

1. COURSE DETAILS

Programme: CE/ME/EE/IE/PL/CH/DE	Semester: III
Course: Applied Mathematics	Group: C*
Course Code: AMT190013	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	-	-	1	4	3	70	20	10	70	25	-	-	125

3. COURSE OBJECTIVE:

This Course is being introduced to provide mathematical background needed for any Diploma engineer. It intends to enable the students to apply basic facts, concepts and principles of Differential Equation, Application of derivatives, Probability Distribution and Definite integral with application as a tool to analyze engineering problems.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified

Competency through various teaching learning experiences:

- Solve application-based Engineering problems using the Advanced Knowledge of mathematics

5. COURSE OUTCOMES (COs) at the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's LEVEL
1	Understand the concepts of differential calculus and definite integral and apply to solve engineering related problems.	U,A
2	Study the Concept of differential equation and apply it to solve engineering problems	R, U, A
3	Solve the Problem based on Numerical Method.	U,A
4	Define Laplace transform, study properties of it and apply it to solve numerical	R,U, A

6. COURSE CONTENTS

Sr. No.	TOPIC/Sub-topic	Hours	Marks	COs
1	Application of Derivatives 1.1 Tangent and normal line 1.2 Velocity and Acceleration 1.3 Maxima and minima 1.4 Radius of curvature	04	07	CO1



2	Differential Equation 2.1 Introduction and definition 2.2 Concept of order, degree of Differential equation 2.3 Formation of Differential Equation 2.4 Differential Equation of first order and first degree <ul style="list-style-type: none"> • Method of variable separable • Equation reducible to method of variable separable • Homogeneous Differential equation • Exact Differential equation • Linear Differential equation 2.5 Application of Differential Equation <ul style="list-style-type: none"> • Geometrical • Growth and Decay • Newton's law of cooling • Electrical circuit 	14	19	CO2
3	Numerical Method 3.1 Solution of equation of one variable using <ul style="list-style-type: none"> • Bisection method • Regular falsi method • Newton Raphson method 3.2 Solving simultaneous equation with 2 and 3 variables using <ul style="list-style-type: none"> • Gauss elimination method, • Iterative methods –Gauss Seidal and Jacobi's methods 	06	09	CO3
4	Integration Method of integration 4.1 By Substitution – Various Types of Integration 4.2 By Parts 4.3 Mixed Problems	07	10	CO1
5	Definite Integral & its Applications 5.1 Definition of Definite Integral 5.2 Properties of Definite Integral 5.3 Reduction Formula 5.4 Area under the curve & Area between curve 5.5 Volume of Solid 5.6 Mean Value, RMS Value 5.7 Centre of Gravity	05	08	CO1
6	Laplace Transform 6.1 Introduction 6.2 Definition and Basic Formula 6.3 Properties of Laplace transform' <ul style="list-style-type: none"> • Linearity property • First shifting • Change of Scale • Multiplication by t^n • Division by t 6.4 Inverse of Laplace Transform 6.5 Properties of Inverse of Laplace Transform 6.6 Methods of Inverse of Laplace Transform <ul style="list-style-type: none"> • By Partial Fraction 	12	17	CO4
TOTAL		48	70	



7. LIST OF ASSIGNMENTS/TUTORIALS

Term Work consists of Journal containing minimum no of 08 tutorials.

Sr. No.	Title of Tutorial	Approx.Hrs required	Cos
1	Assignment on Application of derivatives	2	1
2	Assignment on Differential equation.	3	2
3	Assignment on application of Differential equation	1	2
4	Assignment on Numerical Method.	2	3
5	Assignment on Integration	2	1
6	Assignment on definite integration & its Applications	2	1
7	Assignment on Laplace Transform	2	4
8	Assignment on Inverse Laplace Transform	2	4
Total		16	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Tutorials
2. Assignments
3. Home Work Assignment

9. LEARNING RESOURCES

Sr. No.	Title Of Book	Author	Publication
1.	Calculus for Polytechnics	Shri. S.P.Deshpande	Pune Vidyarthi Graha Prakashan Pune-30
2.	Applied Mathematics	Shri. B.M. Patel, Shri J.M. Rawal	Nirali Prakashan Mumbai
3.	Higher Engineering Mathematics	Dr. B.S. Grewal	Khanna Publishers 2/B, Delhi-6
4	Applied Mathematics	G.V.Kumbhojkar	P.Jamnadas LLP

10. WEB REFERENCES.

1. www.mic-mathematics.com
2. www.math.com
3. www.lernerstv.com
4. www.onlinetutorials.com
5. www.archieves.math.utk.edu

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

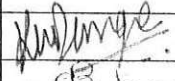

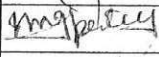
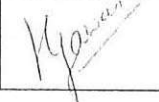
	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Application of Derivatives			7	07
2	Differential Equation	4	10	5	19
3	Numerical Method	2	5	2	09
4	Integration	6	2	2	10
5	Definite Integral & its Applications	2		6	08
6	Laplace Transform	3	10	4	17
TOTAL		17	27	26	70

R Remembering, U Understanding, A Applying and Above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.



