Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	4CV401
Course Name	Transportation Engineering
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To give exposures of highway planning, Design of geometric elements of roads, Rigid and Flexible pavements design, desirable properties of highway materials and various practices adopted for construction.
2	To comprehend components, planning, design and construction of railway track, stations and yards.
3	To make acquainted with general aspects of tunnel components and construction.
4	To develop skills on construction and maintenance of Highways, Railways and Tunnels.

Course Outcomes (CO)

CO1	**Explain** and **apply** the principles of planning and designing of various geometric elements of highways, railways and tunnels.
CO2	**Demonstrate** knowledge for selection of construction material and appropriate method of construction in field of highway, railway and tunnel engineering.
CO3	**Analyze** various techniques used in the traffic management and maintenance of highway, railway and tunnel engineering.
CO4	**Design** flexible and rigid pavements as per IRC and **solve** problems in the field of highway and railway.

Module	**Module Contents**	**Hours**
I	**Highway Engineering Part I** Role and importance of infrastructure development, Various modes of transportation, characteristics and suitability, history of highway engineering, development plans, various organizations involved in highway development, their setups and working, finance options. **Construction Materials** – Stone aggregates, soil, cement, bitumen properties and their testing **Highway Alignment:** basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies.	6
II	**Highway Engineering Part II** **Geometric Design:** Cross sectional elements, sight distance, reaction time, analysis of safe sight distance, and analysis of overtaking sight distance, intersection sight distance, horizontal, vertical and transition curves, super elevation, widening, requirements as per IRC, Design of flexible and rigid pavements.	10
III	**Highway Engineering Part III** Construction methods for various types of flexible and rigid pavements, Drainage, lighting and arboriculture, repairs and maintenance. **Traffic Engineering:** Surveys, signs and signals, islands and markings, highway intersections, traffic management.	8

IV	**Railway Engineering Part I** History, Indian Railways, Permanent Way – components, types, functions, Rails: Coning of wheels and tilting of rails **Geometric Design:** Alignment, Gradients, Horizontal and transition curves, super elevation design, Points and crossings, track junctions, track resistances, tractive effort,	6
V	**Railway Engineering Part II** **Stations and Yards:** Purpose, location, site selection, types and layouts. **Signaling and Interlocking:** Objectives, types, principle of interlocking, control of train movements. **Construction and Maintenance:** Methods, materials, maintenance of tracks and traffic operations, Modern trends in railways.	5
VI	**Tunnel Engineering** General aspects, economic considerations, advantages, Selection of route, transfer of Centre Line on surface, shapes and sizes, Methods of tunneling in soft and hard strata, Modern methods in tunneling.	5

Text Books	
1	Bindra S. P., "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Arora S. P. and Saxena S. C., "A Textbook of Railway Engineering", Dhanpat Rai Publications Pvt. Ltd, 7th Edition, 2006.
3	Saxena S. C., "Tunnel Engineering", Dhanpat Rai Publications, 1st Edition, 1984.

References	
1	Wright, Paul H. and Dixon, "Highway Engineering", John Wiley & Sons; 7th Edition 2003.
2	Mundrey J. S., "Railway Track Engineering", Tata McGraw Hills Publications, 4th Edition, 2009.
3	Megaw T. M. and Bartlett J., "Tunnels Planning, Design, Construction", EHJW, 1st Edition 1981.

Useful Links	
1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/101/105101008/
3	https://nptel.ac.in/courses/105/105/105105107/
4	https://nptel.ac.in/courses/105/107/105107123/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3		1								1	
CO2			3										2	1
CO3			2					1					2	1
CO4			3	2									2	1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Fundamentals of Management and Economics for Engineers
Desired Requisites:	Building Planning Design, Estimating and Costing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To stay competitive companies have sought to shorten the construction times of new infrastructure by managing construction development efforts effectively by using different project management tools.
2	To achieve this, we will use a basic project management framework in which the project life-cycle is broken into organizing, planning, monitoring, controlling and learning from old and current construction projects.
3	To effectively manage a construction project in an Architecture/Engineering/Construction (A/E/C) organization.

Course Outcomes (CO)	
CO1	Organize and Plan for various dimensions of construction projects such
CO2	Demonstrate knowledge in monitoring and controlling construction projects with respect to various dimensions such as time, cost, quality , safety and scope.
CO3	Apply standards of professional and ethical responsibility to determine an appropriate course of action

Module	**Module Contents**	**Hours**
I	**Introduction to construction project management** Evolution of Scientific Management, Concepts and functions of Management • Construction project: unique features, types, phases, role in economic development, role of stakeholders, regulatory requirements. • Construction project management and its relevance • Construction project organization: structure, traits of project manager, project coordinator, • Ethical Conduct for Engineers	7
II	**Construction project planning and scheduling** Stages of project planning • Process of development of plans and schedules: work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities. • Planning techniques: Bar charts, Networks • Formulation and analysis of CPM networks (AOA , AON and precedence networks) • Formulation and analysis of PERT networks. • Introduction to line of balance technique, Simulation. • Resource Scheduling- resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling, calendaring networks.	12

III	**Construction materials management and cost management-** Construction materials management: • Materials flow system, role of materials management and its linkage with other functional areas, vendor networking, buyer-seller relationships, EOQ model, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management Construction costs management- • cost classification, cost codes, • time cost trade-off in construction projects, compression and decompression • cost planning, cost budgeting, • value management in construction,	06
IV	**Project Monitoring & control** Measuring progress, periodic progress reports • Updating of plans. • Cost control,Earned value analysis • Introduction to Management Information System • Common causes of time and cost overruns and corrective measures.	05
V	**Construction Quality and Safety management** Quality assurance & control: • use of manuals and checklists for quality control • Introduction to TQM, quality audit, cost of quality, ISO standards x Safety and health on project sites: • accidents causes and effects, costs of accidents, occupational health problems in construction, • Safety and health management system • Health and safety act regulations	06
VI	Risk Management • Risk in Construction : Identification, Classification, Mitigation, • Basics of Decision Analysis, Decision Tree, Sources of risk in construction Scope Changes and Claims, Disputes and Project closure	04

Text Books	
1	Kumar NeerajZha, "Construction Project Management", Pearson India Education, 1st edition,(2011)
2	Saleh Mubarak, " Construction Project Scheduling and Control", Wiley, 2nd edition (2010)
3	
References	
1	Chitkara K K, "Construction Project Management : Planning, Scheduling and Controlling", Tata McGraw - Hill Education, 2nd edition, 2010
2	P K Joy, "Handbook of Construction Management",Macmillan India Limited,2nd edition(2000)
3	Barrie D.S. & Paulson B C, "Professional Construction Management", McGraw Hill
Useful Links	
1	
2	
3	
4	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3		1						1	1	1	
CO2			3										2	2
CO3							3				2		2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2020-21

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Elective 3: Earthquake Engineering
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To develop awareness about the earthquake engineering and its effects on Civil Engineering structures.
2	To impart the knowledge of dynamic response systems under earthquake loading.
3	To illustrate codal provisions for design of earthquake resistant structures.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Comprehend engineering Seismology and different terminologies related to earthquake.	remembering, understanding
CO2	Compute characteristics of earthquake and its effect on structures	applying ,analyzing
CO3	Find response of structures subjected to earthquake loads for various building configuration.	Evaluate

