy's & Manning's, uniform flow computations,	09	CO1
B	Hydraulically efficient channel section, second hydraulic exponent N , Design of irrigation canals-lined & unlined		
3 A	**GRADUALLY VARIED FLOW:** Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification & problems	09	CO2,CO3
B	**ANALYSIS OF FLOWS PROFILES**: Analysis of flows profiles, transitional depth & Practical problems.		
4 A	**GRADUALLY VARIED FLOW COMPUTATION** by direct method & standard step method	09	CO2
B	**RAPIDLY VARIED FLOW**: Concepts, hydraulic jump in horizontal rectangular channels, classification of jumps and characteristics of jump & computation		
5 A	**HYDRAULIC JUMP**: Hydraulic jump in horizontal non-rectangular channels & Sloping rectangle channels	09	CO4
B	**APPLICATION OF HYDRAULI JUMP:** energy dissipation below overflow weir , Energy dissipation below sluice ways : stilling basins – USBR type II & IV		

Text Books:

1. Open Channel Hydraulics by K. Subramanya ,Tata McGraw Hill Publishing Education Pvt. Ltd, New Delhi, 3rd Edition 2009 (ISBN 0070086958, 9780070086951)
2. Flow through Open Channel by K.G Ranga Raju , Tata McGraw Hill Publishing Co Ltd, New Delhi,2nd Edition 2001 (ISBN-10: 007460497X,ISBN-13: 978-0074604977)
3. Open Channel Flow by Madan Mohan Das, Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition (IBN 8120335228, 9788120335226)
4. Flow Through Open Channels by Rajesh Srivastava, Oxford Press, New Delhi 2008 Edition (IBN 9780195690385)

Reference Books:

1. Open Channel Hydraulics by Richard H .French , Water Resources Publication; 1st edition 2007 (ISBN-10: 1887201440,ISBN-13: 978-1887201445)
2. Open Channel Hydraulics by Francis Martin Henderson, Macmillan Publishing Company, 1966 (ISBN-13: 978-0023535109 ISBN-10: 0023535105)
3. Open Channel Hydraulic by Ven Te Chow, McGraw-Hill Companies, New Delhi, 1959 (ISBN 10: 0070107769 / ISBN 13: 9780070107762)
4. Fluid Mechanics by Modi and Seth , Standard Book Home, New Delhi , 20th Edition 2013 (ISBN: 9788189401269, 8189401262)
5. Irrigation Engineering & Hydraulic structures by S K Garg, New Delhi, 27th Edition 2013 (ISBN 81-7409-047-9)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	5		2	5
Understand	10	3	3	5
Apply	5	3		
Analyze	5	4		
Evaluate				
Create				

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	14
Apply	10
Analyze	16
Evaluate	-
Create	

Percentage Evaluation of Various Blooms' levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	12	10	22	22
Understand	21	14	35	35
Apply	8	10	18	18
Analyze	9	16	25	25
Evaluate	-	-	-	-
Create				
TOTAL			100	100

HYDROLOGY AND IRRIGATION ENGINEERING

Course Code : CIV574	**Credits 03**
L: P: T: S : 2:0:0:1	**CIE Marks 50**
Exam Hours : 3 Hours	**SEE Marks 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand various components of hydrologic cycle, its measurement and estimation.
CO2	Get acquainted with the concepts of hydrographs, floods and its computation.
CO3	Understand and analyze different methods of irrigation, water requirement of crops, frequency and efficiencies of irrigation.
CO4	Analyze the concept of canal alignment & design.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A. Introduction to Hydrology**: Introduction, Hydrologic cycle - Horton's representation, Water budget equation, *Precipitation:* Forms, Types, Measurement using Simon's gauge & Syphon gauge. **B. Computation of Rainfall:** Selection of rain gauge station, Adequacy of rain gauges, Methods of computing average rainfall, Interpolation of missing rainfall data, Double mass curve method, Hyetograph and mass curve of rainfall.	**09**	**CO1**
2	**A. Evaporation**: Definition, Factors affecting evaporation, Measurement using ISI standard pan, Estimation using Meyer's and Rohwer's equation, Methods to reduce evaporation losses. **B. Evapotranspiration**: Definition, Factors affecting evapotranspitation, Measurement using Lysimeter and field plots, Estimation by Blaney criddle method. *Infiltration:* Definition, Factors affecting infiltration, Measurement using double ring infiltrometer, Infiltration indices, Horton's equation of infiltration.	**09**	**CO1**
3	**A. Hydrographs**: Definition, Components of hydrographs, Base flow separation, Unit hydrograph - its derivation from simple storm hydrograph, numerical problems, Limitations and uses. **B. Estimation of flood**: Definition of flood, factors affecting flood, Estimation of floods by using envelope curves, empirical formulae and rational method.	**09**	**CO2**
4	**A. Introduction to irrigation** Introduction, Need for irrigation, Advantages and disadvantages of irrigation, Types of irrigation system, Methods of irrigation. **B. Soil-water-crop relationship:** Introduction, Soil profile, Physical properties of soil, Functions of irrigation soils, Maintaining soil fertility, Soil-water-plant relationship and soil moisture - irrigation relationship, Frequency of irrigation.	**09**	**CO3**
5	**A. Water Requirement of Crops:** Crop seasons of India, Definition of Base period, Crop period, Delta and Duty,	**09**	

	Factors affecting duty, Methods to improving duty of water, Consumptive use, Assessment of irrigation water, Irrigation efficiencies. **B. Canals**: Definition, Types of canals, Alignment of canals, Design of canals by Kennedy's and Lacey's methods – Problems.		**CO3 & CO4**

TEXT BOOKS:

1. Engineering Hydrology – Subramanya.K; Tata McGraw Hill New Delhi, Edition: Fourth-2013, ISBN: 9781259029974.
2. Irrigation & Water Power Engineering - B.C.Punmia, B.B.L. Pande, Ashok K.R. Jain, Arun K.R. Jain; Laxmi Publications (P) Ltd., New Delhi, Edition: First-2016, ISBN: 9788131807637.
3. A Text Book of Hydrology- Jayarami Reddy, Laksmi Publications (P) Ltd., New Delhi, Edition: Third-2016, ISBN: 9789380856049.
4. Hydrology: Principles, Analysis and Design - H. M. Raghunath, New Age International, Edition: Third-2014, ISBN: 9788122436181.

REFERENCE BOOKS:

1. Irrigation, water Resources and water power Engineering - P.N.Modi-standard book house, New Delhi, Edition: Ninth-2014, ISBN: 9788189401290.
2. Irrigation Engineering: Including Hydrology - R.K.Sharma & T.K.Sharma, S Chand & Co Ltd., Edition: Revised Edition-2007, ISBN: 9788121921282.
3. Irrigation Engineering and Hydraulic structures- S. K. Garg- Khanna Publication, New Delhi, Edition: First-2006, ISBN: 9788174090478.
4. Hydrology & Water Resources Engineering- Patra K.C. Narosa Book Distributors Pvt. Ltd. New Delhi, Edition: Second-2015, ISBN: 9788173198465.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	5	-	-	5
Understand	5	5		5
Apply	10	5	5	
Analyze	5	-	-	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	5
Understand	20
Apply	15
Analyze	10
Evaluate	-
Create	-

Percentage Evaluation of Various Blooms levels

Bloom's Category	CIE	SEE	TOTAL	%
Remember	10	5	15	15
Understand	15	20	35	35
Apply	20	15	35	35
Analyze	5	10	15	15
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

CONSTRUCTION QUALITY AND SAFETY

Course Code : CIV575	**Credits 03**
L: P: T: S : 2:0:0:1	**CIE Marks 50**
Exam Hours : 3 Hours	**SEE Marks 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the various types Quality Management.
CO2	Expose to means of quality control
CO3	Become aware of quality assurance and Total Quality Management
CO4	Understand the importance of safety in construction industry

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	PO11	PO12
CO1	**3**	-	**2**	**2**	-	**2**	-	**2**	-	-	-	-
CO2	**3**	-	**2**	**2**	-	**2**	-	**2**	-	-	-	-
CO3	**3**	-	**2**	**2**	-	**2**	-	**2**	-	-	-	-
CO4	**3**	-	**2**	**2**	-	**2**	-	**2**	-	-	-	-

Module No	**Content of Module**	**Hrs**	**Cos**
1A	**Introduction to quality**: Importance of quality; Quality transition - quality control and inspection, quality assurance, total quality management;	9	CO1
B	Evolution of quality management, quality tree, benefits of quality, types of Quality		

2A	**Quality Control**: Planning and control of quality during design of structures; Tools and techniques for quality management; Inspection of materials and machinery.	9	CO2
B	Cost of quality, quality control: objectives of qc, quality at source, Quality control strategy and policy		
3A	**Quality Assurance and Management**: Quality assurance in construction; Systems quality management; Quality standards/codes in design and construction; (ISO:9000);	9	CO3
B	Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, Third Party Certification		
4A	**Introduction To Construction Safety**: Construction Safety-meaning and scope, Safety in construction-Technological aspects, organizational aspects and behavioral aspects.	9	CO4
B	Safety legislation and Standards, Contract conditions on safety in civil Engineering projects		
5A	**Safety Management**: Safety rules in construction, Safety in construction operations, Safety in the use of construction equipment,	9	CO4
B	Ergonomics, Accident Prevention and safety, Construction Safety Management, Training for safety awareness and implementation; Construction safety and health manual.		

Text Books:

1. D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore

2. N. Logothetis, "Management for Total Quality", Prentice Hall
3. David Gold Smith, "Safety Management in construction and Industry", Mc Graw Hill

References

1. Leavenworth, "Statistical Quality Control" Grant Publication.
2. BesterField,"Total Quality Management", by Pearson Education
3. Juran Frank, J.M. and Gryna, F.M, Quality Planning and Analysis, Tata McGraw Hill, 1982.
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 1993.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	5			5
Understand	15	5	5	5
Apply	5	5		
Analyze				
Evaluate				
Create				

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	25
Apply	15
Analyze	
Evaluate	

Percentage Evaluation of Various Blooms levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10	10	20	20
Understand	30	25	55	55
Apply	10	15	25	25
Analyze				
Evaluate				
Create				
TOTAL	50	50	100	100

PREFABRICATED STRUCTURES

Course Code : CIV576 **Credits 03**
L: P: T: S : 2:0:0:1 **CIE Marks 50**
Exam Hours : 3 Hours **SEE Marks 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the need of prefabricated structures and materials.
CO2	Understand the components of prefabricated structures and design principles.
CO3	Understand the production and hoisting technology of Prefabricated structural components.
CO4	Get knowledge about applications and design of abnormal loads.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	Cos
1	**A).INTRODUCTION** Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication – Economy of prefabrication – Modular coordination – Standardization – Planning for Components of prefabricated structures –Disuniting of structures	5	CO1

	B).PREFABRICATED COMPONENTS Design of simple rectangular beams and I beams – Handling and erection stresses –Elimination of erection stresses – Beams, columns - Symmetrical frames	4	
2	**A).PREFABRICATED ELEMENTS** Roof and floor panels, ribbed floor panels – wall panels – footings	4	CO1,CO2
	B).JOINTS FOR DIFFERENT STRUCTURAL CONNECTIONS Joints for different structural connections–Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction.	5	
3	**A).PRODUCTION TECHNOLOGY METHODS** Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup.	5	CO3
	B). PRODUCTION TECHNOLOGY Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening	4	
4	**A).HOISTING TECHNOLOGY** Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads.	5	CO3,CO4
	B) APPLICATIONS Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, Cable frames –	4	
5	**A). APPLICATIONS** Single span single storeyed frames – Single storeyed buildings – slabs, beams andcolumns.	3	CO4
	B).DESIGN FOR ABNORMAL LOADS Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse.	6	