12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.	NAME	SIGNATURE
1	Internal MS.Kavita.K.Dange	
2	Internal Mr.R.R.Ambade	
3	Internal Mr.U.J.Patel	
4	External Ms.Meena Gawas Organisation: Mithibai College Of Arts and Science	



1. COURSE DETAILS

Programme: Civil Engineering	Semester: III
Course: Surveying - II	Group: C*
Course Code: SUR190106	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	4	-	-	7	03	70	20	10	70	50	50	-	200

3. COURSE OBJECTIVE

This is core technology subject which is intended to teach the students core facts, concepts, principles and procedures in surveying and leveling. With this knowledge and skill, he will be able to choose appropriate surveying and levelling methods depending upon requirement, to carry out survey work in Building Construction system, Transportation Engineering system, Environmental Engineering system and Irrigation Engineering system for investigation of projects before and during execution of work, while serving as investigator for design department, supervisor on the site of work, draftsman in the drawing office.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Apply principles and methods of different types of survey.
- Carry out Theodolite Traversing independently on the field.
- Apply surveying knowledge to various problems on site related to survey.
- Undertake civil engineering surveys



5. COURSE OUTCOMES(COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO1	Prepare plans using theodolite surveys	R, U, A
CO2	Prepare plans using plane table surveys	R, U, A
CO3	Find distance and elevations using tacheometer	R, U, A
CO4	Take linear and angular measurements in horizontal and vertical plane using total station	R, U, A
CO5	Use appropriate method to set simple circular curve	R, U, A

6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
1	Introduction of Theodolite: Different parts of the theodolite, temporary adjustments, centering, leveling, elimination of parallax, different fundamental lines of theodolite, relationship between fundamental lines of theodolite, Permanent adjustments of theodolite, different uses of theodolite,	04	06	CO1
2	Classification of Theodolite: Transit and non- transit type, Vernier Theodolite, Micrometer Theodolite, digital theodolite, basic definition like transiting, swinging, face left, face right etc.	04	06	CO1
3	Measurement of Angles with Transit Theodolite Measurement of Horizontal Angle, ordinary method, method of repetition, reiteration method, Measurement of Vertical Angle, angle of elevation, depression and total vertical angle. Errors eliminated by method of repetition and reiteration. Measurements of deflection angle, use of theodolite as level, etc Errors in Theodolite survey work, sources of errors.	08	12	CO1
4	Traversing with Theodolite Latitude and Departures, definitions & calculation, Consecutive and Independent Co-ordinates, definition and calculation, Relation of included angles and bearings, latitudes and departure, Checks on closed traverse. Problems based on latitude and departures, consecutive and independent co-ordinates. Traverse Computation, Reduction and tabulation of co-ordinates, plotting of co-ordinates, balancing the traverse, Gale's Traverse Table, Significance, steps to be followed in calculation of Gale's traverse table, closing error and its adjustments, plotting of traverse using gale's traverse table, Problems based on Gale's Traverse Table.	10	14	CO1
5	Tacheometric Survey: Principles of tacheometric surveying, definition, use of theodolite as tachometers, use of analytic lens, methods, of tacheometry, its use for traversing and contouring, Fixed	08	12	CO3



	Hair method, Problems only on Line of sight Horizontal and staff held vertical and line of sight inclined and staff held vertical cases. Tachometric tables, computations, movable hairs and tangential method.(no questions to be asked)			
6	Plane Table Surveying: Plane table survey definition, use, Equipment's used in plane table surveying, alidade, trough compass, plumbing fork, temporary adjustments of plane table, centering, orientation, Magnetic needle method, back sight method of orientation. Methods of Plane Table Survey, Radiation Method, Intersection Method, Resection Method, Traversing Method, Two point and three point problem, Errors in plane table survey, sources and elimination.	06	08	CO2
7	Curves: Necessity of curves, (as on roads, railways, etc.), Types of curves like simple, compound, reverse, transition and vertical curves, radius and degree of curve. Various component parts of a simple circular curve like tangents, versed sine of curve, apex distance, tangent distance, length of curve, degree of curve, angle of intersection, long chord, normal and sub-chords, etc, problems based on it. Simple methods of setting out curves. (No Numerical on setting of curves)	08	12	CO5
8	Total Station Survey Overview of the Trimble M3 Total Station, setting up tripod, Centering with optical plummet, Levelling, Focusing the telescope, Measurement in DR mode and prism mode, Various measurement modes, taking measurements, setting height of instrument, creating coordinates arbitrary or with GPS, back sighting observation, recording readings and creating points, saving the data, retrieve the data stored.	--	--	CO4
	Total	48	70	

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 14 no of experiments and 6 drawing sheets (marked with *) with approximate no of hours required and corresponding CO attained are specified here.



Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1.	*Study of Theodolite and its parts taking out reading on vernier	2	CO1
2.	*Temporary adjustments of theodolite and taking out reading on vernier	2	CO1
3.	Measurement of Horizontal angle by Ordinary Method	2	CO1
4.	*Measurement of Horizontal angle by Repetition Method	2	CO1
5.	Measurement of Horizontal angle by Re-Iteration Method	2	CO2

Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
6.	*Measurement of Vertical angles	2	CO1
7.	*Theodolite Traversing by method of Included Angles	2	CO1
8.	Theodolite Traversing by method of Included Angles		CO1
9.	*Theodolite Traversing by Gale's Travers Table	2	CO1
10.	*Study of plane table survey equipment and temporary adjustments of plane table	2	CO2
11.	*Radiation method of Plane Table Survey	2	CO2
12.	*Intersection method of Plane Table Survey	2	CO2
13.	Traversing method of Plane Table Survey	2	CO2
14.	*Study of Tacheometer and finding constant of Tacheometer	2	CO3
15.	*Tacheometric survey case-I	2	CO3
16.	Tacheometric survey case-I	2	CO3
17.	*Tacheometric survey case-II	2	CO3
18.	Tacheometric survey case-II	2	CO3
19.	*Theodolite Traversing Project by Gale's Traverse Table	08 (1 days)	CO1
20.	*Plane Traversing Project by using all methods	08 (1 day)	CO2
21.	Setting of curves by any one method	04	CO5
22.	*Drawing sheet of Theodolite Traversing by Gale's Traverse Table	6	CO1
23.	*Drawing sheet of Plane Table Survey: Radiation Method	2	CO2
24.	*Drawing sheet of Plane Table Survey: Intersection Method	2	CO2
25.	*Drawing Sheet of Plane Table Survey: Traversing Method	4	CO2
26.	*Drawing Sheet of Survey project Theodolite Traversing Project by Gale's Traverse Table	6	CO1
27.	*Drawing Sheet of Survey project Plane Table Traversing Project	6	CO2
28.	Study and use of Total Station for 1. Linear measurements in horizontal and vertical plane 2. Angular Measurement in horizontal and vertical plane	4	CO4
Total		70 + 16	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Minimum no. of practical/drawings etc.
3. Survey Project for 2 days on site
4. Slides / Presentation
5. Group discussions for practical assignments
6. Self-Learning Online Resources