Module	**Module Contents**	**Hours**
I	Elements of seismology – terminology, structure of earth, causes of an earthquake, plate tectonic theory, seismic waves, magnitude and intensity, methods of measurement, energy released, seismograph, strong motion earthquakes, accelerando, prominent earthquakes of India	6
II	Fundamentals of theory of vibration, Single-Degree of freedom Systems, Analytical models, Equations of motion free and forced vibrations of single degree of freedom systems, Response to harmonic loading, Resonance, Support motion, Transmissibility, Vibration isolation. SDOF systems subjected to periodic and impulsive loading, Fourier series loading, Sine wave pulse, rectangular pulse etc. Duhamel Integral	8
III	Response Spectrum theory, Strong ground motion, Accelerometers, Peak parameters, Concept of earthquake response spectrum, Tripartite plot of response spectrum, Construction of design response spectrum	5
IV	Earthquake Resistant Design Philosophy, MCE and DBE planning aspects, symmetry, simplicity, regularity, Lateral load analysis, Provisions of IS: 1893 for buildings, Base shear, Application to Multi-storey buildings, Load combinations.	5
V	Concept of earthquake resistant design, Objectives, Ductility, Ductility reduction factors, Ductile detailing, Provisions of IS: 13920,	7

VI	Conceptual design, Building configuration eccentricity, Construction aspects and strengthening techniques of low cost and low rise buildings, Introduction to multi degree of freedom systems. Concepts of structural Control	7
	Module wise Measurable Students Learning Outcomes : 1. 1: Comprehend the concept of seismology. 2. 2: Apply the concept of theory of vibration & SDOF system. 3. 3: Demonstrate response spectrum analysis. 4. 4: Find base shear as per IS:1893 of multistoried buildings. 5. 5: Apply knowledge of ductility in earthquake resistant design of structures. 6. 6: Devise various structural control techniques for earthquake resistance.	

Text Books	
1	A.K. Chopra, "Dynamics of Structure: Theory & Application to Earthquake Engineering", Pearson Education Lim., 4th Edition, 2014. D. J. Dowrick, "Earthquake Resistant Design for Engineers & Architects", John Wiley & Sons,2nd Edition, 1987.
2	P. Agarwal and M. Shrikhande, "Earthquake Resistant Design of Structures", PHI publications, New Delhi, 3rd Edition,2006.
3	D. J. Dowrick, "Earthquake Resistant Design for Engineers & Architects", John Wiley & Sons,2nd Edition, 1987.
References	
1	David Key, "Earthquake Design Practice for Buildings", Thomas Telford Publication,London,2nd Edition,2006.
2	James M. Kelly, "Earthquake Resistant Design with Rubber", Springler-Verlag Publication, London, 2nd Edition, 2012.
3	Manual of "Earthquake Resistant Non engineering Construction", University of Roorkee ,2000.
Useful Links	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**2**														
CO2	**2**			**2**											
CO3	**3**		**3**	**3**											
CO4															

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

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AY 2020-21

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Design of Unreinforced Masonry Structures
Desired Requisites:	Building Materials and Construction, Strength of Materials

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	Introduce the rational theoretical basis for prediction of structural masonry.
2	Understand and apply the structural design of axial and laterally loaded masonry walls.
3	Educate and carry out applied research on structural masonry based on modern and proven structural theories.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Perceive the properties of various building units/mortar and within the available alternatives make qualitative judgment with appropriate choices for structural masonry.	Evaluate
CO2	Analyze design and estimate the strength of masonry under vertical and lateral loading conditions.	Analyse, Create
CO3	Apply the concepts of reinforced and contained masonry and impart ductility and earthquake resistance to masonry buildings.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction on Masonry Materials** History of Masonry, Masonry units, materials and types, Characteristics of bricks in India, stones, Hourdi block, concrete blocks, stabilized mud blocks, FAL G blocks, Factors affecting properties of masonry units, Classification and properties of Mortars, Testing procedures as per IS codes, Energy considerations.	6
II	**Behaviour of Masonry under Compression** Factors influencing masonry compressive strength, Effects of bed materials, unit height, hollow block units, type of bond, wall types, direction of loading, workmanship factors, workmanship and construction details, Deformation properties of masonry under compression, compression failure theories.	6
III	**Masonry in tension, shear and biaxial stress** Interfacial bond strength, tensile bond strength, flexural bond strength, strength of masonry in shear, Failure modes, Masonry under biaxial stress, Shear modulus of masonry.	6
IV	**Design Analysis of unreinforced Masonry** Structural adequacy of masonry walls, types of walls, Design considerations, Lateral support and stability, Stiffening walls, Effective height, length and thickness considerations, Structural design as per codal provisions, Computations of permissible stresses, Application of reduction factors, Assessment of eccentricity.	6

V	**Practical Applications and Case studies** Codes of practice, Planning, detailing and construction techniques, Joints with slabs, Joints with roof structure, Reinforcement, Expansion joints, Tolerances, Case studies.	6
VI	**Reinforced masonry for seismic resistance** Seismicity and buildings, Design philosophy, Performance and vulnerability of masonry structures, Typical failure at Bhuj and Latur earthquakes, Structural configuration, BIS codal provisions, Concept of confined masonry, Minimum wall density, Construction Guidelines, New Research trends in contained Masonry.	6

Moodle wise Outcomes:

At end of each module students will be able to

Module1: collect, experiment and compare the characteristics of various building units/blocks/mortar individually and arrive at an appropriate choice in masonry applications.
Module 2: relate and review the effects of different combinations of masonry units and mortars and its unified behavior in masonry.
Module 3: experiment and evaluate the various failure theories in masonry.
Module 4: synthesize and design masonry walls for a given static axial loading condition.
Module 5: Apply construction techniques by designing masonry walls for a combination of given static axial and lateral loading condition.
Module 6: Comprehend the behavior of masonry structures in earthquake prone regions and recall the basics of mechanics of materials in making masonry structures resistant to dynamic loads.

Text Books

1	Structural Masonry, K. S. Jagadish, I. K. International Publishing House, New Delhi, 2015.
2	Brick and Brick Reinforced Structures, P. Dayaratnam, Oxford and IBH publishing House,

References

1	Structural Masonry, A. W. Hendry, Macmillan Press Ltd, 1998, London.
2	Structural Design of Masonry, Andrew Orton, Longman, 1992 second edition
3	Structural Masonry, Sven Sahlin, Prentice Hall, 1971.
4	Alternative Building Materials and Technologies, K. S. Jagadish, B. V. Venkatrama Reddy, K. S. Nanjunda Rao, New Age International.
5	Structural Masonry designer's Manual, Curtin, Shaw and Beck, BSP Professional Books, Second edition 6. IS 1905, Indian standard code of practice for structural use of unreinforced masonry, BIS, New Delhi.

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		**3**													
CO2			**3**												
CO3				**2**											

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2020-21

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	3AM 402
Course Name	Advanced Design of concrete structures
Desired Requisites:	Design of concrete structures I

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To design of reinforced concrete structures and to impart concepts of prestressed concrete. The knowledge and skills acquired in the basic course design of concrete structures-I will be further enhanced through theory and series of numerical examples.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Distinguish concepts of reinforced and prestressed concrete.	Analyse
CO2	Evaluate various RCC and prestressed concrete sections.	Evaluate
CO3	Design of RCC and prestressed concrete structures.	Create

Module	**Module Contents**	**Hours**
I	**Water tank -** Design of circular and rectangular water tank resting on ground using approximate and IS Code method.	5
II	**Foundation -** Design of combined footing (Slab type, slab beam type) and raft foundation**.**	3
III	**Retaining wall -** Design of cantilever & counterfort retaining wall**.**	6
IV	Introduction to prestressed concrete, material used, systems and methods of Prestressing, basic concepts, Analysis by stress concept, strength concept, load balancing concept, Pre-& Post tensioned members, end anchorages Losses in Prestress, merits & demerits of prestressed concrete	5
V	Analysis of rectangular and Symmetrical I sections, thrust line, cable profiles. Design of rectangular and Symmetrical I sections, kern distances & efficiency of section.	3
VI	Shear & diagonal tension, End block stresses, Design of end block by I.S. code method.	7