TEXT BOOKS:

1. "Prefabricated Concrete for Industrial and Public Structures", L. Mokk, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. "Knowledge based process planning forconstruction and manufacturing", Gerostiza C.Z., Hendrikson C. and Rehat D.R, Academic Press Inc., (ISBN – 9780127819006), 2007.
3. I. T. Koncz, "Manual of Precast Concrete Construction", Vol. I, II, III & IV, Berlin, 1971

REFERENCE BOOKS:

1. CBRI, "Building materials and components", India, 1990.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 1978.
3. "Prefabricated Concrete for Industrial and Public Sectors", LassloMokk, ,AkademiaiKiado, Budapest, 1964.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	05	2		5
Understand	05	4		5
Apply	10	2	3	
Analyze	05	2	2	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests(Theory)
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	-

Percentage Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	12	10	22	22
Understand	14	15	29	29
Apply	15	15	30	30
Analyze	9	10	19	19
Evaluate	-	-	-	-
Create	-	-	-	-
Total	**50**	**50**	**100**	**100**

SIXTH SEMESTER SYLLABUS

ENVIRONMENTAL ENGINEERING 1

Course Code	**: CIV61**	**Credits**	**5**
L: P: T: S	**: 3:2:0:0**	**CIE Marks**	**: 50+25**
Exam Hours	**: 03+03 hours**	**SEE Marks**	**: 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply engineering knowledge to estimate the demand of water and analyse the quality of water.
CO2	Design efficient treatment unit for the benefit of environment and society.
CO3	Gain knowledge about disinfection and water softening.
CO4	Develop layout of water supply in buildings and understand pipe appurtenances.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Content of Module**	**Hrs**	**COs**
1	**A. Introduction:** Human activities and environmental pollution. Need for protected water supply. Drinking water standards BIS & WHO guidelines (IS 10500). Objectives of water quality management. Wholesomeness & palatability, water borne diseases. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics.	**09**	**CO1**

	B. Demand of Water: Types of water demands- domestic, institutional, commercial, public and fire. Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits & demerits- variations in demand of water. Fire demand – estimation by Kuichling's formula, peak factors, design periods & factors governing the design periods **List of experiments** **1.** Determination of Alkalinity, Acidity and pH **2.** Determination of Electrical conductivity, Chlorides **3.** Determination of Hardness		
2	**A. Sources and Collection:** Sources- Surface and subsurface sources – suitability with regard to quality and quantity. Intake structures – different types of intakes; factor of selection and location of intakes.	**09**	**CO1**
	B. Quality of Water: Sampling of water for examination Water quality parameters – Testing Physical- Temperature, Electrical conductivity, Turbidity, colour, odour, taste. Chemical – Total solids, Hardness, Chlorides, Chlorine, pH, Sulphates, nitrogen compounds, iron, DO, BOD, COD, sodium and potassium. Microbiological analysis. **List of experiments** 1. Determination of Dissolved Oxygen. 2. Determination of BOD 3. Determination of sodium and potassium by flame photometer		
3	**A. Water Treatment**: Objectives – Treatment flow-chart. SEDIMENTATION: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing, and clari- flocculator	**09**	

	B. Filtration: Mechanism – theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design (excluding under drainage system) , back washing of filters. Operational problems in filters. **List of experiments** 1. Jar Test for Optimum Dosage of Alum		**CO2**
4	**A. Disinfection:** Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV irradiation treatment – treatment of swimming pool water.	**09**	**CO3**
	B. Softening – Definition, methods of removal of hardness by lime soda process and zeolite process, RO & Membrane technique. **Miscellaneous Treatment-**Aeration- Types of Aeration. Adsorption technique, fluoridation and defluoridation. **List of experiments** **1.** Determination of residual chlorine**.** **2.** Determination of percentage of available chlorine in bleaching powder		
5	**A. Conveyance of water**- Design of the economical diameter for the rising main; Nomograms – use, Pipe appurtenances various valves, type of fire hydrants, pipefitting, Layout o water supply pipes in buildings. Plumbing in high rise buildings.	**09**	**CO4**
	B. Distribution Systems: System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems. **List of experiments** **1.** Determination of Solids in Sewage		

TEXT BOOKS:

1. Water supply Engineering –S.K.Garg, Khanna Publishers, ISBN: 9788174091208, 2010 edition
2. Environmental Engineering I –B C Punima and Ashok Jain, ISBN:9788170080923, 2nd edition.
3. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi.

REFERENCE BOOKS:

1. Hammer, M.J., (1986), **Water and Wastewater Technology** –SI Version, 2nd Edition, John Wiley and Sons.ISBN:9780131745421
2. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse ,** 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd.ISBN: 9780071241403
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986),**Environmental Engineering**–Mc Graw Hill Book Co.ISBN:9780070495395
4. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach**–Prentice Hall of India Pvt. Ltd., New Delhi.ISBN: 9781587161247

CIE- Continuous Internal Evaluation (Theory 50 Marks)

Bloom's Category	Test	Assignment	Quizzes	**Curricular/ Co-curricular activities**
Marks (out of 50)	25	10	5	10
Remember	3	1	2	5
Understand	6	5	3	5
Apply	10	2		
Analyze	6	2		
Evaluate		-	-	
Create	-	-	-	

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	Marks
Remember	5
Understand	10
Apply	10
Analyze	-
Evaluate	-
Create	

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	5
Understand	15
Apply	15
Analyze	15
Evaluate	-
Create	-

SEE – Semester End Examination (Practical 25 Marks)

Bloom's Category	Marks
Remember	5
Understand	10
Apply	10
Analyze	-
Evaluate	-
Create	-

Percentage Evaluation of Various Bloom's levels (50)

Bloom's Category	CIE	SEE	TOTAL	%
Remember	16	10	26	17
Understand	29	25	54	36
Apply	22	25	47	32
Analyze	8	15	23	15
Evaluate		-	-	-
Create	-	-	-	-
TOTAL	75	75	150	100

DESIGN & DETAILING OF RC STRUCTURAL ELEMENTS

Course Code: CIV62 **Credits 5**

L: P: T: S : 3:2:0:0 **CIE Marks: 50+25**

Exam Hours: 04 **SEE Marks: 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply IS provisions in structural detailing.
CO2	Prepare detailing of various RCC structural elements
CO3	Design and detail Footing & Water Tank.
CO4	Design and detail Retaining wall & Portal frame.

Mapping of Course Outcome to Program Outcome

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

Module No.	Contents of Module	Hrs	CO_S
1	**A. Preparation of bar bending schedule** for beams, columns, slabs and footings. **B. Layout Drawing**: General layout of building showing, position of columns, footings, beams and slabs with standard notations. **PRACTICAL CONTENT:** General layout of building showing, position of columns, footings, beams and slabs with standard notations.	**09**	**CO1**
2	**A.** Detailing of continues beams and floor slabs **B.** Detailing of One Way &Two Way slab with torsional reinforcement **PRACTICAL CONTENT:** Detailing of beams & slabs with bar bending schedule.	**09**	**CO2**
3	**A.** Detailing of Staircases: Dog legged and Open well type with waist slab / folded plates **B.** Detailing of Square and Rectangle Column with footing **PRACTICAL CONTENT:** Detailing of Staircases & Column footings.	**09**	**CO2**
4	**A.** Design of Rectangular Combined footing with strap beam. **B.** Design of circular water tank with Flexible base Using IS: 3370 Part IV. **PRACTICAL CONTENT**: Detailing of Rectangular Combined footing & circular water tank.	**09**	**CO3**
5	**A.** Design of Cantilever type Retaining wall.	**09**	**CO4**
	B. Design of Portal Frames subjected to gravity loads - Single bay & Single storey with fixed base. **PRACTICAL CONTENT:** Detailing of Cantilever type. Retaining wall & Portal Frames.		

TEXT BOOKS

1. Structural Design & Drawing Reinforced Concrete & Steel, N. Krishnaraju, 2nd edition, 2005 ISBN No. 8173714894, 9788173714894, University Press.
2. Reinforced Concrete Structures, B.C. Punmia, 10th edition, 2012, ISBN No. 13: 9788131809426 Laxmi Publishing Co
3. Structural Design & Drawing : Reinforced Concrete & Steel- ISBN No 788173714894N. Krishnaraju, 2005, University Press.

REFERENCE BOOKS

1. Structural Design and Drawing, ISBN No. 978-8123901473 Krishnamurthy -1st Edition, 2006, (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
2. Reinforced Concrete Structures, ISBN No.-9788131809426 - B.C. Punmia –2012, Laxmi Publishing Co.
3. Reinforced Concrete Design, ISBN No. - 978-9-35-134247-2 S.N.Sinha, 2014,McGrawHill Education.
4. Illustrated Design of Reinforced Concrete Buildings, ISBN No.81-903717-2-X by Karve & Shaha, 6th Edition, 2010, Structures Publications.

CIE Continuous Internal Evaluation (Theory 50 Marks)

Blooms Category	**Test**	**Assignment**	**Quizzes**	**Curricular/ Co-curricular activities**
Marks (Out of 50)	**25**	**10**	**5**	**10**
Remember	5	2		5
Understand	5	3		5
Apply	5	3	3	
Analyse	10	2	2	
Evaluate	-	-	-	
Create	-			

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	**Marks**
Remember	2
Understand	3
Apply	10
Analyze	10
Evaluate	-
Create	-

SEE-Semester End Examinations (Theory 50 Marks)

Blooms Category	**marks**
Remember	5
Understand	5
Apply	20
Analyse	20
Evaluate	-
Create	-

SEE – Semester End Examination (Practical 25 Marks)

Bloom's Category	Marks
Remember	2
Understand	3
Apply	10
Analyze	10
Evaluate	-
Create	-

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	14	7	21	14
Understand	16	8	24	16
Apply	21	30	51	34
Analyze	24	30	54	36
Evaluate	-	-	-	-
Create	-	-	-	-
Total	**75**	**75**	**150**	**100**

DESIGN OF PRE STRESSED CONCRETE STRUCTURE

Course Code: CIV63 **Credits 3**

L: P: T: S : 3:0:0:0 **CIE Marks 50**

Exam Hours: 03 **SEE Marks 50**

Course outcome –

CO1	Understand the concepts of pre-stressing.
CO2	Analyze pre-stress members for external load and pre-stress.
CO3	Analyze flanged & rectangular members/sections for flexure and shear.
CO4	Design of simple flexural members.