9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Surveying I and II	Punmia B.C.	Laxmi publication New Delhi
2	Surveying Vol. I	Kanetkar and Kulkarni	Pune VidyarthiGruha
3	Surveying	GajareV.S	NiraliPrakashan Mumbai
4	Surveying	J.R. Muley	Vrinda Publication Jalgaon
5	Textbook of Surveying	Venkatramaiah, C	Universities Press.New Delhi
6	Surveying and. Levelling Volume- I	Bhavikatti, S. S	I. K. International, New Delhi
7	Surveying & Levelling	Basak N.N.	Tata McgrawHill , New Delhi

10. WEB REFERENCES

1. <https://nptel.ac.in/courses/105107122/>
2. <https://swayam.gov.in/>
3. www.oupinheonline.com
4. www.mtu.edu/technology/

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN


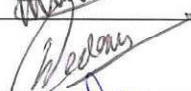

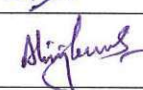
Sr. No.	TOPIC	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction of Theodolite	04	04	02	00	06
2	Classification of Theodolite	04	02	04	00	06
3	Measurement of Angles with Transit Theodolite	08	00	04	08	12
4	Traversing with Theodolite	10	00	06	08	14
5	Tacheometric Survey	08	--	04	08	12
6	Plane Table Surveying	06	03	05	00	08
7	Curves	08	00	04	08	12
	Total	48	09	29	32	70

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.



12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Miss. Neelam Nagraj Petkar	
3	Internal	Mrs. Supriya Prasad Patil	
4	External	Mr. Dheerajkumar Pandirkar	
		Organisation: Dy. Chief Engineer, MHADA	



1. COURSE DETAILS:

Program: Civil Engineering	Semester: III
Course: Civil Engineering Drawing	Group: C*
Course Code: CED190107	Duration: 16 weeks

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per week					Examination Scheme and Maximum Marks								
Theory Hrs/Week	Practical Hrs/Week	Drawing Hrs/Week	Tutorial Hrs / Week	Credits (L+P+D+T)	Theory Paper Duration and marks		SSL	TA	TH	TW	PR	OR	Total
					Hrs	Mks							
2	-	4	-	6	04	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

This is core technology course. This will enable the student to appropriately read and interpret civil engineering drawings while supervising the Building under construction. Drawing helps in detailing the structures processes with quality parameter and is essential for drafting specifications and tender documents. The knowledge of this subject is useful for building construction, estimation and costing, design of structure, surveying, projects etc.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Read different types of drawings at site.
- Prepare the drawings of plan, layout, sections, elevations, sectional elevation etc.
- Prepare the drawings of existing building by taking onsite measurements.
- Apply the building rules, regulations and byelaws for planning the building

5. COURSE OUTCOMES (COs)

After the successful completion of the course, the student will be able to

CO NO		Blooms level
CO-1	Identify & illustrate technical terms, specifications used in drawings	R, U, A
CO-2	Develop line plan and actual plan, elevation, section of public & private buildings.	U, A
CO-3	Read and prepare municipal drawings required for approval from competent authorities.	U, A



CO-4	Develop perspective view of the building and show interiors.	U, A
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6. COURSE CONTENTS

Sr. No.	Topic/Sub-Topics	Hours	Marks	CO No.
1	Introduction: 1.1 Selection and Designation of Paper sizes 1.2 Scales & Dimensioning. 1.3 Conventional representation of materials in section. 1.4 Symbols for General Fitments, Sanitary Applications & Electrical Installations	4	07	CO1
2	Principles of layout 2.1 General principles, proportioning, composition, functional treatment and massing as applied to the buildings of various types. 2.2 Sun path Diagram & orientation of building. 2.3 Building Bye Laws. 2.4 Principles of planning of Residential and Public building as per BIS: 7662 (Load bearing and RCC framed structures). 2.5 Space requirements and norms for various units of Residential and Public building. Recommended space standards for Public building (school building) as per IS 8827-1978	06	07	CO2
3	Development of Line Plan: Proportioning & planning of 3.1 Residential buildings 3.2 Public Buildings like Hospitals, Hostels, Shops, Public Health Centers, Market, Hotels, Primary Schools, Small factories, Office buildings, Scheduled banks. etc.,	8	21	CO2
4	Detailed Drawing & Interior details : 4.1 Important terms used in Building Drawing 4.2 Drawing of Plan Elevation & Sectional Elevation of a Building. 4.3 Detailing and Proportioning of Interior of Building components. 4.4 Measure Drawing 4.5 Preparation of different municipal drawings	08	21	CO2 CO3
5	Perspective Drawing: 5.1 Definitions of different planes 5.2 Introduction to Types of Perspectives 5.3 One point perspective of objects 5.4 Two point perspective of exterior of Building (Single floor only)	6	14	CO4
	TOTAL	32	70	



7. SUGGESTED TERM WORK ASSIGNMENTS/DRAWINGS

The term work for this subject shall consist of the following drawings and sketches:

Sr. No.	Title of Drawings	Approx. Hrs required	COs
1.	Symbols used in Drawings	06	CO1
2.	Development of line plan by applying principles of planning for given building structure and data.	06	CO2
3	Developing line plan with proper scale 1. Bungalow (Load bearing structure) 2. Apartment- Framed Structure (G+2) 3. Public building (G+1)	12	CO2
4	Draw following views on Full Imperial size drawing sheet. 1. Typical Floor Plan 2. Elevation 3. Horizontal section passing through either kitchen or WC & bathroom. 4. Vertical section passing through either kitchen or WC & bathroom. 5. One section details passing through staircase. 6. Foundation plan. 7. Roof plan. 8. Site Plan.	16	CO3
5	Perspective Drawing: 1. One-point perspective of given object 2. Two-point perspective of given object 3. Two point perspective of given building	12	CO4
6	Measured Drawing for given building structure	12	CO2
Total		64	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Drawings
2. Group work during Assignments
3. Measured Drawing