	Module wise Measurable Students Learning Outcomes: 1: Design circular and rectangular water tank resting on ground using approximate and IS Code method. 2: Design combined footing and raft foundation. 3: Design of cantilever retaining wall. 4: Apply concept of prestressed concrete. 5: Analyse and design rectangular and I section of prestressed concrete. 6: Analyse and design end block of prestressed concrete and understand diagonal tension.
Text Books	
1	Sushil Kumar "Treasure of R.C.C Design", standard book house publication, 18th Edition, 2009. 3.
2	A.K. Jain "Reinforced Concrete Design (Limit State)" Nem chand and brother's publishers, 1st Edition, 2012.
3	N.C. Sinha & S.K. Roy, "Fundamentals of Reinforced Concrete" S. Chand Publishing, 4th Edition, 2013.
References	
1	P.C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 2nd Edition, 2011.
2	T.Y. Lin "Prestressed Concrete", John Wiley & sons Inc. New York, 3rd Edition, 1981.
3	N. Krishna Raju "Prestressed Concrete", Tata Mcgraw Hill Education, 4th Edition, 2006.
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**3**														
CO2	**2**		**3**	**3**											
CO3	**3**		**2**	**2**											
CO4															

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**

Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2020-21

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Computer Applications in Structural Engineering
Desired Requisites:	Analysis and Design of Concrete and Steel Structures

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To provide knowledge of numerical approach and significance of analysis by computers.
2	To provide necessary knowledge of numerical tools required for analyzing and solving problems in the field of engineering.
3	To provide pre-requisite knowledge to the students for analyzing and designing structures by computers.
4	To deliver know-how of typical software application techniques applicable to engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Apply program development skill for Matrix operations, Numerical methods to analysis and design structures.	Applying
CO2	Analyze and develop sequential procedure and algorithm/program for analysis and design of civil engineering structures.	Analyzing
CO3	Design civil engineering structures using commercial software on computers and create design reports.	Creating

Module	**Module Contents**	**Hours**
I	**ALGORITHM DEVELOPMENT & PROGRAMMING LANGUAGES** Basics of computer hardware and Algorithm essentials: problem analysis and flowcharting, fundamentals of sequential programming: Variables,data types&functions +input-output+data handling+various development units, Introduction to programming in MS EXCEL®, MATLAB®or SCILAB.	8
II	**MATRIX METHODS AND PROGRAMMING** Matrix operations: product, inverse etc., Simultaneous linear equations, Programming techniques of above methods.	6
III	**NUMERICAL METHODS AND PROGRAMMING** Numerical Integration methods, Regression Analysis tools and curve fitting, Numerical Method in structural dynamics/earthquake engineering. Algorithm/Programming techniques of above methods.	6
IV	**COMPUTER AIDED STRUCTURAL ANALYSIS** Stiffness method: - Analysis of Trusses, Analysis of Continuous Beams by Finite Element method.	8

V	**COMPUTER AIDED STRUCTURAL DESIGN** Design of Steel Truss members by IS-800, Design of Beam sections in RCC, Design of One way slab by IS-456. Algorithm/programming development for each structural design type.	6
VI	**COMMERCIAL SOFTWARE APPLICATIONS** Application in commercial software STAAD® or ETABS® Analysis of TRUSS, Analysis of 2D frame and Essentials of RCC building Design.	6
	Module wise Measurable Students Learning Outcomes: 1. Apply fundamentals of Algorithm and programming. 2. Carry out matrix operations by programming. 3. Implement numerical methods by programming 4. Analyze 2D structural problems by Finite Element Method. 5. Design simple RCC and STEEL members by latest BIS-codes 6. Generate structural applications in Finite Element software.	

Text Books	
1	M.K.Jain, S.R.K.Iyengar & R.K.Jain " Numerical Methods for Scientific and Engineering Computation ", 4th ed. 2004
2	Pundit & Gupta "Structural Analysis", Tata MC Graw Hill Book company
3	Devdas Menon,S. Pillai , Reinforced Concrete Design - The MC Graw Hill company Third Ed–2009
4	N. Subramanian, "Design of Steel Structures", (Oxford Higher Education)-2008
References	
1	Steve Otto and James P. Denier,,An Introduction to Programming and Numerical Methods in, Springer International books, 1st Edition, 2007
2	Cotes, R.C., Couties, M.G., and Kong, F.K., Structural Analysis, 3rd Edition, 1990, ELBS
3	A.K.Chopra, “Structural Dynamics for Earthquake Engineering”, 4th Edition, 2008,Pearson Pubilications
Useful Links	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**3**			3											
CO2	**2**			**2**											
CO3			**2**	**2**				**2**							
CO4															

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Remote Sensing and GIS
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	Introduce students the necessary knowledge and concepts in the field of RS and GIS and their civil engineering significance. To develop the sense of Applications of Spatial technology among civil engineering students.
2	Introduce the technique of interpreting, classifying and applying various RS and GIS data in Civil Engineering decision making
3	Enable students in decision making to manage the Civil Engineering related spatial problems before preparing and implementing any civil engineering action plans.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Identify and describe the fundamentals of Remote Sensing and photogrammetry.	Understanding
CO2	Demonstrate, Classify, Interpret spatial data to extract maximum information.	Analyzing
CO3	To investigate, manipulate and generate spatial database useful to formulate or forecast the future civil engineering activities/events.	Applying

Module	**Module Contents**	**Hours**
I	Definition, History of Remote sensing, Remote sensing process, interaction of EMR with atmosphere, interaction of EMR with ground objects data transmission and reception GRS, RS platforms, EMR and spectrum, atmospheric windows.	6
II	Early history of aerial photography, simple camera, aerial camera, types of aerial photographs , taking vertical aerial photograph and flight planning , scale determination, image parallax, parallax measurement, relief displacement of vertical features, stereoscopy .	7
III	Introduction of ISRO, NASA, NRSC, IIRS and SAC. Earth observation sensors and platforms, India and foreign remote sensing satellites and sensors, sensor applications	7
IV	Types of remote sensing, types of satellite, digital image, spatial resolution, spectral resolution , radiometric resolution and temporal resolution, visual image interpretation ,image interpretation keys ,spectral signature, spectral reflectance curves, hyperspectral data and its applications.	7
V	Digital image processing , pre-processing and post-processing, image registration ,image enhancement, image transformation, digital image classification, supervised and unsupervised classification.	6
VI	Geographical information system, definition, spatial and non-spatial data, data inputs, data storage, data transformation, data reporting ,advantages of GIS, essential elements of GIS hardware, software GIS data types, thematic layers and layer combinations. introduction to GPS applications of RS and GIS in civil Engineering.	6

	Moodle wise Outcomes: At end of each module students will be able to 1. Understand and remember basic concepts of remote sensing. 2. Understand and remember basic concepts of aerial photogrammetry. 3. Understand various sensors and explain their applications. 4. Interprete various remote sensing data. 5. Evaluate various spatial data parameters and manipulate satellite imageries. 6. Apply remote sensing data in GIS environment.
Text Books	
1	M. Anji Reddy 2002: "Remote Sensing & Geographical Information System", BS Publications, Hyderabad.
2	Lillesand Thomas M. & Kiefer Ralph 1999 : "Remote Sensing and Image Interpretation" , John Villey
3	A.N. Patel, Surendra Singh, "Remote Sensing Principles and Applications", Scientific Publishers, Jodhpur
References	
1	John R. Jensen 2003: "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia
2	Panda B C 2002 : "Principals of Remote Sensing", Viva Books Private Limited.
3	ShahabFazal,"Remote Sensing Basics", Kalyani Publishers Ludhiyana3.
4	Gupta Ravi P., "Remote Sensing Geology" Springer; 2nd ed. 2003 edition
5	George Joseph, 2003: "Fundamentals of Remote Sensing", Universities Press
Useful Links	
1	www.nrsc.gov.in
2	www.itc.nl/ilwis

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2													2	
CO2		2		1	3								2	2	
CO3				1	3									1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember	10			**10**
Understand	10	10	30	**50**
Apply			15	**15**
Analyze		10	15	**25**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Hazardous waste management
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	Provide in-depth knowledge of hazardous waste management.
2	To enhance the technical competency and apply the acquired knowledge for research and Development, industry, and consultancy activities.