Mapping of Course Outcome to Program Outcome

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

Module No	Module Contents	HRS	COS

1.	**A. MATERIALS:** Materials for pre-stressed concrete, high strength concrete and high strength steel. Stress-Strain characteristics and properties, advantages of pre-stressed concrete	**6**	CO 1
	B .BASIC PRINCIPLES OF PRESTRESSING:. Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages. Pre-stressing systems (1) Fressinet System (2) Gifford Udall (3) Magnel Blatan System, Tensioning devices, is anchoring devices. (d) Pretensioning and Post tensioning.		
2	A**. ANALYSIS OF SECTIONS FOR FLEXURE**: Analysis of pre-stress members, assumptions, Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles. Thrust line concept of load balancing, cable profile, as per IS 1343 - 2012.	**14**	CO1
	B. **LOSSES OF PRE-STRESS:** Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force. Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to curvature etc. I.S. code		
3	**A.DEFLECTIONS:** Effect of tendon profile on deflections – Factors influencing deflections – Calculation of Short term and long term deflections of simply supported flexural members, Elastic deflections under transfer loads and due to different cable profiles	**7**	CO2
	B.DEFLECTION LIMITS: as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection		

4	**A. LIMIT STATE OF COLLAPSE:** Limit state design of flexural members, stress, I.S. code provisions, design of symmetrical beams, Flexure -IS Code recommendations – Ultimate flexural strength of sections. **B. LIMIT STATE OF COLLAPSE** : Shear - IS Code recommendations, shear resistance of sections, shear reinforcement.	**7**	CO3
5	**A.DESIGN OF END BLOCKS:** Transmission of pre-stress in pre-tensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement. **B.DESIGN OF PRE-TENSIONED & POST TENSIONED BEAMS:** design of simple rectangular pre & post tensioned flexural members	**11**	CO4

Text Books

1. N. Krishna Raju , "Pre-stressed Concrete", Tata McGraw Publishers, (ISBN**:** 9781259003363), 5th Edition, 2012.
2. P. Dayarathnam "Pre-stressed Concrete", Oxford and IBH Publishing Co.(ISBN: 9788120417915), 2016.

Reference Books

1. T.Y. Lin and Ned H Burns "Design of pre-stressed concrete structures", Wiley India Private Limited, (ISBN: 978-8126528035), 3rd Edition, 2010.
2. N.C. Sinha & S.K. Roy "Fundamentals of pre-stressed concrete", S Chand Publishers, New Delhi, (ISBN: 9788121924276), 3rd Edition, 2011,
3. N.Rajgopalan, "Pre-stressed Concrete", Narosa Publishing House, (ISBN:9781842652121), 2nd Edition, 2015
4. IS-1343

CIE Continuous Internal Evaluation (Theory 50 Marks)

Blooms Category	Internal	Assignments	Quizzes	Curricul r/. Co-curricular activities
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	3	2		5
Understand	10	3	3	5
Apply	7	3	2	
Analyse	5	2		
Evaluate	-	-	-	
Create	-	-	-	

SEE-Semester End Examinations (Theory 50 Marks)

Blooms Category	marks
Remember	10
Understand	10
Apply	15
Analyse	15
Evaluate	-
Create	-

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	10	10	20	17
Understand	21	10	31	26
Apply	12	15	27	31
Analyze	7	15	22	26
Evaluate	-	-	-	-
Create	-	-	-	-
Total	**50**	**50**	**100**	**100**

APPLIED GEOTECHNICAL ENGINEERING

Course Code: CIV64 **Credits 3**
L: P: T: S : 3:0:0:0 **CIE Marks 50**
Exam Hours: 03 **SEE Marks 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Evaluate suitability of a site using soil exploration techniques and ground improvement techniques.
CO2	Analyse slope stability and to determine stresses using Boussineq's and Westergaard's solution.
CO3	Determine the lateral earth pressures on earth retaining structures and bearing capacity of soils for foundations.
CO4	Analyse and compute the settlement in foundations and to design shallow foundations and pile foundations.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	Cos
1	**SOIL EXPLORATION AND IMPROVEMENT** **A. Subsurface Exploration:** Importance of soil exploration, Methods of exploration: Boring (Auger, Rotary, percussion drilling), types of samples, Samplers, Sample disturbance, Area ratio, Recovery ratio, clearance, Stabilization of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures, Standard penetration test and cone penetration test, geophysical methods of exploration. Preparation of Soil exploration report.	9	CO1
	B. Site improvement: Introduction, Need for ground improvement, Stabilization of soils, different types- mechanical, lime, fly ash and chemical stabilization, Vibroflotation.		
2	**SOIL STRESSES AND SLOPE STABILITY** **A. Stresses in Soils**: Boussinesq's and Westergaard's theories for different types of loadings (no derivations). Comparison of Boussinesq's and Westergaard's analysis, Newmark's chart.	9	CO2
	B. Stability of Earth Slopes: Types of slopes, Causes and Types of slope failures. Definition of Factor of safety, Stability of infinite slopes for cohesive and cohesion less soils, Stability of finite slopes by Swedish slip circle method, Taylor's stability number.		

3	**EARTH PRESSURE THEORIES AND BEARING CAPACITY OF SOIL** **A. Lateral Earth Pressure**: Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories-–assumptions and limitations, Graphical solutions for active and passive earth pressures - Culmann's and Rebhann's methods.	9	CO3
	B. Bearing Capacity: Definitions of bearing capacity, ultimate, net and safe bearing capacities, and allowable bearing pressure. Terzaghi's bearing capacity equations – assumptions and limitations (no derivation), Types of shear failure, Effect of ground water table on bearing capacity. Plate load test.		
4	**SETTLEMENT ANALYSIS AND SHALLOW FOUNDATIONS:** **A. Settlement analysis**: Distribution of contact pressure-estimation of immediate and consolidation settlement - causes of settlement - permissible, total and differential settlement - methods of reducing differential settlement.	9	CO4
	B. Shallow foundations: General considerations - Functions of foundation - shallow foundation - different types of shallow foundation -Selection of type of shallow foundation-steps involved.		
5	**RAFT FOUNDATION AND PILE FOUNDATION** **A. Raft foundation:** Bearing capacity equations, Design considerations, Floating foundations.	9	CO4
	B. Pile foundation: Necessity, Classification, Pile load capacity, group of piles, pile spacing, pile group efficiency, dynamic and static formulae, Pile load test, penetration tests.		

TEXT BOOKS:

1. "Soil Mechanics and Foundation Engineering", Dr. Arora K. R, Standard Publishers and Distributors,(ISBN: 978-8180141126) 3rd edition 2009.
2. "Soil Mechanics and Foundation Engineering", B.C. Punmia, Laxmi Publications Co, (ISBN:978-8170087915) 16th edition, 2016.

REFERENCE BOOKS:

1. "Basic and Applied Soil Mechanics", Gopal Ranjan & A.S.R Rao, New Age International Pvt Ltd, (ISBN: 978-81-224-4039-3), 3rd Edition, 2016.
2. "Principles of Geotechnical Engineering", Braja M Das, (ISBN-13: 978-1133108665), CL Engineering, 8th Edition, 2013.
3. "Principles of Soil Mechanics and Foundation Engineering", V.N.S. Murthy, (ISBN 9780824708733), CRC Press, 2004.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Test	Assignment	Quizzes	**Curricular/ Co-curricular activities**
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	2		5
Understand	10	2		5
Apply	10	5	5	
Analyze		1		
Evaluate				
Create				

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests(Theory)**
Remember	10
Understand	17
Apply	20
Analyze	3
Evaluate	
Create	

Percentage Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	12	10	22	22
Understand	17	17	34	34
Apply	20	20	40	40
Analyze	1	3	4	4
Evaluate				
Create				
Total	**50**	**50**	**100**	**100**

MINI PROJECT (EXTENSIVE SURVEY VIVA-VOCE)

Course Code : CIV67 **Credits 04**
L: P: T: S : 0:4:0:0 **CIE Marks : 50**
Exam Hours : 3 **SEE Marks : 50**

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

CO1	To apply the concepts of surveying practically in the field
CO2	To design new water treatment project and enhancement of capacity of existing project
CO3	To apply the concepts of surveying in highway projects
CO4	To draw layout and access the requirements of water supply and sanitary projects

Mapping of CO v/s PO:

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

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Course syllabus:			
Unit No	Contents of Unit	Hrs	Co's
1	General instructions, Reconnaissance of the sites and fly leveling to establish bench marks. **New Tank** Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line. Capacity surveys Details at Waste weir and sluice points.	12	CO1,CO2
2	**WATER SUPPLY AND SANITARY PROJECT** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.	10	CO1,CO4
3	**HIGHWAY PROJECT** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment Final alignment, longitudinal section along final alignment, typical cross, sections of road.	10	CO1,CO3
4	**OLD TANK PROJECTS** Longitudinal and cross sections of the centre line of bund. Capacity surveys to explore the quantity, Details at existing Waste weir and sluice points.	10	CO2

TEXT BOOKS:

1. **Surveying'** Vol 2 and Vol 3 - B.C. Punmia , Er. Ashok Kr. Jain, Dr.Arun Kumar Jain, Laxmi Publications, New Delhi. Edition: 16th (2016), ISBN: 8170088836.
2. **'Plane Surveying'** A. M. Chandra – New age international (P) Ltd,3rd Edition (Reprint 2015), ISBN 978-81-224-3880-2
3. **'Higher Surveying'** A.M. Chandra New age international (P) Ltd, 3rd Edition (2015), ISBN 978-81-224-3812-3 .

REFERENCE BOOKS: 1. Fundamentals of Surveying - Milton O. Schimidt – Wong, Thomson Learning.

2. Fundamentals of Surveying - S.K. Roy – Prentice Hall of India.
3. Surveying Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi. * Survey of India Publication on maps.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Self Study
Marks (out of 50)	
Remember	
Understand	15
Apply	20
Analyze	15
Evaluate	
Create	

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	
Understand	15
Apply	20
Analyze	15
Evaluate	
Create	

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	**CIE**	**SEE**	**Total**	**%**
Remember				
Understand	15	15	30	30
Apply	20	20	40	40
Analyze	15	15	30	30
Evaluate				
Create				
Total	**50**	**50**	**100**	**100**

THEORY OF ELASTICITY

Course Code : CIV651 **Credits :04**
L: P: T: S : 3:0:0:1 **CIE Marks : 50**
Exam Hours : 3 Hours **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Comprehend basic and combined cases of stress and strain and their mechanical response to simple elements**.**
CO2	Understand fundamental equations of elastic continuum and Airy's Stress functions.
CO3	Comprehend Plane stress & plane strain 2D problems n rectangular coordinates and polar coordinates with response of thick cylinders.
CO4	To understand basics theory of plates in tension, compression and shear.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	**2**	**3**	**3**	**2**	**-**	**2**	**2**	**-**	**2**	**1**	**-**	**2**
CO2	**2**	**3**	**3**	**2**	**-**	**2**	**2**	**-**	**2**	**1**	**-**	**2**
CO3	**2**	**3**	**3**	**2**	**-**	**2**	**2**	**-**	**2**	**1**	**-**	**2**
CO4	**2**	**3**	**3**	**2**	**-**	**2**	**2**	**-**	**2**	**1**	**-**	**2**

Module No	Content of Module	Hrs	Cos
1	**A. INTRODUCTION** Introduction to Mathematical theory of elasticity, definition of continuum, Concepts of stress at a point and stress tensors, Transformation of stresses, Stress Invariants - Principal stresses, Maximum Shear stresses and their planes,	05	CO1
	B. CONCEPT OF STRAIN Concepts of strain at a point and strain tensor, Engineering strain, Transformation of strains, Principal strains, Maximum strains and their planes.	04	
2	**A. BASIC EQUATIONS OF ELASTICITY** Generalised Hooke's Law, Strain- displacement relations, St. Venant's principle, Differential equations of equilibrium, boundary conditions, compatibility equations,	04	CO2
	B. AIRY'S FUNCTION Airy's stress function, problems, Stress polynomials – for Two Dimensional cases only.	05	
3	**A. PLANE STRESS AND PLANE STRAIN PROBLEMS** Plane stress and plane strain, Principal stresses and strains, strain rosettes.	04	CO3
	B. TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES Two-dimensional problems in rectangular coordinates, bending of a cantilever beam subjected to end load, effect of shear deformation in beams, Simply supported beam subjected to UDL.	05	
4	**A. TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES** Two-dimensional problems in polar coordinates, strain-displacement relations, equations of equilibrium, compatibility equation,	05	CO3