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author	Publisher
1	Civil Engineering Drawing	Malik & Meo	Asian Pub. New Delhi
2	Building Drawing.	Shah/Kale/Pataki	Tata McGraw- Hill.
3	Civil Engineering Drawing	Y.S.Sane	-
4	Building Planning & Drawing	SudhindraYeri	Eastern Book Promoters. Belgaum
	Civil engineering drawing and design	Shahane	Poona Allies Book stall



10.WEB REFERENCES: -

1. https://onlinecourses-archive.nptel.ac.in/noc18_ce27/preview
2. <http://nptel.ac.in/courses.php>
3. <http://jntuk-coeerd.in>

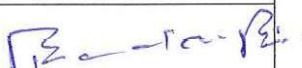



11. SUGGESTED SPECIFICATIONS TABLE WITH HOURS AND MARKS (THEORY):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction:	4	03	04	00	07
2	Principles of layout	6	01	02	04	07
3	Development of Line Plan:	6	00	07	14	21
4	Detailed Drawing & Interior details	6	00	07	14	21
5	Perspective Drawing	6	00	04	10	14
Total		32	04	24	42	70

Legends: R- Remember; U-Understand; A- Apply and above (Bloom's revised Taxonomy).

Note: This specification table shall be treated as indicative and actual distribution of marks may slightly vary from table. But the questions from each topic shall be asked as per marks weightage.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. K. P. Jayteerth	
2	Internal	Shri. S. N. Ranshur	
3	Internal	Miss. Neelam Petkar	
4	External	Jaweed Ghazali	
		Organisation: Architect	



13. QUESTION PAPER PATTERN:

Ques. No.	Periodical Test		Term End Exam	
	Bits	Marks	Bits	Marks
1.	Any 1 out of 2 (10 marks each)	10	Any 1 out of 2 (15 marks each)	15
2.	Any 1 out of 2 (4 marks each)	04	Any 2 out of 3 (5 marks each)	10
3.	Any 2 out of 3 (3 marks each)	06	Any 2 out of 3 (5 marks each)	10
4.	-----	--	Any 1 out of 2 (15 marks each)	15
5.	-----	--	Any 2 out of 3 (5 marks each)	10
6.	-----	--	Any 2 out of 3 (5 marks each)	10
Total		20		70



1. COURSE DETAILS

Programme: Civil Engineering	Semester: III
Course: Highways, Bridges and Railways	Group: C*
Course Code: HBR190108	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	03	70	20	10	70	25	-	-	125

3. COURSE OBJECTIVE

Highways, Bridges & Railways is an applied engineering subject contains basic engineering knowledge about planning, construction, operation, and maintenance of highways, bridges and railways to ensure safe and effective transportation of people and goods, serving the social and economic needs of contemporary society and its successors.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following competency through various teaching learning experiences:

- Supervise construction & maintenance of pavement, railways, bridges.

5. COURSE OUTCOMES(COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO 1	Identify the type of road according to IRC specifications & components of railways.	R, U
CO 2	Differentiate between the geometric design, construction and maintenance of highways, bridges and railways	R, U
CO 3	Identify the terms commonly used in bridge engineering & summarize different types of bridges	R, U
CO 4	Draw different C/S of highways & railways, bearing of bridges, types of bridges & able to perform tests on road materials	A



6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
1	Introduction 1.0 Overview of Transportation Engineering 1.1 Role of transportation in the development of nation 1.2 Modes of transportation System - Roads, Railways, Waterways 1.3 Importance of each mode, Comparison and their relative merits	3	3	CO1
2	Highway and components 2.1 Classification of highway 2.2 Typical cross-section and components of a road 2.3 Requirements of an ideal highway 2.4 Highway Alignment and factors affecting it	4	4	CO1, CO2
3	Surveys, Alignment and Geometrics 3.1 Types of Surveys-Reconnaissance, Preliminary, Location 3.2 Sight Distance and its types 3.3 Gradient, super elevation, camber, grade compensation, widening of roads 3.4 Types of Curves	6	6	CO1, CO2,
4	Bituminous Roads 4.1 Bituminous Materials and its applications 4.2 Bituminous pavement layers : prime coat, Tack Coat, 4.3 Bituminous Macadam : Bituminous penetration macadam, Built up spray grout, Bituminous Concrete. 4.4 Tests for Bituminous Aggregates 4.5 Failures in Bituminous Roads 4.6 Constuction procedure of Water Bound macadam road	6	6	CO1, CO4
5	Cement Concrete Roads 5.1 Construction of Cement Concrete roads 5.3 Failures in Cement Concrete Roads	4	6	CO2, CO4
6	Highway Drainage 6.1 Sources of Drainage entering the road structure 6.2 Defects due to improper highway drainage 6.3 Requirements of a good drainage system 6.4 Surface and Subsurface Drainage	4	4	CO2
7	Bridge and component parts 7.1 Components of a bridge-Abutments, Wing walls, Piers, Bearings	6	7	CO3