Course Outcomes (CO)	
CO1	***Explain*** characterization, waste minimization, transportation, site remediation, and risk associated with hazardous waste.
CO2	***Explain*** and ***Apply*** the physical, chemical, and biological methods of treating hazardous waste.
CO3	***Design*** treatment and disposal facilities for hazardous waste.

Module	**Module Contents**	**Hours**
I	**Introduction to hazardous Waste Management** Hazardous waste: Definition, Sources, Characterization, Classification, Magnitude of problem, Concept of toxicity, Assessment of sites	5
II	**Waste minimization and Treatment** Waste minimization: Benefits, Approaches, Priorities in hazardous waste management, Resources recovery, Case studies. Treatment: Physical, Chemical and Biological treatment systems applicable for hazardous waste, Hazard in processing, Case studies of treatment	6
III	**Transportation of Hazardous Waste** Transportation: Storage of hazardous waste, Regulations governing transporters, Containers, Bulk transport, Non-bulk transport, Hazardous substances emergency response.	6
IV	**Disposal of Hazardous Waste** Land fill disposal: Land fill as disposal sites, Siting, Designing, Closure, Case studies Injection well disposal: Classifications, Deep well injection, Case studies.	7
V	**Site Remediation** Site remediation: Site assessment and inspection, Hazard ranking system, Containment and treatment technologies, financial considerations, Case studies.	7
VI	**Risk Assessment** Risk Assessment: Process, Risk management, Hazardous waste management rules.	6

Text Books	
1	LaGrega, M. D., Buckingham, P. L. and Evans, J. C., Hazardous Waste Management, 2nd Edition, McGraw Hill, 2001.

2	Metcalf and Eddy “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publication, 6th Reprint, 2003.
References	
1	Sincero A, P and Sincero G, A, “Environmental Engineering A Design approach”, PHI learning private limited, 2004.
2	Wentz, C. A., Hazardous Waste Management, 2nd Ed., McGraw Hill, 1995.
3	Lewandowski G.A. and DeFilippi L.J., Biological Treatment of Hazardous Wastes, John Wiley & Sons, 1998.
Useful Links	
1	https://www.youtube.com/watch?v=ri9Op5vQfA&list=PLL9jm6CAGn2UzZZfZzSycEANAQUkc5E_e
2	https://www.youtube.com/watch?v=x8ViYoqjEhc

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2												
CO3			3										1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level

Bloom’s Taxonomy Level	T1	T2	ESE	Total
Remember	10			**10**
Understand	10	10	30	**50**
Apply			15	**15**
Analyze		10	15	**25**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Highway Engineering Lab
Desired Requisites:	Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To explain parameters governing the selection of best pavement construction material.
2	To develop ability to assess various properties of highway materials and various practices adopted for construction.
3	To demonstrate the method of design of bituminous mixes for flexible pavement.
4	To give the exposure of various tests adopted on field to characterise the road construction materials and management of traffic.

Course Outcomes (CO)

CO1	**Apply** practices to examine the properties of road construction material for their use in road construction and to manage the road traffic.
CO2	**Interpret** the test results of materials and **compare** the values with Indian standard codal provision to decide the suitability of road construction material
CO3	**Comprehend** concept of bituminous mix design for flexible pavements.

List of Experiments / Lab Activities

List of Experiments:

1. Specific Gravity of Bitumen
2. Penetration Test on Bitumen
3. Viscosity of Bitumen
4. Softening Point of Bitumen
5. Flash and Fire Point of Bitumen
6. Ductility of Bitumen
7. Bituminous Extraction Test
8. Spot Speed Study
9. Intersection Volume Study
10. Parking Usage Study
11. Demonstration of Marshall Stability Test
12. Demonstration of CBR Test on Soil and Aggregates

Text Books

1	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018
2	Khanna S. K., Justo C. E. G., Veeraragavan A, " Highway Materials And Pavement Testing", Nem Chand & Sons, 2013
3	

References

1	IS 1201 to 1220 (1978). “Methods for testing tar and bituminous materials.” Bureau of Indian Standards (BIS), New Delhi, India.

2	IS 73 (2013). "PAVING BITUMEN — SPECIFICATION" Bureau of Indian Standards (BIS), New Delhi, India
3	MORTH Specifications for Road and Bridge Works, Indian Roads Congress (IRC) 5th Revision 2013, New Delhi, India
Useful Links	
1	https://ts-nitk.vlabs.ac.in/List of experiments.html
2	
3	
4	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3									1	
CO2				3		1							2	1
CO3				3	1								2	1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Mini Project :-Construction Project Management
Desired Requisites:	Building Planning Design, Estimating and Costing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To develop amongst students the necessary analytical & managerial skills to systematically analyze the scope of work on construction sites and evaluate the relation between time and money during the planning phase of construction projects to achieve better productivity.
2	To understand the practical complexities involved during the planning and execution of various phases/activities of construction projects and learn the various tools and techniques to manage the resources namely time, money, material, equipment & labour, thereby facilitating to become productive managers.

Course Outcomes (CO)

CO1	Comprehend scope of selected construction project and develop WBS
CO2	Schedule selected project using precedence network technique based contemporary scheduling software.
CO3	Demonstrate conceptual level Quality management and safety management Programme for the same projec

List of Experiments / Lab Activities

List of Experiments:

Small student groups formed will need to undertake following stages in this course; -

1. Identify a small construction project and collect its documents defining scope (BOQ, drawings etc.)
2. Prepare the Work breakdown structure to evolve at least 100 distinct activities (appropriate software may be used)
3. Schedule the project using contemporary software taking into consideration following:-
   - Activity list generated from WBS
   - Construction methodology decision for each activity
   - Important Resource allocations
   - Precedence relations (Both technical and resource constrained)
   - Time duration allotment (based upon resources, work content)
   - Working calendar
4. Demonstrate quality management plan and safety management plan for the same project at preliminary level.

Text Books

1	Kumar Neeraj Zha, “Construction Project Management”, Pearson India Education, 1st edition,(2011)
2	Saleh Mubarak, “ Construction Project Scheduling and Control”, Wiley, 2nd edition (2010)

3	S. Seetharaman, “Construction Engineering & Management”, Umesh Publications Delhi, 4 th edition,(2008)
References	
1	Chitkara K K, “Construction Project Management : Planning, Scheduling and Controlling”, Tata McGraw - Hill Education, 2nd edition, 2010
2	Sonia Atchison, Brian Kennemer,” Using Microsoft Project 2010”, Pearson, 2011
3	Paul E Harris ,“Planning and Control Using Primavera® P6 Version 7: For All Industries”, Eastwood Harris Pty Limited, 2013
Useful Links	
1	
2	
3	
4	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2										1	
CO2			1	3									2	1
CO3			2		1								2	1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom’s Taxonomy Level				
Bloom’s Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Project-I
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	6 hrs/week				
Interaction	-	**Credits:3**			

Course Objectives

1	This course intends to make group of students to identify a specific problem for their next semester major project and design methodology to address the problem. It also focuses on skills such as teamwork, leadership, interaction skills, and presentation skills.
2	

Course Outcomes (CO)

CO1	Identify a specific problem for the current need of the society and collect information related to the same through detailed review of literature.
CO2	formulate problem statement and Design solution methodology
CO3	present work progress.

List of Experiments / Lab Activities

The student groups collectively are made to work on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. o They can select any topic which is relevant to the area of Civil Engineering. (may be theoretical or case studies) o At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.