	B.STRESS DISTRIBUTION Axis Symmetric stress distribution - Rotating discs, Lame's equation for thick cylinder.	04	
5	**A.INTRODUCTION TO THEORY OF PLATES** Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.	05	CO4
	B.TORSION: Inverse and Semi-inverse methods, stress function, torsion of circular and elliptical sections.	04	

TEXT BOOKS:

1. Theory of Elasticity, Timoshenko, S. and Goodier T.N, (ISBN-13 : 9780070701229), 2nd Edition, McGraw Hill Education,2010.
2. "Theory of Elasticity", Sadhu Singh, (ISBN 8174090606),3rdEdition,,Khanna Publishers, New Delhi,2015.
3. Verma, PDS, "Theory of Elasticity", (ISBN 9788125903697), 1st Edition, Vikas Publishing Pvt. Ltd. New Delhi -1997**.**

REFERENCE BOOKS:

1. **Advanced Mechanics of Solids**- Srinath.L.S, (ISBN-13 9780070139886), TataMcGraw Hill Publications Co.Ltd., New Delhi, 2008.
2. **Structural Mechanics with Introduction to Elasticity and Plasticity**-(ISBN-13: 9780070673984)Venkataraman and Patel : 1st edition,cdddMcGraw Hill Book Inc.,New York,1970
3. **Mechanics of Solids**- Arbind Kumar Singh : Prentice hall ofIndia Pvt. Ltd. New Delhi - 2007.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	2		5
Understand	5	2	2	5
Apply	10	3	3	
Analyze	5	3		
Evaluate				
Create				

GROUND IMPROVEMENT TECHNIQUES

Course Code: CIV652 **Credits 4**

L: P: T: S : 3:0:0:1 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the suitability of ground improvement techniques like drainage & preloading and compaction in different soil conditions
CO2	Learn stabilization techniques using cement, lime and bitumen
CO3	Acquaint with the applications of various grout materials and grouting techniques
CO4	Gain knowledge about field application of reinforced earth and geotextiles

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	Cos
1	**GROUND IMPROVEMENT** **A. Ground improvement:** Definition, Objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. **B. Drainage & preloading:** Importance, Vertical drains, Sand drains, Electro kinetic dewatering, Preloading.	9	CO1
2	**COMPACTION** **A. Effect of compaction:** Effect of grain size distribution on compaction for various soil types like lateritic soil, coarse-grained soil. Effect of compaction on engineering behavior like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. **B. Field compaction**: static, dynamic, impact and vibratory type. Specification of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation.	9	CO1
3	**STABILIZATION** **A. Cement stabilization:** Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. **B. Lime and Bitumen stabilization:** Lime stabilization – suitability, process, criteria for lime stabilization. Bitumen stabilization in brief.	9	CO2

4	**GROUTING AND STONE COLUMN** **A. Grouting:** Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting	**9**	**CO3**
	B. Stone column: Function, Design principles, load carrying capacity, construction techniques, settlement of stone column.		
5	**SOIL REINFORCEMENT** **A. Earth reinforcement**: Concept of reinforced earth, Reinforcing materials, Backfill, Construction of reinforced earth wall. Stability analysis of reinforced earth retaining wall- external stability analysis, internal stability analysis(Brief mention about the methods only, application areas of reinforced earth structures	**9**	**CO4**
	B. Geotextiles: Soil reinforcement with geotextiles, classification, concepts, geotextiles as separators, filters, and drainage media, damage and durability of geotextiles		

TEXT BOOKS:

1. Ground Improvement Techniques**,** Purushothama Raj P, , (ISBN: 978-8131805947), Laxmi Publications New Delhi, 3rd Edition, 2016.
2. An Introduction to Soil Reinforcement & Geosynthetics, G L Sivakumar Babu, Universities Press, (ISBN:978-8173714818), 2nd Edition, 2005.

REFERENCE BOOKS:

1. "Engineering principles of ground modification", Manfred Hausmann, Mc Graw Hill Pub. Co., New York, (ISBN-13: 978-0070272798), 1990.
2. "Ground Improvement", Moseley M.P., Blackie Academic and Professional, Chapman a nd Hall, Glasgow, (ISBN-13: 978-0415274555), 2004.
3. "Earth Reinforcement and Soil Structure", Jones J.E.P, Butterworths, (ISBN-13: 978-0727734891), 1995.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizz	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	10	4	2	5
Understand	10	6	3	5
Apply	5			
Analyze				
Evaluate				
Create				

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests(Theory)**
Remember	18
Understand	27
Apply	5
Analyze	
Evaluate	
Create	

Percentage Evaluation of Various Blooms' levels (100 Marks)

Bloom's Category	**CIE**	**SEE**	**Total**	**%**
Remember	21	18	39	39
Understand	24	27	51	51
Apply	5	5	10	10
Analyze				
Evaluate				
Create				
Total	**50**	**50**	**100**	**100**

ADVANCED CONCRETE TECHNOLOGY

Course Code : CIV653 **Credits: 04**
L: P: T: S : 3:0:0:1 **CIE Marks 50**
Exam Hours : 3 **SEE Marks 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the basics of cementitious materials, admixtures and design concepts of Ferro cement and fibre reinforced concrete
CO2	Understand the basic concept and applications of High performance, lightweight& high density concrete
CO3	Mix design and applications of Self compacting concrete as per requirement with proper preliminary tests
CO4	Understand design concepts and applications of Geo polymer concrete with better knowledge of its chemical behavior

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**A).BRIEF REVIEW OF CONVENTIONAL CONCRETE AND CONSTITUENT MATERIALS:** Different types of blended cement & their salient properties, including cement binding materials (fly ash, condensed silica fumes, GGBS and other fine fillers), concrete aggregates-classification, Salient features of concrete mix design.	05	CO1
	B).CHEMICAL ADMIXTURES: Classification, effect on fresh and hardenedconcrete, retention time, Dosage ant their effects, Influence on properties ofpaste, mortar, and concrete.	04	
2	**A).FERROCEMENT:** Materials, mechanical properties, strength, cracking and durability of normal Ferrocement. Strength and behavior of light weight Ferrocement, and PrestressedFerrocement. Mix design procedure.	05	CO1
	B).FIBER REINFORCED CONCRETE: Fibers, types, characterstics, Fiber distribution, orientation and interfacial bond. Mechanical properties of FRC mix design of FRC, behavior of hardened FRC under compression, tensionflexure and impact, SIFCON, Ductal Concrete.	04	
3	**A).HIGH PERFORMANCE CONCRETES**: Concept, materials selection, mineral admixture, proportioning, strength, and durability aspects, Construction & economical Aspects, codal provisions, Applications and their performance.	06	CO2
	B).LIGHT WEIGHT AND HIGH DENSITY CONCRETE: Definition, Proportioning, Properties and Applications	03	
4	**A). SELF-COMPACTING CONCRETE:** Brief history of development, Definition, Fresh property requirements, Tests as per EFNARC and ASTM,	04	CO3

	B).MIX DESIGN: Mix design procedures, Comparison of hardened properties with conventional concrete, Applications, Economical aspects	05	
5	**A).GEO-POLYMER CONCRETE:** Brief history of development, Definition, Reaction chemistry, material characterization,	05	CO4
	B).MIX DESIGN: Mix proportioning, properties and applications	04	

Text Books:

1. Properties of Concrete,A.M.Neville,,(ISBN-13: 978-0273755807)5th Edition,Pearson Education (Singapore)Pte. Ltd.2015
2. Concrete Microstructure, Properties, and Materials, by P.Kumar Mehtaand Paulo J.M.Monteiro.,(ISBN-13: 978-0071797870) 4th Edition, Tata McGraw Hill Education,2012.
3. "Design of Concrete Mixes", Krishna Raju N,(ISBN-13: 9788123924670), 5th Edition, CBS Publications, 2017

Reference Books:

1. Fiber Reinforced cement composites, by Perumalsamy.N Balaguru andsurendra P.Shah, (ISBN-13:978-0070564008), McGraw Hill International edition, 1st Edition, 1992.
2. Concrete technology and Design-vol.1& 2:,R N Swamy, ISBN 13: 9780903384346, New concrete materials, Surrey University Press, London (1983).
3. Self-Compacting Concrete by Geert De Schutter,PeterJ.M.Bartos andPeter Domone, (ISBN-13: 978-1904445302),Whittles Publishing,2008

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	5	2		5
Understand	5	2	2	5
Apply	10	3	3	
Analyze	5	3		
Evaluate	-	-	-	-
Create	-	-	-	-

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	10
Understand	10
Apply	15
Analyze	15
Evaluate	-
Create	-

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	12	10	22	22
Understand	14	10	24	24
Apply	16	15	31	31
Analyze	8	15	23	23
Evaluate	-	-	-	-
Create	-	-	-	-
Total	**50**	**50**	**100**	**100**

WATER RESOURCES ENGINEERING

Course Code	**: CIV654**	**Credits**	**04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**50**
Exam Hours	**: 3 Hours**	**SEE Marks**	**50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand water resource, precipitation, types and measurement.
CO2	Understand hydrologic cycle &losses.
CO3	Apply engineering knowledge for finding and analyzing reservoir capacity and surface runoff.
CO4	Understand and develop methods for flood control, storm water control & surface detention.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**POI0**	**POII**	**PO12**
CO1	3	3	1	-	-	2	2	-	-	-	-	2
CO2	3	3	1	-	-	2	2	-	-	-	-	2
CO3	3	3	1	-	-	2	2	-	-	-	-	2
CO4	3	3	1	-	-	2	2	-	-	-	-	2

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	Content of Module	Hrs	Cos
1	**A. Introduction** : Introduction, The world's fresh water resources, water use in the world, water management sectors, the future of water resources, water budget Single and multipurpose projects.	09	CO1
	B. Precipitation: Formation and types, rainfall measurements – types of rain gauges, computation of average rainfall over a basin &missing rain fall data, numerical		
2	**A. Hydrologic process**: Introduction to hydrology, hydrologic cycle, hydrologic losses.Infiltration: Process affecting factors, measurement and estimation, Infiltration Indices. **B. Evaporation and consumptive use**: Process affecting factors, estimation and measurement techniques, Evapo transpiration	09	CO2
3	**A. Hydrograph Analysis**: Hydrograph definition, Effective Rainfall - Base Flow Separation - Direct Runoff Hydrograph, numerical **B. Unit Hydrograph:** definition, and limitations of applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff, Hydrograph, S-hydrograph, numerical	09	CO3
4	**A. Flood control:** Introduction, flood plain management, flood plain definition, Flood control alternatives: structural and non-structural measures. **B. Reservoir capacity-** introduction, classification, site selection, determination of live storage by mass curve method, Determination of Reservoir yield, Numerical, Reservoir sedimentation.	09	C03&CO4

5	**A. Storm water control**: Storm water management, storm system: information needs and design criteria. Rational method design, numericals **B. Storm detention**: effects of urbanization, types of surface detention, detention basin outlet work, subsurface disposal of storm water	09	CO4

Text Books:

1. Water resources engineering by Ralph A Wurbs, Wesley P. James, PHI Learning pvt. Ltd. New Delhi 2001 (ISBN 10: 0130812935 ISBN 13: 9780130812933)
2. Water resources engineering: Larry W. Mays, John Wiley & sons, 2010 (SBN-10: 0470460644 / ISBN 13: 9780470460641)
3. Irrigation, water power and water resources engineering by Dr A K Arora, Standard Publishers Distributors. 4th Revised Edition, 2014 (ISBN 81-8014-007-5)

Reference Books:

1. Water resources engineering: Sathya Narayana Murthy Challa, New Age International Publishers, New Delhi, 2000 (ISBN 10: 812241382X ISBN 13: 9788122413823)
2. Water resources engineering, lecture notes, IIT Kharagpur.
3. Elements of water resources engineering, Duggal K.N., Soni J.P., New age international publishers, New Delhi (ISBN 13:9788122408072)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	3	4		5
Understand	10	3	2	5
Apply	10	2	2	
Analyze	2	1	1	
Evaluate	-	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	12
Understand	17
Apply	14
Analyze	7
Evaluate	
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	CIE	SEE	TOTAL	%
Remember	12	12	24	24
Understand	20	17	37	37
Apply	14	14	28	28
Analyze	4	7	11	11
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

URBAN TRANSPORT PLANNING

Course Code : CIV655 **Credits : 04**

L: P: T: S : 3:0:0:1 **CIE Marks : 50**

Exam Hours : 3 Hours **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the scope and system approach and stages in urban transport planning.
CO2	Apply the knowledge of traffic survey and analyze the various aspects of transport planning process by various methods and numerical problems
CO3	Evaluate the assignment techniques, traffic forecasting and analyze using different models and numerical problems
CO4	Understand the difficulties in transporting planning, Planning and scheduling of Mass transit systems and features of intelligent transport systems

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**

Module No	Content of Module	Hrs	COs
1	**A. Introduction:** Scope of Urban transport planning – Inter dependency of land use and traffic – System Approach to urban planning. **B. Stages in Urban Transport Planning**: Trip generation – Trip production - Trip distribution – Modal split – Trip assignment	09	CO1
2	**A. Urban Transport Survey** - Definition of study area-Zoning-Types of Surveys –– Expansion of data from sample. **B.Trip Generation:** Trip purpose – Factors governing trip generation and attraction – Category analysis – Problems on above	09	CO2
3	**A. Trip Distribution:** Methods – Growth factors methods – Synthetic methods – Fractor and Furness method and problems on the abov **B. Modal Split:** Factors affecting – characteristics of split – Model split in urban transport planning – problems on above	09	CO2,CO3

4	**A. Trip Assignment:** Assignment Techniques – Traffic fore casting – Land use transport models – Lowry Model – Grain Lowry model – Applications in India – (No problems on the above) **B. Graph theory**, Entropy in transportation and commodity flows. Problem related to above.	09	CO3
5	**A. Urban Transport Planning For Small And Medium Cities:** Introduction – Difficulties in transport planning – Recent Case Studies **B. Mass Transit Systems:** Capacity, Fleet planning and Scheduling , Introduction to Intelligent Transport system	09	CO4

TEXT BOOKS:

1. Traffic Engineering and Transportation Planning, Kadiyali, L.R, ISBN-13: 978-8174092205, 2011, Khanna Publication
2. Principles of Urban Transport System Planning, Hutchinson, B.G, ISBN-13: 978-0891165279, 1974, McGraw Hill Book Co.
3. Fundamentals of Transportation Engineering, Papacostas, C.A, ISBN-13: 978-0133448702 2000, Prentice-Hall of India Private Limited

REFERENCE BOOKS:

1. Introduction to Transportation Engineering, Jothi Kristey & Lal, 3, ISBN-13: 978-013033560., 2002, Pearson's ISBN-13: 978-013033560.
2. Urban and Regional Models in Geography and Planing 13: 9780471951971, **A. G. Wilson,** 1974, John Wiley & Sons Inc (1974

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	25	10	5	10
Remember	10		2	5
Understand	5	5		5
Apply	5	5	3	
Analyze	5			
Evaluate				
Create				

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

Percentage Evaluation of Various Bloom's levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	%
Remember	17	10	27	27
Understand	15	10	25	25
Apply	13	10	23	23
Analyze	5	10	15	15
Evaluate		10	10	10
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

STRUCTURAL DYNAMICS

Course Code: CIV656 **Credits 4**

L: P: T: S : 3:0:0:1 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concepts of Structural Dynamics
CO2	Apply direct integration and numerical techniques to structural dynamic problems
CO3	Determine the natural frequencies and normal modes of multi-degree freedom System
CO4	Determine the response of shear buildings to free and forced vibrations

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	3	3	3	3	3	3	2	-	2	2	3	2	-
CO2	3	3	3	3	3	3	3	-	2	2	3	2	-
CO3	3	3	3	3	3	3	3	-	2	2	3	2	-
CO4	3	3	3	3	3	3	3	-	2	2	3	2	-

Module No	Content of Module	Hrs	Cos
1	A. Introduction to structural dynamics, basic definitions, vibration of single degree of freedom system-Simple numerical problems B. Undamped & damped free vibrations, logarithmic decrement- Simple numerical problems	09	CO1
2	A. Forced vibrations of single degree freedom system, response of undamped and damped systems subjected to harmonic loading- Simple numerical problems B. Rotation unbalance, reciprocating balance, support motion.- Simple numerical problems	09	CO1 CO2
3	A. Duhamel's integral, response due to general system of loading, dynamic load factor Response spectrum- Simple numerical problems B. Response of SDOF subjected to harmonic excitation, Vibration isolation- Simple numerical problems	09	CO2
4	A. Free vibration of two and three degree of freedom systems, natural frequencies- Simple numerical problems B. Normal modes, orthoganality property of natural modes, Eigen values- Simple numerical problems	09	CO3
5	A. Shear buildings modeled as multi degree of freedom systems, free vibrations, natural frequencies- Simple numerical problems B. Forced vibration motion of shear buildings, modal super position method, response of shear buildings to base motion, harmonic forced excitation- Simple numerical problems	09	CO4

TEXT BOOKS:

1. Mario Paz, "Structural Dynamics", CBS Publishers, (ISBN: 9780442275358), 2nd Edition, 1997.
2. M Mukhopadhyay, "Structural Dynamics", CRC Press, (ISBN:9788180520907), 1st Edition, 2010.

Reference books:

1 Anil K. Chopra "Dynamics of Structures", Prentice Hall of India, (ISBN :9780132858038), 4th Edition 2012

2 S.K. Duggal, "Earthquake Resistant Design of Structures", (ISBN:9780195688177) Oxford University Press, 2007

3 Pankaj Agarwal, Manish Shrikande, "Earthquake Resistant Design of structures", (ISBN: 8120328922), PHI India, 2007

4. IS4326, IS13920, IS1893.

CIE- Continuous Intrnal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self study assessment
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember		1		5
Understand	5	2.5	3	5
Apply	10	2.5	2	
Analyze	10	2		
Evaluate		2		
Create				

SEE: Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	5
Understand	10
Apply	15
Analyze	15
Evaluate	5
Create	

Evaluation of Various Bloom's levels (100 Marks)

Bloom's Category	CIE	SEE	Total	%
Remember	6	5	11	11
Understand	15.5	10	25.5	25.5
Apply	14.5	15	29.5	29.5
Analyze	12	15	27	27
Evaluate	2	5	7	7
Create	-	-	-	-
Total	**50**	**50**	**100**	**100**

Big Data Analytics Using HP Vertica- 1

Code : NHOP01 **Credits: 04**
L:P:T:S : 3:0:0:1 **CIE Marks: 50**
Exam Hours : 3 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate SQL command in Oracle and Vertica Databases
CO2	Apply the features of Vertica in running database designer.
CO3	Creation of projection , partition of table manually in Vertica
CO4	Apply Copy, Delete, Merge, Purge concepts in Vertica database.
CO5	Apply the concepts of HDFS in designing multi node clustering in Hadoop
CO6	Demonstrate Hadoop ecosystem tools like Pig, HBase.

Mapping of Course Outcomes to Program Outcomes

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

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3

Module No.	Module Contents	Hours	COS
1	**Introduction to SQL and HP Vertica:** Types of SQL, Data Types, Constrains, JOINS, Types of JOINS, Clause, Group by, Having, Order by, Where Clause with examples,SQL Alias, Views, Union, Union all, aggregate functions, Operators, SQL exists, **Introduction to HP-Vertica Database**, Vertica Analytics Platform, Columnar Orientation, Advanced Compression, High Availability, Automatic Database design, Massively Parallel Processing, Application Integration. **Hands on sessions** a) Creation of tables with constrains and insertion of values into tables b) Hands-on DML commands to apply different aggregate function, Group by-Having-Order by clause, Operators. c) Creation of views and working with joins	9	**CO1, C02**
2	**HP Vertica- 1** Projections, Query Execution ,Vertica Transactions, Hybrid data store – WOS & ROS, **Projection Design**: Projection fundamentals, Projection types, Projection properties, Replication and Segmentation Database Designer, Comprehensive mode, Incremental mode, Sample data, Sample queries, DBD Advantages **Hands on sessions** **a)** Creation of schema, tables and execution of SQL statements on Vertica Database, **b)** Running Database designer **c)** Hands-on projections	9	**CO2, CO3**
3	**HP Vertica -2** Loading data via INSERT-COPY-MERGE, Deleting data in Vertica- delete vector, design for delete, process of deleting Truncate, Purge, Update, Partitioning, Tuple Mover-MoveOut Parameter, MergeOut Parameter, Working with Vertica Management Console. **Hands on sessions** a) Loading data files from different sources to Vertica database. b) Verifying the log files after loading the data into Vertica database. c) Hands-on partitions.	9	**CO3, CO4**

4	**Big Data Analytics with Hadoop** Big data overview, Introduction to Hadoop, Overview of Hadoop Distribution File Systems[HDFS] and Map reduce Operations Clustering types in Hadoop- Standalone mode, Pseudo distributed mode, Fully distributed mode. **Hands on Sessions :** Verifying Hadoop installation (Pseudo distributed mode) • Java path, Hadoop location, Hadoop configuration files, Name Node setup, Job Tracker, Metadata files, Accessing Hadoop on browser	9	**CO5**
5	**Hadoop Ecosystem** Introduction to SQOOP, Overview of PIG – modes of pig, when to use PIG latin, Introduction to HIVE- data types, architecture, Introduction to HBASE- comparison of Hadoop hdfs and HBASE, how data stored in HBASE . **Hands on Sessions :** a) Moving data from local file system to Hadoop file system b) Performing MAP Reduction operation in Hadoop c) Verification of operation results through terminal and browser	9	**CO6**

REFERENCES

1. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2016.
2. Chris Eaton,Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2016.
3. Tom White, "HADOOP: The definitive Guide", O Reilly 2015.
4. Efraim Turban , Jay E. Aronson , Ting-Peng Liang, "Decision Support Systems & Intelligent Systems", 9th edition, Prentice Hall, 2014.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

VM ware Virtualization Essentials-1

Course Code: NHOP02 **Credits: 04**
L:P:T:S : 3:0:0:1 **CIE Marks:50**
Exam Hours: 3 **SEE Marks:50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the common terms and definitions of Operating System, Cloud Computing and Virtualization.
CO2	Learning the business benefits and considerations of VMware virtualization.
CO3	Knowing various approaches to server virtualization, its relevance to the modern data center, available platforms and important features.
CO4	Analyzing the implications of virtualization on Data Center Challenges.
CO5	Enable to configure the VMware vSphere storage and network virtualization.