	7.2 Afflux, Economic Span, Freeboard, Waterway, Linear way 7.3 Alignment of a bridge 7.4 Selection of site for a bridge			
8	Types of Bridges and Culverts 8.1 Fixed Span Bridge 8.2 Movable Span Bridges 8.3 Temporary Bridges 8.4 Types of Culverts	4	4	CO3, CO4
9	Maintenance of Bridges 9.1 Routine & special maintenance	2	2	CO3, CO4
10	Railways 10.1 Permanent way section for single line in cutting: Requirements, components and their functions 10.2 Rail gauges in India : Broad gauge, metre gauge and narrow gauge. Standard dimension for Indian Railways, standard cross sections of rails, embankments and cuttings 10.3 Permanent way: Requirements, components and their functions: 10.4 Rails: Standard section used on Indian Railways, their relative merits and demerits.	7	8	CO2, CO4
11	Components of Railway 11.1 Section of Rails, Fish plates and fish bolts: 11.2 Various rail sections along with their merits and demerits. 11.3 Rail joints. Fish plates _ common types. Expansion of rails, welding of rails. 11.4 chair with fasteners 11.5 Bearing plates with fasteners 11.6 Spikes and Rail anchors	6	8	CO2, CO4
12	Types of sleepers 12.1 Wooden, C.I., Steel, and R.C.C. sleepers: Standard types; timber, cast iron, steel, R.C.C. and prestressed concrete. 12.2 Relative merits and demerits, 12.3 fastenings for sleepers - chairs, bearing plates, wooden and metal keys, spikes, bolts, creep and anti- creepers	4	4	CO2
13	Stations and yards. 13.1 Selection of site. Junctions, terminal and wayside stations. Good yards, marshalling yard, loco sheds., Island platform. Level crossings. Lay out of a single line station with a crossing loop.	8	8	CO2, CO4



	13.2 Points and crossings: turns out: Left hand turn out, Number of crossings, switch lead, lead of crossing, cross over. Diamond crossing, triangles, ladder tracks, gauntlet tracks. (No calculations.)			
	13.3 Ballast: Function of ballast, essential requirements, and different materials used such as stone, sand, earth, etc. Relative merits and demerits.			
	TOTAL	64	70	

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 2 no of experiments and minimum 5 sketches & minimum 1 no of visit with approximate no of hours required and corresponding CO attained are specified here.

Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1	Draw neat sketches of C/S of highways (NH/SH/ODR/MDR/VR) in embankment & in cutting on A4size paper	4	CO4
	Any Two tests can be conducted from the following	4	
2	Conduct Flakiness Index Test on aggregates.	--	CO4
3	Conduct Impact Test on aggregates	--	CO4
4	Conduct flash point test on aggregates	--	CO4
5	Conduct penetration test on bitumen	--	CO4
6	Draw neat sketches of components of bridge & different types of Bridges on A4 size paper	2	CO4
7	Draw neat sketches of Permanent way of railway section for single line in cutting	2	CO4
8	Draw neat sketches of Rail joints. Fish plates _ common types. Expansion of rails, welding of rails.	4	CO4
9	Draw a neat sketch of left hand turn out with crossing loop.	2	CO4
10	Visit report based on construction of a road in & around Mumbai	4	CO2
11	Visit report based on different types of bridges/ flyover in & around Mumbai	4	CO3
12	Draw neat sketches of types of rails.	2	CO1
13	Draw neat sketches of Left hand turn out ,Diamond crossing	4	CO1
	TOTAL	32	



8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Minimum no. of practical/drawings etc.
3. Slides / Presentation
4. Group discussions for practical assignments
5. Self-Learning Online Resources

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Highway Engineering	Khanna &Justo	New Chand & Company
2	Highway Engineering	T.D. Ahuja	Standard Book House
3	Transportation Engineering	N.L. Arora	S. Chand Publication
4	Highway Engineering	S.P. Bindra	Ghanpat Rai
5	Railway Engineering	Rangwala S.C.	Charotar Publishing House,Anand Gujrat
6	Bridge Engineering	Ponnuswami.S.	McGraw Hill Education, New Delhi
7	Railway Engineering	Chandra, Satish & Agarwal, M.M.	Oxford University Press , New Delhi

10. WEB REFERENCES

1. <https://nptel.ac.in/courses/105107123/9>
2. <http://onlinepubs.trb.org/onlinepubs/millennium/00014.pdf>.
3. www.mtu.edu/technology/

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Teaching Hours	R Level	U Level	A Level	Total Marks
1	Introduction		3	--	--	3
2	Highway and components	4	--	4	---	4
3	Surveys, Alignment and Geometrics	6	2	4	---	6
4	Bituminous Roads	6	--	6	---	6
5	Cement concrete roads	4	---	6	--	6
6	Highway Drainage	4	4	--	---	4
7	Bridge and component parts	6	2	--	5	7
8	Types of Bridges and Culverts	4	--	4	----	4
9	Maintenance of Bridges	2	2	----	----	2

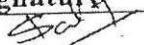
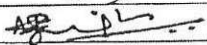
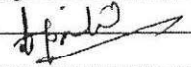


10	Railways	7	2	---	6	8
11	Components of Railway	6	2	---	6	8
12	Types of sleepers	4	4	---	---	4
13	Stations and yards	8	2	---	6	8
	Total	64	23	24	23	70

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of Cos. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		Name	Signature
1	Internal	Mrs. Supriya Prasad Patil	
2	Internal	Mr. Atulya kumar singh	
3	External	Mr. B. R. Patel Organisation: Procem Consultants	



1. COURSE DETAILS

Program: CE	Semester: III
Course: Materials and Structures	Group: C*
Course Code: MNS190109	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)	SSL	TA	TH	TW	PR	OR	Total
					Hours	Marks						
3	-	-	-	3	03	70	20	10	70	-	-	100

3. COURSE OBJECTIVE

To impart the knowledge of elastic behaviour of materials and judge the strength characters against the different modes of stresses acting on it by using the principles of mechanics as a tool.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Calculate Stresses in simple and complex section.
- Calculate deformations of the specimen subjected to uni-axial and biaxial stress system.
- Draw shear force and bending moment diagrams.
- Calculate moment of inertia of standard plane section and their components.
- Calculate shear stress and bending stress in beam cross section.