Text Books

1	based upon broader area selected for the project
2	
3	

References

1	R.C. Kothari, ”Research Methodology”, New Age Publications, 2nd Edition
2	Technical books based upon broader area selected for the project
3	

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						2						2		
CO2		2		2									2	1
CO3						2					3		2	1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code					
Course Name	Elective 5:Advanced Structural Analysis				
Desired Requisites:	Solid Mechanics, Structural Mechanics I, Structural Mechanics II				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	The objective of this course is to apply advanced structural analysis techniques to various civil engineering structures based on courses structural mechanics I & II through theory and series of numerical examples. The course serves as a prerequisite for the advanced design of reinforced concrete structures.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Demonstrate advanced techniques of structural analysis to various types of structures.	Applying
CO2	Analyse special type of structures in civil engineering.	Analyzing
CO3	Evaluate external and internal forces in structures for design of structures.	Evaluating

Module	**Module Contents**	**Hours**
I	**Influence Lines:** Muller Breslau principle, qualitative and quantitative Influence line diagrams for reactions, Shear force and bending moment's for propped cantilever, fixed beam and continuous beams. Practical applications of influence lines.	7
II	**Beams Curved in Plan:** Analysis of statically determinate and indeterminate beams curved in plan subjected to loads normal to plane of beam using strain energy method. Bending moments and twisting moment diagrams.	7
III	**Fixed Arches:** Types of arches, Elastic Center Method, Analysis of parabolic and circular / semicircular fixed arches. Normal Thrust, Radial Shear and Bending Moment at any section of an arch.	7
IV	**Approximate Methods:** Portal and Cantilever methods for analysis of building frames subjected to lateral loads. Axial force, Shear force and bending moment diagrams.	6

V	**Secondary Stresses:** Causes of secondary stresses, Change in angles, deflection angles and Analysis of Secondary Stresses in Plane Frames, Analysis of pin jointed space frames by tension coefficient method.	6
VI	**Beams on Elastic Foundations:** Assumptions, Types of beams on elastic foundation, Analysis of beams on elastic foundation subjected to various loads and boundary conditions, deflection curve, pressure distribution, shear force and bending moment diagrams.	6
	Module wise Measurable Students Learning Outcomes: An ability to, 1. Construct ILD for indeterminate structures. 2. Analyze beams curved in plan. 3. Analyze parabolic & circular fixed arches. 4. Construct SFD & BMD of building frames subjected to lateral loads. 5. Find secondary stresses in plane frame. 6. Analyze beams on elastic foundation	
Text Books		
1	V.N. Vazarani and M.M. Ratwani, "Analysis of Structures" Khanna Publishers, 8th Edition, 1983.	
2	C. S. Reddy, "Basic Structural Analysis", Tata McGraw hill, 7th Edition, 1981.	
3	S. B. Junnarkar, "Mechanics of Structures Vol. I", Chartor House pulications. 31st Edition, 2014.	
References		
1	S. Timoshenko "Strength of Materials Vol-II," East Van Nostrand, 3rd Edition, 1955.	
2	N. Krishna Raju & D. R. Gururaja, "Advanced Mechanics of Solids and Structures"-, Naraosa Publishing House, New Delhi, 1997	
Useful Links		
1		

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			**2**	**2**											
CO2			**2**	**3**											
CO3			**3**	**3**											

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VIII				
Course Code					
Course Name	Elective 5:Structural Health Monitoring				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	1: Structural Sustainability Structural Health Monitoring examines the use of low-cost, long term monitoring systems to keep civil infrastructure under constant surveillance, ensuring structural integrity. Moreover, the tools and skills the students will learn in this class can be implemented to develop sustainable maintenance and rehabilitation schemes and programs.
2	2: Structural Resiliency Structural Health Monitoring covers the concepts of rapid after disaster assessment of civil infrastructure. The tools and skills incorporated within the curriculum of this class provide quantitative means to assess the structural integrity loss a system undergoes after natural disasters and other hazardous events.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Demonstrate the knowledge of SHM for various components of structures.	Apply
CO2	Evaluate various techniques for SHM of structures.	Evaluate
CO3	Design various SHM techniques for various structures.	Create

Module	**Module Contents**	**Hours**

I	**Introduction to Structural Health Monitoring (SHM) :** Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design	7
II	**Application of SHM in Civil Engineering:** Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.	7
III	**Non Destructive Testing of Concrete Structures:** Introduction to NDT - Situations and contexts, where NDT is needed, classification ofNDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra Red thermography, ground penetrating radar, radio isotope gauges, other methods.	7
IV	**Condition Survey & NDE of Concrete Structure:** Definition and objective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, quality control of concrete structures - Definition and need, Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies of a few NDT procedures on concrete structures	6
V	**Rehabilitation and Retrofitting of Concrete Structure :** Repair rehabilitation & retrofitting of structures, damage assessment of concrete structures, Materials and methods for repairs and rehabilitation, modeling of repaired composite structure, structural analysis and design -Importance ofre-analysis, execution of rehabilitation strategy, Case studies	7
VI	**Damage Detection of Composite Structures:** Introduction to composites and their applications in structural Industry. Learning from failures. Various kinds of damage detection techniques. Repair & rehabilitation & retrofitting of composite structures, damage assessment of composites structures, Case studies.	6
	Module wise Measurable Students Learning Outcomes: 1. Demonstrate concepts of Structural Health Monitoring (SHM). 2. Apply SHM to Civil Engineering structures. 3. Carry out non-destructive testing of concrete Structures. 4. Judge condition of existing concrete structures by NDT survey. 5. Devise rehabilitation and retrofitting strategies for concrete Structures. 6. Evaluate damage of composite structures.	
Text Books		
1	Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, Structural Health monitoring, Published by ISTE Ltd., U.K. 2006.	
2	Guide Book on Non-destructive Testing of Concrete Structures, Training course series No.17, International Atomic Energy Agency,Vienna, 2002.	
References		

1	Hand book on "Repair and Rehabilitation of RCC Buildings ", Published by Director General, CPWD, Govt. of India, 2002.
2	Hand Book on Seismic Retrofitting of Buildings, Published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.
Useful Links	
1	

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			**3**	**3**				**2**							
CO2			**2**	**2**				**2**							
CO3			**2**	**2**				**1**							
CO4															
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VIII				
Course Code					
Course Name	Elective 5:Advanced Water and Wastewater Treatment				
Desired Requisites:	Water Supply and Treatment Technology, Waste Management and Pollution Control				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To provide students the necessary knowledge and concepts of advancements/emerging techniques of treatment in physical, chemical and biological treatment processes.
2	To impart students with the skill of design and operation of water and wastewater treatment plants based on latest technology.
3	To provide students prerequisite knowledge necessary for higher studies and research in the field of water and wastewater treatment.
4	To encourage students for undertaking further studies in the field of environmental engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Explain and Apply the concepts of unit operations and processes for advanced treatment of water and wastewater.	Understanding Applying
CO2	Analyze and evaluate the advanced treatment systems used in water and wastewater.	Analyzing Evaluating
CO3	Design the advanced treatment facilities for water and wastewater.	Creating

Module	**Module Contents**	**Hours**

I	**Fundamentals** Need for Advanced water and wastewater Treatment Reactors and Reaction Kinetics: Types of Reactions and Reaction Kinetics Types of reactors and Principles of Reactor Design Principles of aeration, Gas-liquid mass transfer, two film theory	5
II	**Physical** Ion Exchange: Process, Ion exchange resins, exchange capacity, ion exchange chemistry and reactions, Applications for hardness and TDS removal, Design of ion exchange units	5
III	**Membrane Processes** Membrane Filtration: Terminology, Process classification, Membrane configurations, Membrane operation for micro filtration, Ultra filtration and Reverse osmosis, Membrane fouling and its control, Application of Membranes. Electro dialysis: Theory, Area and power requirement, Disposal of Concentrate waste streams.	8
IV	**Adsorption** Adsorption processes, causes and types of adsorption, influencing factors, adsorption equilibria and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of GAC and PAC contactors.	6
V	**Biological Treatment** Physical, Chemical and Biological processes for Nitrogen and phosphorous removal, Removal of heavy metals. Anaerobic sludge blanket processes, Design considerations for up flow Anaerobic Sludge Blanket process. Design of high rate clarifier Disinfection with ozone: chemistry, modeling, estimation of ozone dosage. UV disinfection: system components, modeling, Estimation of UV dose.	8
VI	**Constructed wetland** Wetland and aquatic treatment systems; Types, application, Treatment kinetics and effluent variability in constructed wetlands and aquatic systems, Free water surface and subsurface constructed wetlands, Floating and emergent plants, Combination systems, Design procedures for constructed wetlands, Management of constructed wetlands and aquatic systems.	8
Text Books		
1	Metcalf and Eddy “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publication, 6th Reprint. 2003.	
2	Davis, M, L, and Cornwell, D, A, “Introduction to Environmental Engineering”, Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.	
References		
1	Quasim, S. R., “Wastewater Treatment Plants Planning, Design and Operation”, CRC Press, 2nd Edition, 2010.	
2	Droste, Ronald L “Theory and Practice of Water and Wastewater Treatment”, John Wiley & Sons Publication, 1st Edition, 1997.	
Useful Links		