Mapping of Course Outcomes to Program Outcomes

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

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	**PSO2**	**PSO3**
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

Module No	Module Contents	Hours	COs
1	**Understanding Virtualization: Operating Systems Essentials:** Process Management, Memory Management, Storage Management. **Cloud Computing Essentials:** Introduction to Cloud Computing, Cloud Deployment Models, Challenges. **Virtualization Essentials:** Importance of Virtualization, Examining today's trends, Virtualization Software Operations: Virtualizing Servers, Virtualizing Desktop, Virtualizing Applications.	8	CO1
	List of programs: 1. Using vSphere Web Client. 2. Creating a Virtual Machine.	4	
2	**VMware vSphere Virtualization Overview: Introduction to Data Center Virtualization:** Traditional Architecture, Virtual Architecture, Types of Virtualization**. Understanding Hypervisors:** Describing hypervisor, Type-1 Hypervisor, Type-2 Hypervisor**. vSphere Products & Features:** vSphere vMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection.	9	CO2
	List of programs: 1. Deploying Virtual Machines Using Cloning, Templates, and a Content Library 2. Modifying Virtual Machine Settings	4	
3	**Creating & Managing Virtual Machines: Creating, Managing, Monitoring & Configuring VM:** vSphere Client and vSphere Web Client, vSphere Web Client UI, **Creating VM**:VM Components, Installing Guest OS, **ManagingVM:** Startup and Shutdown of VM's, Creating and	9	CO3
	Managing Snapshots, RDM, **Configuring VM:** Memory/CPU Hot Plug, Swap Files**. Creating Clones, Templates & Content Libraries**Cloning VM, Creating Templates, OVF Templates, Types of Content Library.	4	
4	**vSphere Solutions to Data Center Challenges: Data Center Challenges:** Availability, Scalability, Optimization, Management, Application Upgrade & Cloud Challenges.**vSphere for Scalability and Business Continuity:** vSphere vMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection.	9	CO4

	List of programs: 1. Managing Tasks, Events, and Alarms 2. Using vSphere vApps, Managing Multitiered Applications	4	
5	**Understanding VMware vSphere Storage & Network Virtualization** **Storage Virtualization:** Storage Concepts, iSCSI Concepts, NFS Data stores, VMFS Data stores, Virtual SAN Data stores, Virtual Volume **Network Virtualization:** Introduction to vSphere Standard Switch, Configuring Standard Switch Policies, Introduction to vSphere Distributed Switch	9	CO5
	List of programs: 1. Using vSphere vMotion and Storage vMotion to Migrate Virtual Machines 2. Implementing a vSphere DRS Cluster	4	

TEXT BOOKS:

1. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, **Mastering VMware vSphere 6** ,Publisher:Sybex; 1 edition (24 March 2015).
2. Matthew Portnoy, **Virtualization Essentials** , 2nd Edition, Wiley India Pvt. Ltd.

REFERENCES:

1. Thomas Kraus, KamauWanguhu, Jason Karnes , VMware Network Virtualization: Connectivity for the Software-Designed Data Center , VMwarePressTechnology 1st Edition.

2. Bill Ferguson , vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press , 1st Edition.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Adobe Experience Manager - 1

Course Code	**: NHOP03**	**Credits: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks: 50**
Exam Hours	**: 3**	**SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain a fresh perspective on online marketing in a global scenario. Understand the concepts of object oriented programming in JAVA.
CO2	Understand the programming concepts in Web scripting languages and will be able develop web pages using scripting languages.
CO3	Understand the architecture, technologies and frameworks in Adobe Experience Manager.
CO4	Create online webpages, Digital asset management and campaigning using AEM
CO5	Integrate new digital marketing techniques into the strategic marketing plan using AEM. Drive change and foster innovation in Digital Marketing with AEM

Mapping of Course Outcomes to Program Outcomes:

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

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2

Module No	Module Contents	Hours	COs
1	**Introduction to DM & AEM** **Getting started with DM:** What is online marketing? Characteristics of good domain name? What is digital marketing? Different methods of digital Marketing, Main methods of DM, Search engine optimization, pay per click & display advertising, email marketing, content marketing, social media marketing. **Introduction Object Oriented Programming with JAVA** **Fundamentals:** Class Objects, Methods, Constructor, this reference, inheritance, and polymorphism,Introduction to JSP	8	CO1
	Hands on : 1. Write a program to calculate and area of four different geometric shapes: triangles, squares, rectangles, and circles.Use Method overriding. 2. Employee program to create n object to find gross salary. Data: empid,empname,gender,basic,hra = 25% of basic, DA = 125% of basic,CCA=Rs 300, IT=10% if gross >1L. • Display all information. • Use constructors • Implement required methods. 3. Student program to create n objects to find Grade.	4	

	Data:usn,studname,sem,sub name[ ],sub marks[],percentage, Grade. 90 - 100 = S		
	80 – 89 = A 70-79 =B 60 – 69 = C 50 – 59 = D 40 – 49 =E < 40 = F		
2	**Introduction to Scripting Languages:** **Web and XHTML:**Internet, WWW, Web Browsers and Web Servers, URLs, HTTP, **XHTML:** Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames**CSS:** Introduction,Levels of style sheets,formats,selector forms,The box model,conflict resolution**Javascript:** Overview , Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Arrays, Functions, Pattern matching using regular expressions, Errors in scripts.**Introduction to Sightly**	9	CO2
	Hands on: 1. Create a web page using HTML forms for email registration. 2. Create a web page using HTML frames. 3. Develop a XHTML file that includes Javascript script for that accepts a number n using prompt and outputs the first n Fibonacci numbers 4. Develop a XHTML file that includes Javascript script for that accepts a number n using prompt and outputsa table of numbers from 1 to n and their squares using alert 5. Develop a web page usingHTML and apply the various CSS styles. Develop a web page usingHTML and apply selector forms.	4	
3	**Getting started with AEM:** Introduction to Web content management, History of AEM ,The adobe marketing cloud, Install & deploy AEM, Author Instance, Publish Instance,AEM Consoles: Authoring in AEM, work with user interfaces: Classic UI, Touch optimized UI, AEM web console: OSGi management console, CRX Explorer, CRXDE Lite **AEM Architecture** **OSGi framework**: Introduction ,AEM functional building blocks, Architecture stack, OSGi framework. **Content Repository:** JCR, Jackrabbit Oak, Adobe CRX**Web Framework:** REST, Apache Sling.	9	CO3

	Hands on: **1.** AEM installation & deployment.	4	
	2. Working in AEM Environment **3.** Familiarize yourself with a Repository structure. **4.** Create a Node and add properties.		
4	**Managing Content** **AEM Authoring Framework —**Templates, Create Templates, Components and Design ,components ,Create a Page-Rendering Component ,Modularize the Page Component ,Inheriting Foundation Components , Design , Adding a design to a page ,Creating Components and Include them in Scripts, Create a Top Navigation Component, Dialog Boxes ,Create Dialog Boxes for Components, Dialog Box -Classic-UI ,touch-optimized UI ,Use Design Dialog Boxes for Global Content , Create a logo component.	9	CO4
	Hands On 1. Create the Structure of Your Website 2. Create a Template for Your Website 3. Create a Page-Rendering Component 4. Create a Website Structure 5. Modularize the Page Component 6. Inherit the Sightly Foundation Component Page 7. Add a Design to the Page 8. Create a Top Navigation Component and Include it in a Script 9. Create a Training Title Component 10. Create a Logo Component	4	
5	**Digital Asset Management, Mobile pages, Managing Campaign :** Introduction to DAM, Basic DAM functions, DAM Metadata, DAM Components, Finding Assets, Asset Management, Adding New content, Authoring Responsive& Mobile Pages,Managing Campaigns& Content Targeting.		

	Hands on: 1. Create and customize asset share page 2. Add a predicate to the asset share page 3. Add an asset editor page 4. Versioning for assets 5. Create folders 6. Add CUG properties to folders 7. Use tags to organize assets 8. Edit images 9. Upload thumbnail	4	CO5
	10. View references to assets 11. Edit metadata of an asset 12. Create a Page 13. Insert a New Paragraph 14. Edit the next Paragraph 15. Add an image from the content finder 16. Insert an image from your file system 17. Add more Components 18. Annotate a component 19. Move or delete a component 20. Working with responsive page Layout 21. Create a Mobile page 22. Add content to Mobile Page 23. Creating brand 24. Creating campaign 25. Defining a new segment 26. Create experiences 27. Turn a component into targeted component 28. Test the campaign		

Text Books:

1. Ryan D Lunka **, —Adobe Experience Manager: Classroom in a Book—,** 2014, Adobe Press .
2. Shane closser , **Adobe Experience Manager: Quick Reference Guide** , 2014, Adobe Press .
3. Shivanikarwal, **Digital Marketing Handbook** , 2015 , CreateSpace Independent Publishing Platform.
4. RobertW.Sebesta , **Programming the World Wide Web** ,4th Edition,PearsonEductaion , 2008
5. M.Deitel,P.JDeitel,A.B.Goldberg, **Internet and World Wide Web How to Program**,4th Edition,Pearson Eductaion , 2004
6. Shivanikarwal , **Digital Marketing Handbook:A Guide to Search Engine Optimization, Pay**

Per Click Marketing, Email Marketing, Social Media Marketing and Content Marketing , 2015 , CreateSpace Independent Publishing Platform

7. HerbertSchield , —**Java:The Complete Reference** , 9th Edition,OraclePress,Tata McGraw Hill.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Big Data Analytics Using HP Vertica- 2

Code : NHOP04 **Credits: 04**

L:P:T:S : 3:0:0:1 **CIE Marks: 50**

Exam Hours : 3 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate Hadoop filesystem and mapreduce programs
CO2	Demonstrate the working of SQOOP tool
CO3	Apply Pig shell commands and operators
CO4	Creating and running Pig Latin scripts
CO5	Demonstrate HIVE commands and creating tables in HIVE
CO6	Perform handson practice on HBase commands

Mapping of Course Outcomes to Program Outcomes

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

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3

Module No.	Module Contents	Hours	COS

1	**VERTICA & Hadoop Review**
	Vertica Cluster Management: Adding nodes to an existing cluster, Removing nodes from a cluster, Replacing nodes, Node recovery in vertica, Rebalancing data across nodes
	Hands on sessions
	- Check hadoop configuration file
	- Load a .csv file from local file system to hadoop file system
	- Perform analysis on loaded files using hadoop mapreduce programs and verify the output using hadoop commands as well as browser
	  - Count
	  - Grep
	SQOOP
	- Verifying Sqoop status through cloudera manager
	- Hand-on Practice on various Sqoop basic commands
	  - List-database
	  - List-table
	  - Eval
	- Import of tables from Mysql database to hdfs
	  - Import of all tables
	  - Import of specific tables to default directory /target directory
	  - Import of subset of tables using „where" clause
	  - Import table as sequence file
	  - Incremental import
	Export files from hdfs to mysql database
		9	**CO1, CO2**

2	**Apache Pig Architecture**: -Apache Pig components, Pig Latin Data Model: atom, tuple, bag, relation, map. **Basic grunt shell commands,** Running local mode - mapreduce mode, **Pig Latin 1:** Pig Latin Statements: **Data types-** simple & Complex Data Types **Hands on sessions:** **Operators (Part 1):** • Loading and storing - from/to local file system, from/to hdfs • Diagnostic operator – Dump, Describe, Explain, illustrate	9	**CO3**