5. COURSE OUTCOMES (COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO 1	Determine simple stresses and strains in structural members subjected to axial, bending and torsional loads and strain energy due to axial load	R,U,A
CO 2	Determine the moment of inertia prismatic structural members.	R, U
CO 3	Determine shear force & bending moment in structural members and draw SF & BM Diagram.	R,U,A
CO 4	Classify concentric (axial) load and eccentric load on structural member and determine stresses due to eccentric load.	R,U,A
CO 5	Determine the compound stresses & strains and identify principal stresses and planes	R,U,A

R-Remember, U-Understand, A-Apply and above (Bloom's revised taxonomy levels)



6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
1	STRESS & STRAIN 1.1 Definition of rigid body, plastic body and elasticity 1.2 Definition of strain, stress, modulus of elasticity 1.3 Classification of stress, strain. 1.4 Deformation of body of uniform and varying c/s due to axial load 1.5 Max. stress and min. stress induced in the body 1.6 Stresses in bars of composite section. 1.7 Shear stress, complementary shear stress, state of simple shear, modulus of rigidity.	8	10	CO1
2	ELASTIC CONSTANTS 2.1 Definition of lateral strain and Poisson's ratio. 2.2 Change in lateral dimensions 2.3 Volumetric strain due to axial force and change in volume 2.4 Bi-axial, Tri-axial stresses and volumetric strain 2.5 Definition of Bulk Modulus and change in volume 2.6 Relation between Modulus of Elasticity Modulus of Rigidity and Bulk Modulus.	6	8	CO2, CO3
3	STRAIN ENERGY 3.1 Types of loading - gradual, sudden & Impact load 3.2 Definition of strain energy, modulus of resilience and proof resilience. 3.3 Comparison of stresses due to gradual load, sudden load and impact load (no problems)	2	6	CO2, CO3
4	MOMENT OF INERTIA 4.1 Concept of moment of inertia M.I. of plane areas such as rectangle, triangle, circle, semicircle and quarter circle 4.2 Parallel axis and perpendicular axis theorem M.I of composite sections, built up sections, symmetrical and unsymmetrical sections, radius of gyration polar moment of inertia	6	8	CO4
5	SHEAR FORCE (SF) & BENDING MOMENT (BM) DIAGRAMS 5.1 Definition of Shear Force and Bending Moment, relation between SF & BM and Load. 5.2 SF & BM Diagram for Simply supported, cantilever and Over Hang beams subjected to combination of Point Load, Uniformly Distributed Load. 5.3 Maximum SF and BM and their positions, Point of contra flexure	8	10	CO3
6	BENDING AND SHEARING STRESSES IN BEAMS 6.1 Concept of pure bending, Theory of Simple Bending, assumptions in Theory of Bending, Neutral Axis, Bending Stresses and their nature, Bending Stress Distribution Diagram and moment of resistance of flitched beam (no problems on flitched beam)	7	10	CO4, CO1



	6.2 Shear stress equation, meaning of terms in equation, shear stress distribution for rectangular, hollow rectangular, angle section, channel sections, circular sections and T-sections 6.3 Relation between max. Shear stress and average shear stress			
7	TORSION (NO PROBLEMS) 7.1 Definition of torsion, theory of pure torsion, assumptions, equation of torsion, angle of twist, torsional rigidity, polar section modulus 7.2 Torque transmitted by shaft	2	4	CO1
8	DIRECT AND BENDING STRESSES. 8.1 Concept of direct (concentric) and eccentric load. 8.2 Uniaxial bending of short compression member. 8.3 Stress distribution across the section, resultant stress, condition for no tension, middle third rule, core of the section.	5	8	CO4
9	PRINCIPAL PLANES AND STRESSES 9.1 Stresses on oblique plane i.e. normal stress and tangential stress 9.2 Definition of principal planes and principal stresses 9.3 Principal planes and principal stresses due to Biaxial and complex stress system	4	6	CO5
	TOTAL	48	70	

7. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Tutorials
2. Self-Learning Online Resources
3. Slides / Presentations

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1.	Strength of Materials	Khurmi R.S.	S.Chand & Co.
2.	Strength of Materials	Ramamurtha	Dhanpatrai & Co.
3.	Strength of Materials	S. S. Bhavikatti	Vikas Publishing
4	Strength of Materials	Rajput	S.Chand & Co.
5	Strength of Materials	Sunil M. Deo	Pragati / Nirali Prakashan
6	Mechanics of Structures Vol-I & II	S. B. Junnarkar	Charotar Publishing House

9. WEB REFERENCES

1. www.nptel.ac.in
2. www.discoveryforengineers.com
3. www.swayam.gov.in



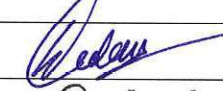
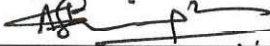
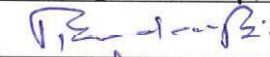
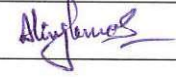
10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	CHAPTER	Distribution of Theory Marks			
		R Level	U Level	A LEVEL	Total Marks
1.	Stress and Strain	02	03	05	10
2.	Elastic Constants	02	02	04	8
3.	Strain Energy	02	02	02	6
4.	Moment of Inertia	02	02	04	8
5.	Shear Force and Bending Moment Diagrams	02	03	05	10
6.	Bending and Shearing Stresses in Beams	02	03	05	10
7.	Torsion	02	01	01	4
8.	Direct and Bending Stresses	02	03	03	8
9.	Principal Planes and Stresses	01	02	03	6
TOTAL		16	21	33	70

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of Cos. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Ms. Neelam N. Petkar	
2	Internal	Mr. A. K. Singh	
3	Internal	Mr. K.P. Jayateerth	
4	External	Mr. Dheerajkumar Pandirkar	
		Organization: Dy. Chief Engineer, MHADA	



1. COURSE DETAILS

Programme: Civil Engineering	Semester: III
Course: Civil Engineering Software	Group: A
Course Code: CES190110	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
--	4	-	-	4	-	-	-	-	-	50	50	-	100

3. COURSE OBJECTIVE

This is application oriented subject which is intended to teach the students concepts, principles and procedures in computing and drafting for various civil engineering projects. Student will have awareness of various computer software related to civil engineering, use of computers for editing the drawings, use of excel for the simple repetitive calculations of tedious nature and use the computer for their project work and presentations

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- Select the proper tool for repetitive calculations of complex nature.
- Apply drafting knowledge to draw various drawings of civil engineering.
- Undertake drawing and detailing works of building project.