1	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			**1**		**1**										
CO2			**2**	**2**	**2**										
CO3			**2**		**2**										
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code					
Course Name	Professional Elective-6: Traffic Engineering & Management				
Desired Requisites:	Transportation Engineering, Highway Engineering				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To give exposures of highway planning, Design of geometric elements of roads, Rigid and Flexible pavements design, desirable properties of highway materials and various practices adopted for construction.
2	To comprehend components, planning, design and construction of railway track, stations and yards.
3	To make acquainted with general aspects of tunnel components and construction.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Explain and apply the principles of planning and designing of various geometric elements of highways, railways and tunnels.	Understanding & Applying
CO2	Demonstrate knowledge for selection of construction material and appropriate method of construction in field of highway, railway and tunnel engineering.	Understanding & Applying
CO3	Analyze various techniques used in the traffic management and maintenance of highway, railway and tunnel engineering.	Understanding & Applying

Module	**Module Contents**	**Hours**

I	**Traffic Engineering and control-**Review of various traffic surveys and traffic Studies; Statistical methods for traffic engineering and their applications - Distributions, sampling theory and Significance testing, Regression and Correlation; **Intersection design-** Principles, various available alternatives, rotary design, mini roundabout, traffic signals: types of traffic signals, advantages, determination of optimal cycle time and signal setting for an intersection with fixed time signals, co-ordination of signals, types, area traffic control, delay at signalized intersection. Accident and road safety: accident causes, recording system, analysis and preventive measures, accident cost, alternative methodologies for calculation. **Traffic management-** various measures and their scope, relative merits and demerits. Highway capacity: passengers car units, level of service, factor affecting capacity and level of service, influence of mixed traffic.	8
II	**Transportation Planning and management-**Introduction to the process of urban transport planning. Travel demand forecasting=Trip generation analysis, trip classification, multiple regression analysis, category analysis. Modal split analysis: introduction, earlier modal split models, modal split models with behavioural basis. **Trip distribution analysis-** introduction, methods of trip distribution, uniform and average factor method, Fratar method, Furness method, The Gravity model, Intervening and competing, Linear programming approach to trip distribution. **Traffic Assignment-** purpose of traffic assignment, traffic flow characteristics, Assignment techniques=All or nothing assignment, Multiple route assignment, Capacity restraint assignment, Diversion curves. Rout building algorithms. **Land- use transport models-** Introduction, selection of Land-use transport models, The Lowry model, Grain – Lowry model, Applications of Lowry model.	8
III	**Theory of traffic flow-** Scope, definitions and basic relationship, review of flow density speed studies, hydrodynamic analogies, Application of hydrodynamic analogy, **Car-** following theory and its application to traffic engineering, probabilistic description of traffic flow, an introduction to queuing theory as applied to traffic flow problems for study state conditions, simulation studies.	8
IV	**Transport Economics-** Economic evaluation of highway schemes, need for economic evaluation, cost and benefits of transportation projects, basic principles of economic evaluation, Net present value method, benefit/cost ratio method, internal rate of return method. Vehicle operating costs, Value of travel time saving, Accident costs.	6
V	**Public Transportation-** Mass transit systems: Bus and rail transit, characteristic capacities.	4
VI	Introduction to intelligent transportation systems, Introduction to advanced computational techniques for transportation planning.	4
Text Books		
1	G.J. Pingnataro, Principles of Traffic Engineering, McGraw Hill, 1970.	
2	Wohl and Martin, Traffic System Analysis for Engineering and Planners, McGraw Hill, 1983	
3	B.G. Hutchinson, Introduction to Urban Transport Systems, Planning, McGraw Hill,1970.	

4	Fair and Williams, Economics of Transportation, Harper & Bros., Publishers, NY, 1959.
5	Traffic engineering and transport planning by L.R. Kadiyali, Khanna Publishers Delhi
References	
1	Manual of Economic Evaluation of Highway Projects in India (SP30), Indian Roads Congress
2	Subhash Saxena, A Course in Traffic Engineering and Design, Dhanpat Rai & Sons
3	Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall, India
4	Winfrey, Robley, Economic Analysis for Highway ,International Textbook Co., PA,USA, 1969
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					1									
CO2														
CO3														
CO4														
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VIII				
Course Code					
Course Name	Professional Elective-6: Finite Element Method				
Desired Requisites:	Engineering Physics , Engineering Mechanics and Mathematics				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To impart knowledge of element stiffness matrix formulation for 1D,2D and 3D elements
2	To demonstrate applications of finite element method in structural engineering in a wide perspective.
3	To provide knowledge of finite element method to model and solve continuum structures by using FEM based softwares.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Organize finite element methodology by developing element stiffness matrix.	Analyzing
CO2	Evaluate nodal degrees of freedom and stress resultants.	Evaluating
CO3	Devise finite element model for solutions of various field problems.	Creating

Module	**Module Contents**	**Hours**
I	Basic concept of finite element analysis, Discretization, nodes, element incidences, formulation of element stiffness matrices for spring, bar and plane truss elements. Solutions for unknown nodal displacements; Applications of method to spring, bar and plane truss problems	8
II	Formulation of element stiffness matrices for beam and plane portal frame element by direct method; Transformation of matrix from local to global system; Numbering of nodes; minimization of band width; force displacement relations; Solution for displacement unknowns; Applications of method to plane truss; Continuous beams and plane portal frames	6

III	Elementary theory of Elasticity: Stress strain relation; Strain displacement, relations; plane stress and plane strain problems; Compatibility conditions; differential equations of equilibrium; equations for two dimensional and three dimensional problems.	6
IV	Principle of minimum potential energy; variational method; continuum problems; Two dimensional Elements; use of displacement functions; Pascal's triangle; triangular and rectangular elements; Formulation of element stiffness matrix. Convergence requirements – Selection of the order of polynomial, conforming and non-conforming elements, Effect of element aspect ratio, finite representation of infinite bodies.	6
V	Shape function in Cartesian and natural co-ordinate system, Lagrange's interpolation formulae, concept of iso-parametric element, relation between Cartesian and natural coordinate system, Jacobian matrix, one and two dimensional Iso-parametric elements.	7
VI	Introduction to three-dimensional problem, various three-dimensional elements, Axisymmetric problems, formulation of stiffness matrix of three dimensional and axisymmetric elements.	6
	Module wise Measurable Students Learning Outcomes: 1. Comprehend basic concept of F.E.M. and formulation of [k] for spring, bar and truss element with their applications. 2. Develop element stiffness matrix for beam and frame element and solve the problems of continuous beams and portal frames. 3. Analyze plane stress/strain problems by using theory of elasticity. 4. Demonstrate the concept of displacement function and its convergence requirements. 5. Develop shape functions in Cartesian and natural coordinate system and apply concept of isoparametric elements. 6. Solve three dimensional and axisymmetric problems by using finite element method.	
Text Books		
1	P.N.Seshu "Finite Element Analysis", PHI learning private Lim. Delhi,2013.	
2	J. N. Reddy. "An Introduction to the Finite Element Method" McGraw Hill, 3rd Edition, New York, ,3rd edition, 2006.	
3	Robert D. Cook, David S. Malkus, Michael E. Plesha,Robert J. Witt,"Concepts and Applications of Finite Element Analysis",2003	
References		
1	Klaus-Jurgen Bathe, "Finite Element Procedures in Engineering Analysis",1982	
2	T. R. Chandrupatla and A.D. Belegundu, "Introduction to Finite Element in Engineering", Prentice Hall of India Private Limited, 3rd Edition,2002.	
3	Zienkiewicz.O.C. & Taylor.R.L., "The Finite Element Method- Vol I &Vol II Tata McGraw-Hill Publishing Company Limited, 6th Edition,2005.	
4	C. S. Desai & J. F. Abel "Introduction to Finite Element Method", AEP,1st Edition, 1972.	