	• Filtering – filter operator; For Each Generate operator: projection, nested projection, schema; Distinct Operator • Arthematic operators • Comparision operator • Boolean Operators		
3	**Hands on Sessions:** **Operators (Part 2) :** Grouping & Joining Operator – GROUP, CO- GROUP, JOIN(INNER, SELF JOIN) Combining & splitting – UNION, SPLIT Sorting – ORDER BY, LIMIT **Pig Latin Built-in functions:** **Eval functions:** AVG, SUM, MIN, MAX, COUNT, SIZE, CONCAT, DIFF, SUBTRACT, ISEMPTY, TOKENIZE **Bag&Tuple Functions:** TOTUPLE, TOBAG, TOMAP **String Functions:** ENDSWITS, STARTSWITH, SUBSTRING, EQUALSIGNORECASE, INDEXOF, LCFIRST(), UCFIRST(), UPPER(), LOWER(), REPLACE() **Math Functions:** ABS, CBRT, SQRT, COS, SIN, TAN, CEIL, FLOOR, EXP, LOG, LOG10, ROUND **Apache Pig - Running Scripts:** Creating pigscript Commenting pigscript Executing–runningpigscript– with/withoutparameters Sample examples: word count program using pig script, count of similar events from a log file, simple twitter case studyexample.	9	**CO4**
4	**HIVE** **Hive:** Why hive? , components of hive, simple architecture of hive, data-model of hive(database, table, partition, bucket) **Hands on Session**: **Hive Commands :** ***Data Definition Language (DDL)*** CREATE database/ table/ external table , DROP, TRUNCATE, ALTER, SHOW, DESCRIBE Statements. Create table with partition by, clustering by commands ***Data Manipulation Language (DML)*** LOAD, INSERT Statements- INSERT INTO,	9	**CO5**

	INSERT OVERWRITE ***Built-in Operators-*** Relational Operators- Arithmetic Operators- Logical Operators - Complex Operators- example: simple queries on these operators ***Order by clause- Group by clause-*** aggregate functions(sum, avg, count, min, max) **Joins, Create and drop of views , index**		
5	**HBASE : Various types of No Sql Databses – when HBASE is used? - HBase Data Model**(Table, Rowkey, Column families, Column qualifiers, Cell, Timestamp) **Hands on Sessions:** HBase shell Command: Create table with /without version – put command get command with / without version Scan command delete column – column family disable – enable drop table	9	**CO6**

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

VMware Virtualization Essentials -2

Course Code : NHOP05 | **Credits: 04**
L:P:T:S: 3:0:0:1 | **CIE Marks: 50**
Exam Hours : 3 | **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Learn the common terms and definitions of data center, vSphere Virtual infrastructure
CO2	Learning the vCenter Server architecture, virtual machine and importance of VMware tools
CO3	Analyzevirtual machine management, resource management and monitoring.
CO4	Learning vSphere products and solutions for protecting data
CO5	Enable to configure the VMware vSphere products and solutions

Mapping of Course Outcomes to Program Outcomes

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

Module No	Module Contents	Hours	COs
1	**Introduction to vSphere and the Software-Defined Data Center:** Describe the topology of a physical data center, Explain the vSphere virtual infrastructure, Define the files and components of virtual Machines, Describe the benefits of using virtual machines, Explain the similarities and differences between physical architectures and virtual architectures, Define the purpose of ESXi, Define the purpose ofvCenter Server, Explain the software-defined data center, Describe private, public, and hybrid clouds.	8	CO1
	List of programs: 1. Using vSphere Web Client.		

2	**vCenter Server:** Introduce the vCenter Server architecture, Deploy and configure vCenter Server Appliance, Use vSphere Web ClientBackup and restore vCenter Server**,** Examine vCenter Server permissions and rolesExplain the vSphere HA architectures and features,Examine the new vSphere authentication proxy**,** Manage vCenter Server inventory objects and licenses**,** Access and navigate the new vSphere clients**.** **Creating Virtual Machines:** Introduce virtual machines, virtual machine hardware, and virtual machine filesIdentify the files that make up a virtual machine, Discuss the latest virtual machine hardware and its features, Describe virtual machine CPU, memory, disk, and network resource usage, Explain the importance of VMware Tools™, Discuss PCI pass-through, Direct I/O, remote direct memory access, and NVMe, Deployand configure virtual machinesand templates, Identify the virtual machine disk format. **List of programs:** **1.** Creating a Virtual Machine. **2.** Manage vCenter Server inventory objects	9	CO2
3	**Virtual Machine Management**: Use templates and cloning to deploy new virtual machines, Modify and manage virtual machines, Clone a virtual machine, Upgrade virtual machine hardware to version 12, Remove virtual machines from the vCenter Server inventory and datastore, Customize a new virtual machine using customization specification files, Perform vSphere vMotion and vSphere Storage vMotion migrations, Create and manage virtual machine snapshots, Create, clone, and exportvApps, Introduce the types of content libraries and how to deploy and use them. **List of programs:** **1.** Create clone, templates and manage virtual machines **2.** Perform vSphere vMotion migrations.	9	CO3
4	**Resource Management and Monitoring:** Introduce virtual CPU and memory concepts, Explain virtual memory reclamation techniques**,** Describe virtual machine over-commitment and resource competition**,** Configure and manage resource pools**,** Describe methods for optimizing, CPU and memory usage, Use various tools to monitor resource usage**,** Create and use alarms to report certain conditions orevents**,** Describe and deploy resource pools, Set reservations, limits, and shares**,** Describe expandable reservations**,** Schedule changes to resource settings**,** Create, clone, and export vApps, Use vCenter Server performance charts and esxtop to analyze vSphere performance.	9	CO3

	List of programs: **1.** Create virtual machine snapshots **2.** Manage resource and monitoring of virtual CPU and memory concepts		
5	**vSphere HA, vSphere Fault Tolerance,and Protecting Data:** Explain the vSphere HA architecture**,** Configure and manage a vSphere HA cluster**,** Use vSphere HA advanced parameters**,** Define clusterwide restart ordering capabilities**,** Enforce infrastructural or intra-app dependenciesduring failover**,** Describe vSphere HA heartbeat networks and datastore heartbeats**,** Introduce vSphere Fault Tolerance**,** Enable vSphere Fault Tolerance on virtual machines**,** Support vSphere Fault Tolerance interoperability with vSAN**,** Examine enhanced consolidation of vSphere Fault Tolerance virtual machines, Introduce vSphere Replication, Use vSphere Data Protection to back up and restore data.	9	CO4 CO5
	List of programs: 1. Perform vSphere HA 2. Perform vSphere Fault Tolerance		

TEXT BOOKS:

1. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, "**Mastering VMware vSphere 6**",Publisher:Sybex; 1 edition (24 March 2015).
2. Matthew Portnoy, "**Virtualization Essentials**", 2nd Edition, Wiley India Pvt. Ltd.

REFERENCES:

1. Thomas Kraus, KamauWanguhu, Jason Karnes ,"**VMware Network Virtualization: Connectivity for the Software-Designed Data Center**", VMware Press Technology 1st Edition.
2. Bill Ferguson ,"**vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press**", 1st Edition.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Adobe Experience Manager – 2

Course Code : NHOP06 **Credits: 04**

L:P:T:S: 3:0:0:1 **CIE Marks: 50**

Exam Hours : 3 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Learn to write a server side java application called JSP to catch form data sent from client and store it on database.
CO2	Learn to develop a dynamic webpage by the use of java script and HTML5.
CO3	Demonstrate a server side java application called Servlet to catch form data sent from client, process it and store it on database and write scripts using perl
CO4	Building Web applications with PHP
CO5	Gain an understanding of search engine algorithms and how they affect organic search results and websites.

Mapping of Course Outcomes to Program Outcomes

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

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2

Module No.	Module Contents	Hours	COS
1	Java Server Pages (JSP) Introduction, Advantages of JSP, Developing First JSP, JSP Scripting Elements- (Directives, Declaratives, Scriplets, Expressions, Implicit Variables), Page Directives. *Java Server Pages Standard Tag Library*: Why you should use the JSTL, JSTL Expression Language, Core ags, custom tag Libraries: why custom Tags, Tag Library basics, how are tags being used, new and old custom tags, Tag library Descriptors (TLDs), simple JSP 2.0 custom tags.	9	**CO1**
2	Introduction to HTML5 Overview, Browser Support, New features, Backward compatibility, Syntax, The DOCTYPE, Character Encoding, The <script> tag, The <link> tag, HTML5 Elements, HTML5 Document, HTML5 Attributes: Standard Attributes, Custom Attributes, HTML5 EVENTS, Iframes, WEB FORMS 2.0, SVG, MathML, Web Storage, Server Sent Events, WebSockets.	9	**CO2**
3	Building Web applications with PHP Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling. *Building Web applications with PHP:* File handling, Tracking users, cookies, sessions, Using Databases, Handling XML.	9	**CO4**
4	Perl for web development: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays. *Advanced concepts of Perl:* Hashes, References, Functions, Pattern matching, File input and output; Examples.	9	**CO3**
5	Planning a powerful Search Engine Strategy-SEO Investigating Search Engines and Directories, Where Do People Search?, Search Engine Magic, Gathering Your Tools. Understanding the Limitations, Eyeing the Competition, Going Beyond Getting to #1, Controlling Search Engine Variables, Determining Your Plan of Attack, Look Away a Few Minutes. *Making Your Site Useful and Visible:* Learning from Amazon, Revealing the Secret But Essential Rule of Web Success, Making Your Site Work Well, Panda-Google Endorses Good Design.	9	**CO5**

TEXT BOOKS:

1. The Art of SEO Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, and Jessie C. Stricchiola, 3rd Edition, O"Really.
2. HTML5 for Masterminds, J.D. Gauchat, Revised 3rd Edition, MinkBooks, 2014, ISBN: 154292331X.
3. Core Servlets and Java Server Pages. Volume 1: Core Technologies, Marty Hall, Larry Brown, Prentice Hall, 2nd Edition, 2013.
4. Web Programming Building Internet Applications, Chris Bates, 3rd Edition, Wiley India, 2012.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SAP

Course Code	**: NHOP07**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks:**	**50**
Exams Hours	**: 03**	**SEE Marks:**	**50**

COURSE OUTCOMES: At the end of the course, the students will be able to:

CO1	Understand the concept of production system and facilities, automation, Computer Aided Process planning (CAPP), Material Requirement Planning (MRP), Master Production Schedule (MPS), capacity planning
CO2	Understand SAP system along with its navigation in the software
CO3	Create master data for new vendor and new trading goods in Materials Management
CO4	Evaluate and create production order for the product group
CO5	Create master data for new customer
CO6	Facilitate the flow of goods between producer and the purchaser for near fail proof logistic operations

Mapping of Course outcomes to Program outcomes:

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

Module No.	Contents of Module	Hrs	COs
1	**Computer Integrated Manufacturing Systems:** Introduction, Production system facilities, Manufacturing support system, Automation definition, Types of Automation, Reasons for Automation, limitations of Automation, Automation principles & Strategies, CIM, Information Processing Cycle in Manufacturing, Production concepts **Computerized Manufacturing Planning System:** Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement Planning, Fundamental Concepts of MRP, Inputs to MRP, Capacity planning.	07	CO1
2	**Introduction to SAP**: Case study of Global bike group (GBI), **Materials Management (MM) Case study**: Creation of new vendor, Creation of material master for trading goods, create purchase requisition, creating request for quotation, Create and display purchase order, create and verify goods receipt for purchase order, create invoice receipt from vendor, post payments to vendor, display and review goods ledger account balances	07	CO2,CO3
3	**Production Planning and Execution (PP) Case study:** Change material master record, change routing, display product group, creating sales and operation plan, Transfer SOP to demand management, Review demand management, Run MPS with MRP, Review stock and requirement list, convert planned order into production order, receiving goods from inventory, issuing goods to production order, review production order status, confirm production completion, receive goods from production order, review costs assigned to production order, settle costs of production order.	07	CO4
4	**Sales and Distribution (SD) Case study:** Creation of new customer, create contact person for customer, changing the customer, create customer inquiry and quotation, create sales order referencing for quotation, check stock status, display sales order, start delivery process, pick materials on delivery note, post goods issue, create invoice for customer, display billing document and customer invoice, post receipt of customer payment, review the document flow	06	CO5
5	**Warehouse Management (WM) Case study:** Create purchase order, display material inventory, display material inventory value, receive the goods, display material inventory and value, run bin status report, create transfer order, confirm transfer order	06	CO6

TEXT BOOKS:

1. **Automation, Production System & Computer Integrated Manufacturing,** M. P. Groover, Person India, 2015, 3rdEdition.
2. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.
3. **A beginner's guide to SAP**, Martin Munzel, SydneyMcConnel
4. **Online course material for SAP**

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Schneider - Industrial Automation

Course Code :NHOP08
L:P:T:S : 3:0:0:1
Exam Hours : 03

Credits CIE : 04
Marks SEE : 50
Marks : 50

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the architecture of an industrial automation system
CO2	Design a PLC application using ladder diagram language according to a specification
CO3	Design a PLC application using SFC diagram language according to a specification
CO4	Use Unity Pro to program and test an application
CO5	Use Vijeo Designer to program and test an application

Mapping of Course Outcomes to Program Outcomes:

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

Module	Contents of the Module	Hours	COs
1	**Basics of Automation:** Control Systemsand Automation Strategy Evolution of instrumentation and control, role of automation in industries, benefits of automation. **Structure ofPLC:** Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS. • **Practical activities:** o Application to Schneider M340 pedagogic bench and wiring of input and output.	8	CO1 CO4

2	**Instrumentation Standard Protocols:** Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/ RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control). • **Practical activities:** o **A**nalysis of a PLC configuration and communication **devices** **Sensors in industrial automation:** Types and characteristics of most used sensors in industry. Application to sensors in PLC environment. • **Practical activities:** o Analysis of several sensors (technologies, performances, …) and connections to PLC	9	CO1 CO4
3	**Ladder and FBD programming languages:** Introduction to PLC programming ladder and FBD methods as per IEC 61131. • **Practical activities:** o Basic logic operations under Unity ProEnvironment, o Timers/counters functional bloc, o Applications with M340 Bench, o Application with surface treatment industrial device.	9	CO1 CO2 CO4
4	**SFC programming language:** Introduction to PLC programming SFC method as per IEC 61131. • **Practical activities:** o Basics Applications under Unity Pro environment, o Applications with M340 Bench, o Application with surface treatment industrial device.	9	CO1 CO3 CO4
5	**HMI development:** Introduction of HMI in Industrial Automation. • **Practical activities:** o Applications with Vijeo Designer Environment, o Applications with M340 Bench, o Application with surface treatment industrial device.	9	CO1 CO5

Text books:

1. Programming Industrial Control Systems Using IEC 1131-3 (I E E CONTROL ENGINEERING SERIES) Revised Edition,1998 by Robert W. Lewis (Author)
2. Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition, 2017 by Madhuchhanda Mitra and Samarjt Semgupta.
3. Industrial Controls and Manufacturing (Engineering) 1st Edition,1999 by Edward W. Kamen

Reference books:

1. Industrial Instrumentation Paperback, 2nd Edition, 2018 by K Krishnaswamy , S. Vijyachitra.
2. Overview of Industrial Process Automation Paperback,2011 by K.L.S. Sharma
3. Industrial Process Automation Systems 1st Edition,2014 by B.R. Mehta Y. Jaganmohan

Reddy

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Cisco- Routing and Switching - 1

Course Code	**:NHOP09**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Describe the devices and services used to support communications in data networks, Internet and Role of Protocol Network.
CO2	Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 network
CO3	Build a simple Ethernet network using routers and switches
CO4	Describe enhanced switching technologies such as VLANs, VLAN Trunking Protocol,
CO5	Describe and analyse the operations of Dynamic Host Configuration Protocol and Domain Name
CO6	Configure and troubleshoot basic operations of a small switched network

Mapping of Course Outcomes to Program Outcomes:

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

Module No	**Module Contents**	**Hours**	**COs**
1	**Introduction to Networks** Introduction to Networks Networking Types, OSI Reference Model, TCP/IP Model Configuring a Network Operating System ,Physical Layer Protocols ,Data Link Layer Protocols ,Media Access Control, Ethernet Protocol ,Address Resolution Protocol	9	CO1
	Hands On : CCNA LAB 01 CCNA LAB 02 CCNA LAB 03		

2	**Connecting Devices and IP Addressing** Introduction to Routers, Switches, IOS and Boot Process ,IPv4 Network Address and IPv6 Network Address ,Subnetting , Addressing Schemes ,Design Consideration for IPv6,Routing : Static, Default and Dynamic , Routing Metrics, Classes of Routing Protocol ,Connectivity Verification	9	CO2
	Hands On: Basic Configuration of Router and Switches Use of Command Line Interface Configuring Router Interfaces Gathering Information and Verifying Configuration Saving, Erasing, Restoring and Backing up Configuration & IOS File Troubleshooting IP Address Route Summarization CCNA LAB 04		
3	**Introduction to IP Routing** Understanding IP Routing, Classes of Routing Protocol, Routing Decision, Router Operation, Static Routing : Implement Static Routes, Dynamic Routing : Dynamic Routing Protocols, RIPv2, RIPv1, Routing table, EIGRP, OSPF	9	CO3
	Hands On: Routing Initial Configuration Route Redistribution Static and Default Route Lab Configure static and Default Routes Verifying and Troubleshooting RIP Configuring EIGRP Verifying and Troubleshooting EIGRP Open Shortest Path First (OSPF) Configuring OSPF Verifying and Troubleshooting OSPF CCNA LAB 05 :RIP CCNA LAB 06 :EIGRP CCNA LAB 07 :OSPF		
4	**Switching and Spanning Tree Protocol** LAN Design, The Switched Environment Basic Switch Configuration, Switch Security, Understanding Switching and Switches, Types of Switch Ports, Virtual LANs (VLANs) , VLAN Trunking Protocol (VTP) , VLAN Segmentation, VLAN Implementation	9	CO4
	Hands On: Initial Configuration of a Catalyst Switch Port Security Spanning Tree Protocol VLAN Configuration , Inter-VLAN Routing Configuration VTP Troubleshooting		

	Voice VLAN Configuration		
5	**Access Control Lists** Introduction to Access Lists, Standard Access Lists, Extended Access Lists, ACL Operation, Standard IPv4 ACLs, DHCP : DHCPv4 and DHCPv6, NAT for Ipv4 : Introduction to NAT, , Device Management and Maintenance : Device Discovery, Device Management, Device Maintenance	9	CO5
	Hands On: Initial Setup and Access List Lab Static NAT Configuration and Verification and Dynamic NAT Configuration NAT Configuration NAT Troubleshooting ACL Troubleshooting Configuring DNS and DHCP		

TEXT BOOKS:

1. CCNA Routing and Switching 200-125 Pearson u Certify Course, Wendell Odom, Sean Wilkins, Published Jan 19, 2017 by Cisco Press.

REFERENCE BOOKS:

1. CCNA v2.0 R&S Lab Workbook 200-120.
2. Computer Networks, Andrew S. Tanenbaum, Fourth Edition Pearson Education
3. Data Communications and Networking, Behrouz A.Forouzan, Tata McGraw Hill, 4th Edition

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

DATA ANALYTICS

Course Code : NHOP10 | **Credits 04**
L:P:T:S : 3:0:0:1 | **CIE Marks 50**
Exam Hours : 03 | **SEE Marks 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Learn various types of data warehousing and modeling techniques.
CO2	Understand the basics of various SQL commands and HP Vertica.
CO3	Demonstrate Copy, partitioning, DBD, Analytic functions in Vertica.
CO4	Understand various types of Web Analytics.
CO5	Understand various types of Marketing Analytics.

Mapping of Course Outcomes to Program Outcomes:

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

Sl. NO	Contents of Module	Hrs	Co's
Module-1	**Data Modeling and Introduction to Data Analytics:** Overview of the Data Warehouse and Data mart modeling process, Dimensional modeling, Snowflake and Star schema, Aggregate fact tables, Fact Constellation schema, The characteristics of dimension table and fact table. Fundamentals of Data analytics, Phases in Data Analytics, Types of Data Analytics, Challenges in Data Analytics	9	CO1
Module-2	**Introduction to basic SQL and HP Vertica:** Introduction to Structured Query Language, Types of SQL, Data types, Constraints, Select, Insert, Delete and Update statements in SQL , Aggregate functions. Introduction to HP-Vertica Database, Vertica Analytics Platform, Columnar Orientation, Advanced Compression, High Availability, Automatic Database design, Massively Parallel Processing, Application Integration **Hands on sessions** a) Creation of databases, Creation of schema, Creation of tables b) Inserting values to the table, select operations c) Delete and update operations a) Creation of tables with constrains and insertion of values into	9	CO2

	tables b) Hands-on DML commands to apply different aggregate function		
Module-3	**HP Vertica-2:** Projection fundamentals, Replication and Segmentation, Hybrid data store – WOS & ROS. Database Designer, Comprehensive mode, Incremental mode, COPY command, Merge and Partitioning, Basic VERTICA Analytic functions. **Hands on sessions** a) Hands-on projections b) Running Database designer c) Copying a file to Vertica database and verifying error logs.	9	CO3
Module-4	**Web Analytics :** Descriptive, Predictive and Prescriptive analytics	9	CO4
Module-5	**Marketing Analytics and CASE Studies :** Introduction, Market segmentation : Cluster analysis, Using classification trees for segmentation; Advertising : Pay Per Click Online advertising; Internet and Social marketing : Networks, Viral marketing, Text mining **CASE Studies :** Bristol Myers Squibb, Xerox , Kroger, Weather.com, Pratt and Whitney, AVIS-Budget Car Rental.	9	CO5

Text Books:

1. The Data Warehouse Lifecycle Toolkit Second Edition, by Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy and Bob Becker, 2008.
2. Marketing Analytics : Data Driven Techniques with Microsoft-Excel, Wayne L. Winston, John Wiley & Sons, Inc. 2014

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**%**
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

APPENDIX A

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

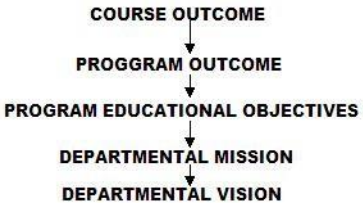
There are three educational Outcomes as defined by the National Board of Accredition:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX B

The Graduate Attributes of NBA

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

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

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 the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

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.

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.

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.

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

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

Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

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.

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.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.
[eduglosarry.org]