5. COURSE OUTCOMES (COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO 1	Prepare letters using MS Word and excel sheet for repetitive calculations and presentation of technical content in civil engineering	R,U,A
CO 2	Draw single line and double line plan of buildings in AutoCAD	R,U,A
CO 3	Select the software for intended application in civil engineering	R,U,A



6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	CO No.
1	Introduction to Computers and information technology. Recent Developments, Computer as a tool to perform various functions.	CO1
2	Various applications of computer and their uses related to Civil Engineering for example- MS Office.	CO1
3	Introduction to AutoCAD Use of Draw commands Use of Modify commands Plotting options	CO2
4	Various drawings using AutoCAD applications	CO2
5	Various software available for problems in civil engineering	CO3

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 10 no of experiments (marked with *) with approximate no of hours required and corresponding CO attained are specified here.

Sr. No	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1	*Exercise on MS word	4	CO1
2	*Exercise on MS Excel	4	CO1
3	*Exercise on PowerPoint	4	CO1
4	*AutoCAD draw commands	4	CO1
5	*AutoCAD Edit commands	4	CO1
6	*Drawing Line Plan in AutoCAD	4	CO1
7	*Developing double line plan in AutoCAD	4	CO1
8	*Developing elevation in AutoCAD	4	CO1
9	Developing sectional elevation in AutoCAD	8	CO1
10	Developing Steel Truss with exact placement of angles in AutoCAD	8	CO2
11	Developing RCC details for various RCC structural elements in AutoCAD	4	CO2
12	*Reading drawings for Municipal Approval in AutoCAD	4	CO2
13	*Introduction to various software available for problems in civil engineering	8	CO3
Total		64	



8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Slides / Presentation
3. Visits to Architect Office and Collecting drawings for reading
4. Self-Learning Online Resources



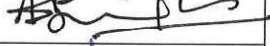

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Engineering Drawing + AutoCAD	K. Venugopal, V. Prabhu Raja	New Age International
2	AutoCAD (Civil) Self-learning AppBOOK: (Android version)	Prerana Badjate	Azuko Technical Institute and
3	AutoCAD 2019 Training Guide	Linkan Sagar/ Nisha Gupta	Online BPB Publication
4	AutoCAD 2019 For Beginners	Cadfolks	Cadfolks

10. WEB REFERENCES

1. www.nptel.ac.in
2. <https://www.autodesk.com/education/home>
3. www.swayam.gov.in

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Miss. Neelam Nagraj Petkar	
3	Internal	Shri. A. K. Singh	
4	External	Mr. Dheerajkumar Pandirkar	
		Organisation: Dy. Chief Engineer, MHADA	



1. COURSE DETAILS

Programme: Civil Engineering
Course: Airports and MRTS (Mass Rapid Transport systems)
Course Code: AMT190111

Semester: III

Group: C

Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
2	2	-	-	4	-	-	-	-	-	50	-	50	100

3. COURSE OBJECTIVE

This applied engineering course containing basic engineering knowledge about need assessment, planning, construction, operation and maintenance of airports, metro rails, mono rails, suburban rails, bullet trains, BRTS, feeder services, express ways and coastal roads to ensure safe and swift transportation of people and some important or perishable goods serving social and economic needs of contemporary society and its successors.

4. SKILL COMPETENCY

The aim of this course is to facilitate the student to attain the following competencies identified by public and private sectors through various teaching learning experiences:

- Undertake need assessment exercise for identifying transportation system for mobility of people within and from locality, town, city and region,
- Apply knowledge to participate in team's entrusted design and construction of airports and various mass rapid transportation systems.
- Differentiate between various terms and project management related activities of various MRTS projects.
- Able to undertake repair and maintenance of civil works related to airports railways, metro, mono, suburban and bullet trains, coastal roads etc.



5. COURSE OUTCOMES (COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO 1	Carry out survey work to arrive at need of airport or MRTS in city or town fully developed or under urban development	R,U,A
CO 2	Supervise construction of civil works related to airports, metro and mono rails, coastal roads and BRTS.	R,U,A
CO 3	Carry out project management activities related to airports and MRTS Projects	R.U.A
CO 4	Carry out maintenance of civil works related to airports, metro and mono rails, bullet trains, coastal roads and BRTS.	R,U,A

6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	CO No.
1	INTRODUCTION Introduction to airport engineering, development of air transport in India, Hub air ports. Recent scenario of other transport system. Need of MRTS in towns, metro and mega cities.	3	CO1
2	AIRPORT PLANNING Airport planning and design standards, selection of site , stages of development of airport, orientation of runways, length of runways, design standards, estimate of future traffic requirement.	5	CO1
3	AIRPORT REQUIREMENTS Airport terminal area and layout, terminal requirements, typical airport requirements, types of pavements, flexible, rigid and LCN system of pavement.	5	CO2
4	AIRPORT DRAINAGE Airport drainages, surface, underground, special features of airport drainage, traffic aids, marking, terminal area control, runways, lighting of runways, accidents and causes, Navigational aids, landing categories.	6	CO2
5	MRTS INTRODUCTION Metro and mono rails, BRTS, Coastal road, Concept and construction	4	CO2
6	MODES OF MRTS Project management of MRTS projects, feasibility, safety, new modes like sky walks, station traffic control systems, Linkages, Trans Harbor link, link roads, FOBs , common ticketing, point to point services, Government initiatives for private sector to participate in MRTS.	6	CO3
7	MAINTENANCE Maintenance of civil works of airports related and related to MRTS like metro, mono, BRTS, Coastal road etc.	4	CO4
	Total	32	



7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 12 no of experiments/assignments (marked with *) with approximate no of hours required and corresponding CO attained are specified here.