Useful Links	
1	

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			**3**	**3**											
CO2			**2**	**2**				**2**							
CO3			**2**	**2**				**2**							
CO4															
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	15	**35**
Analyze		5	15	**20**
Evaluate			10	**10**
Create			10	**10**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Semester VI
Course Code	
Course Name	Professional Elective-6: Repairs and Rehabilitation of Structures
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial		20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	The Degree holder enables to inspect and identifies the damages of civil engineering structures.
2	To make conversant with the techniques for Retrofitting and strengthening of structures.
3	Prepare the estimate of maintenance, rehabilitation and strengthening of structure.
4	

Course Outcomes (CO)

CO1	Distinguish between different types of causes of damage and decide the appropriate technique of repair according to failure.
CO2	Identify causes of failure of masonry building & R.C.C. building its retrofitting.
CO3	Compute strength and age of building, maintenance of life lines and prepare estimates & tenders for structure damage due to hazards.

Module	**Module Contents**	**Hours**
I	**Introduction** Necessity, operation, maintenance & repairs of structures Classification of maintenance, Rehabilitation (restoration), strengthening, retrofitting. Methodical approach to repairs, inspection-annual, emergency, special, repairs- minor, special and renovation. **Causes & detection of damages:** Causes of damages, damages due to earthquakes, fire hazards, flood, hazards, dilapidation, List of basic equipments for investigation.	08
II	**Materials for repairs:** Epoxy resin, epoxy mortar, gypsum cement mortar, quick setting, cement mortar, Shot-creating Mechanical anchors. **Masonry walls:** Damp walls, causes effects, remedies, eradication of efflorescence cracks in walls, remedial & preventive measures bond between old & new brick work, reinforced brickwork.	05

III	**Repairs to foundation:** Remedies, types & processes of settlement, foundation sinking Examination of existing foundation, strengthening of foundation. **Water proofing:** Leaking Basements & roofs	05
IV	**Concept of repairs & strengthening of RCC structures:** Concept of repairs of RCC structures Physical examination of common defects, Structural repairs & strengthening repairs by new developments **Damage due to fire:** Fire resistance, effects of temp. of RCC, Repairs to RCC structures damaged due to fire	06
V	**Advanced Damage detection techniques**: Advanced damage detection techniques, non-destructive testing. **Strengthening methods:** Cantilevers, beams, slabs, walls, columns, foundation	10
VI	**Evaluation of strength, economic & age of building**: Determination of approx. age of a building. Determination of strength of structural member of old building. Finding cost in use of a existing building. **Maintenance of life lines:** Maintenance of electric supply, water supply leaking pipe joints and sewerage systems, closed drains, sewers. Maintenance of roads, road berms, side drain maintenance of bridges, culverts causeways	05

Text Books	
1	P.K. Guha, "Maintenance and Repairs of Buildings", New Central book Agencies Publications, 5th Edition, 2015,
2	Nayak B. S., "Maintenance Engineering For Civil Engineers" Khanna Publication, 2nd Edition, 2011
3	Hutchin B. D., "Maintenance and Repairs of Buildings", Newnes Butterworth Publications, 6th edition, 1975
References	
1	Shrikhande and Agrwal, "Earthquake resistant Design of Structures", 1st edition, PHI Learning Pvt. Ltd., 2006
2	S. K. Duggal, "Earthquake Resistant Design of Structures" 3ed Edition, Oxford University Press, 2007
3	
Useful Links	
1	https://nptel.ac.in/course.html

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1		1									
CO2			2	2	2									
CO3			2		2									

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code					
Course Name	Professional Elective-II : Town & Country Planning				
Desired Requisites:	Quantity Surveying & Valuation, Water supply and Treatment Technology, Waste Management & Pollution control, Transportation Engineering-I, Building planning and Design				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	This course is designed to be offered as elective to interested students who wish to consider town and country planning as their probable career option.
2	It focuses on relevant practices in preparation of RP, DP, TPS etc.
3	It also includes relevant legislations knowledge required for a modern town planner.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	comprehend general principles of town planning	Understanding
CO2	explain elements of regional plan(RP) and development plan(DP)	Understanding
CO3	describe important provisions of different town planning legislations and town planning schemes	Understanding

Module	**Module Contents**	**Hours**
I	**Introduction** Objective of town planning, principles, stages in town development, brief history, growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zone etc.), Institutional arrangements in Maharashtra (CIDCO, MMRDA, MHADA, SRA, TPVD etc.)	7
II	**Regional Plan (R.P)** Need , Regional Delimitation, Surveys , Analysis and Projections, Necessary Steps for process of Regional Planning, Relation with the state Plan and surroundings	5

III	**Development Plan (D.P)** Surveys, types, duration etc., Analysis and Projections, Demographic Projections, Goals and objectives, Public Participation, Implementation and Financial Aspects, Delineation, Relation with R.P., Content of DP and Planning norms, Modifications, purchase notice, Legal and Administrative process to start D.P.	6
IV	**Town Planning Scheme** Concept of T.P.S, Legal Provision, Relation with D.P., Original Plot, final Plot, Semi-final Plot, Incremental Contribution (Betterment charge), Rational for charging Incremental Contribution, Function of Arbitrator, Advance Possession, Amenities, Partially beneficial, Cost of Scheme	6
V	**Acts and Rules** Municipal Act, MR and TP Act 1966, LA Act. 1894, and LARA 2013, SEZ, DCR	8
VI	**Special Townships** Special Township Policy,Land requirement, Procedures for locational clearance, salient feature, Responsibilities of developer, Hill station Policy	7
Text Books		
1	G.K. Hiraskar,"Fundamentals Of Town Planning", DhanpatRai Publication (p) Ltd., New Delhi,17th Edition (English)2012	
2	S. C. Rangawala "Town Planning", Charotar Publications, Pune ,27th : 2014	
3	Biswas Hiranmay "Principles Of Town Planning And Architecture", VAYU Education of India, 2012 edition	
References		
1	MRTP Act 1966	
2	Land Acquisition Act	
3	Economic development in Third world: Todaro Michael, OrientLongman Publication, New delhi	
4	Planning legislation by Koperdekar and Diwan.	
5	UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.	
Useful Links		
1	https://nptel.ac.in/content/storage2/courses/109104047/pdf/lecture35.pdf	
2	http://www.iitb.ac.in/newacadhome/MUDEbrouchure28032019.pdf	
3	https://www.civil.iitb.ac.in/~dhingra/local/preview/pages/lectures.htm	
4	https://www.youtube.com/watch?v=QJZcCs9RwDY	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1										1	
CO2			2											2
CO3							2							2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B. Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Semester VIII				
Course Code					
Course Name	**Bridge and Airport Engineering**				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial		20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To give exposure to bridge hydrology, construction and maintenance aspects of bridges and make familiar with substructure and superstructure of bridges.
2	To make conversant with the techniques for planning and designing the airport components like runways, taxiways, terminal building, hangars etc. along with the drainage and traffic controls methods.
3	To make familiar with various construction methods of bridges and airport.
Course Outcomes (CO)	
CO1	**Demonstrate** the knowledge required for planning and designing of various components of bridges and airports.
CO2	**Explain and Apply** design considerations of the various components of bridges and airports.
CO3	**Compare and apply** various techniques used in the construction of bridges & airports and **Analyze** professional practices for solving problems in the field of bridge and airport engineering.

Module	**Module Contents**	**Hours**
I	**Bridge Engineering Part I** Classification of bridges, selection of site **Bridge Hydrology:** Determination of design discharge, linear water way, economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.	7
II	**Bridge Engineering Part II** **Standard Specification for Bridges:** Indian Road Congress Bridge Code. Width of carriage-way and clearances, IRC loads, Railway bridge loading, forces acting on super structure. Design considerations, aesthetics of bridge design.	7
III	**Bridge Engineering Part III** Bridge foundations, Types and their suitability, Bridge piers, Abutments, Wing walls, Approaches. Construction of various types of bridges, launching, erection, bearings. Maintenance and rehabilitation of bridges	7

IV	**Airport Engineering Part I:** Introduction, History, Terminology, components of aircraft, characteristics, airport classification, and organizations concerned with Airport Engineering. **Planning:** Surveys, site selection, airport obstructions, layouts, zoning laws.	6
V	**Airport Engineering Part II** **Designing:** Runways- orientation, basic runway length, geometric design. Taxiways- layouts, geometric design. **Terminal Buildings:** Site selection, facilities, aprons, gate positions.	7
VI	**Airport Engineering Part III** **Hangars:** Function, types, requirements. **Drainage:** Necessity, types. **Air Traffic Control:** VFR, IFR, visual aids, lighting and marking. **Heliports:** Characteristics, site selection, planning, size, obstructions, orientation, marking and lighting.	6

Text Books	
1	Bindra S. P., "Principles and Practice of Bridge Engineering", Dhanpat Rai Publications, 8th Edition, 2012.
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers, 6th Edition, 2012.
3	Victor D. J., "Elements of Bridge Engineering", Oxford and IBH, 5th Edition, 2001

References	
1	Alagia J. S., Rangwala S. C., "Elements of Bridge Engineering", Charotar Publishing House, 8th Edition, 1983.
2	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports", McGraw Hill Professional, 5th Edition, 2010.
3	

Useful Links	
1	https://nptel.ac.in/course.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1											
CO2			2											
CO3			3	2										

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VIII
Course Code	
Course Name	Civil Engineering Software Laboratory
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide the students hands-on practice of various Civil Engineering software

Course Outcomes (CO)

CO1	***Explain*** the basic concepts related to various Civil Engineering related software.
CO2	***Analyze*** building and infrastructure facilities using Civil Engineering related software
CO3	***Design*** building and infrastructure facilities using Civil Engineering related software

List of Experiments / Lab Activities

At least one of following software

List of Projects:

a. Preparation of building drawings in 2D and 3D using AutoCAD
b. Structural analysis and design of buildings using STAAD-PRO
c. Analysis and design of Water Distribution Systems (WDS) using EPANET/WaterGEMS
d. Analysis and design of sewerage systems using SewerGEMS
e. Analysis and design of storm water management systems using SewerGEMS/StormCAD

Text Books

1	Water Infrastructure Division, US EPA, EPANET 2.2 User Manual, 2020.
2	Autodesk, An Introduction to AutoCAD for beginners, 2020
3	SewerGEMS V8i User Guide, Bentley Systems, 2020

References

1	Shih R., AutoCAD 2021 Tutorial, 2021
2	Walski T., 'Advanced Water Distribution Modeling', Haestad Press, 1st Edition, 2003.
3	'Stormwater Conveyance Modeling and Design', Haestad Press, 1st Edition, 2007

Useful Links

1	https://www.youtube.com/channel/UCbFIgNot42PRCi-05X8aF_A

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli
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AY 2021-22

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Project-II
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	8 hrs/week				
Interaction	-	**Credits:8**			

Course Objectives

1	This sequel course after Project-I course in the earlier semester is designed to make students solve the identified problem based on the formulated methodology. Thereby students will also develop skills to analyze and discuss the test results, make conclusions & present report. Students are also permitted to execute major part of their project work at the premises of identified industry.
2	

Course Outcomes (CO)

CO1	execute solution methodology stated in pre-project course through data collection surveys/ experimentation / professional assignment etc.
CO2	analyze & interpret the results obtained.
CO3	conclude project work and present the same

List of Experiments / Lab Activities

The student groups collectively are made to work on a specific topic approved by the head of the The student group should continue the pre-project work on the selected topic as per the formulated methodology under the same supervisor. Students are also permitted to execute major part of their project work at the premises of identified industry. o At the end of the semester, after completing the work to the satisfaction of the supervisor and/or review committee, a detailed report should be prepared and submitted to the head of the department. o The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Text Books

1	based upon broader area selected for the project
2	
3	

References

1	R.C. Kothari, ”Research Methodology”, New Age Publications, 2nd Edition
2	Technical books based upon broader area selected for the project

3	

Useful Links

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2	2	2		3	2	2			2	2		
CO2			2	2		2								
CO3			2	2		2					3	2	2	1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem VIII				
Course Code					
Course Name	Summer Internship				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	1 hrs/week				
Interaction	-	**Credits:1**			
Course Objectives					
1	To acquire communication, cognitive and professional skills to demonstrate the acquisition and retention of understandings of concepts learnt through theoretical and lab courses pertaining to the program.				
2					
Course Outcomes (CO)					
CO1	Study field practices in Civil Engineering..				
CO2	Demonstrate knowledge acquired to identify improper practices and suggest appropriate measures.				
CO3	Convince the concerned through effective interaction.				
List of Experiments / Lab Activities					

The students should identify an appropriate area in Civil Engineering wherein they are exposed to constructionwork/design/monitoring/analysis/planning/estimation/survey/investigations/scheduling/testing. They will apply to respective authority through proper channel, obtain the permission from the due authority and undergo field training to achieve course learning outcomes.

Period of Activity: It is typically spread between 3rd and 7th semester in vacations. The student has to devote 270-300 man-hours (@ 45 days) distributed over the three semester vacations since completion of second year of B. Tech. program. Out of the total man-hours minimum 120 hours (@ 20 days) could be spent in a single vacation broadly defined as follows
SY B.Tech.- Sem I – FS Part I: Site selection, Surveying methodologies, Soil/ Geological investigations, Structural systems, Planning principles, Building materials, and Construction practices.
TY B.Tech.- Sem I – FS Part II: Learn professional customs and practices being applied for water treatments or structural designs
TY B.Tech. Sem II – FS Part III: Learn professional customs and practices being applied for any one of Waste management facility, Road/ railway works, Real Estate developers, architect or structural consultancy. The student may work with any Govt./ Non Govt/ or research organization pertaining to their interest.

Reporting and Submission requirement:
At each of the semester commencement student will submit a report to respective mentor based on training one has undergone for gradation. The report should be supported by certificate from appropriate authority, actual photographs, video's and day wise field notes. The field notes may consist of communication records, log of activities, work specifications, analysis of material, labor, and cost requirements, billing
1. Regular reporting to mentor.
2. Certificate from company/organization/firm stating attendance, satisfactory completion of work assigned. 3. Log book and photographs
4. Feedback by employer
5. Report consisting of Introduction, Study/Work carried out, Observations, and Outcomes

Text Books	
1	Same as recommended under specific course curriculum
2	Technical reports, Magazines & Journals pertaining to Civil Engineering
3	
References	
1	R.C. Kothari, "Research Methodology", New Age Publications, 2nd Edition
2	Technical books based upon broader area selected for the project
3	
Useful Links	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3	2			3	2						
CO2	2				2				2					
CO3						3				3			2	1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**