Sr. No.	Title of Assignments and Educational Visits	Approximate No. of Hrs required	COs
1	Over view of airports and aviation industry	2	CO1
2	Over view of mass rapid transportation systems.	2	CO 2
3	Challenges in transportation systems	2	CO 2
4	Benefits of Metro rails	2	CO 2
5	Bus Rapid transport systems	2	CO 2
6	Some characteristics of BRTS	2	CO 2
7	Increase in ridership and travel time saving	2	CO 2
8	Integration of mass rapid transit modes for sustainable development.	2	CO 2
9	Types of public transport integration and advantages of integration	2	CO 2
10	ITS- intelligent transport systems	2	CO1
11	Comparison of metro systems and BRTS	2	CO 2
12	Advantages and limitation of mono rails	2	CO 2
13	Visit to developed airport /or airport under development/or metro rail station under construction or developed one/Visit to mono rail under operation	2	CO 4
14	Case study of Airport Development at New Mumbai	2	CO 3
15	Case studies of Metro rails in Delhi and Mumbai	2	CO 3
16	Case studies of Mono rails in KL Malaysia and Mumbai	1	CO 3
17	Case study of Coastal road development in Mumbai	1	CO 2
Total		32	

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Slides / Presentation
3. Video film on development of airports in India.
4. Guest lectures by Experts
5. Visits to airports, metro stations and sites of coastal roads.
6. Self-Learning Online Resources.



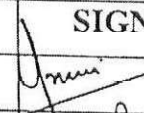
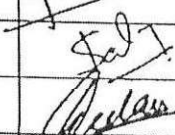
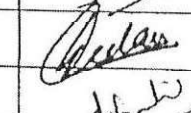

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Airport Planning and Design	S K Khanna M G Arora	Nem Chand & Bros, Roorkee 1982
2	Airport Engineering	Rangwala	Charotar Publication
3	Optimization of Mass Rapid Transit systems	Danny Tandela	Danny Tandela
4	Urban Mass transit : The Life story of a technology		Johns Hopkins University Press
5	Advanced transportation systems, analysis, modelling and evaluation of performance.	Janic and Milan	Springer books

10. WEB REFERENCES

1. <https://dl.acm.org/doi/10.1109/TITS.2002.994799>
2. <https://www.springer.com/gp/book/9780387232577>
3. <https://arxiv.org/ftp/arxiv/papers/1407/1407.0313.pdf>
4. <https://hal.archives-ouvertes.fr/hal-00728663/document>

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. V B Vanvari	
2	Internal	Smt S P Patil	
3	Internal	Ms Neelam Petkar	
4	External	Mr B R Patel	
		Organisation: Procem consultants	



1. COURSE DETAILS

Programme: Civil Engineering	Semester: III
Course: Development Control and Promotion Regulations	Group: C
Course Code: DCR 190112	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
--	3	-	-	3	-	-	-	-	-	50	-	50	100

3. COURSE OBJECTIVE

This is core subject is intended to teach the Regulations applicable to building activity and development work in areas under the entire jurisdiction of the Municipal Corporation of Greater Mumbai. With this knowledge and skill, he /she will be able to choose appropriate formats, drafting and drawing methods depending upon requirement, to carry out building activity and development work before and during execution of work, while serving as investigator for design department, supervisor on the site of work, draftsman in the drawing office.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- Select the proper format for application to start building activity and development work in entire jurisdiction of the Municipal Corporation of Greater Mumbai.
- Apply drafting knowledge to draw various drawings of civil engineering as per the requirement of DCPR 2034.

Apply various rules and regulations applicable for building activity and development work in entire jurisdiction of the Municipal Corporation of Greater Mumbai

5. COURSE OUTCOMES (COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
1.	Differentiate between various technical terms applicable in building activity and development work required to start and complete the activity.	R,U,A



2.	Apply various rules and approach the competent authority with required formats for various permissions before, during and after completion of the building activity and or development work.	R,U,A
3.	Liaison with various MCGM authorities for intended permissions.	R,U,A

6. COURSE CONTENTS

Sr No.	Topic / Sub topics	Hours	COs
1	PART- I ADMINISTRATION 1. Short title, extent and commencement 2. Definitions of Terms and Expressions, include all 129 terms 3. Applicability 4. Interpretation 5. Delegation of powers 6. Discretionary powers 7. Power to delegate 8. Amendment/modification to Appendices / Annexures	4	CO1 CO3
2	PART II DEVELOPMENT PERMISSION 9. Development permission and commencement certificate 10. Procedure for obtaining Development Permission and Commencement Certificate. 11. Procedure during Construction. 12. Inspection	4	CO1, CO2, CO3
3	PART III LAND USES AND MANNER OF DEVELOPMENT 13. Development Stipulations. 14. Amenities 15. Inclusive Housing (IH) 16. Road /Road Widening 17. (1) Development of Reserved land for Public Purposes 17. (2) Redevelopment of existing Cinema/Theater, 17. (3) Development of reserved land falling under the provisions of Regulation No.33	6	CO1, CO2
4	PART-IV REQUIREMENT OF SITE AND LAYOUT 18. Requirement of Site 19. Public Street and Means of Access 20. Alignment & Intersection of Roads 21. Highway and wider Roads 22. Access to land-locked plot 23. Internal means of access 24. Minimum Width of Pathways 25. Means of Access to be Constructed & Maintained 26. Layout/amalgamation/subdivision of plot 27. Layout/Plot Recreational Ground/Open Spaces(LOS) in Layout/Plot 28. Substation 29. Additional facilities in the Development in Large Holding/layout	6	CO1, CO2
5	PART V- FLOOR SPACE INDEX	5	119 CO1,



Sr No.	Topic / Sub topics	Hours	COs
	30. Floor Space Indices & Floor space / Built-Up Area (BUA) computation, Tenement Density and Protected Development 31. Exemption from FSI to be counted in FSI/ Fungible Compensatory Area: 32. Transfer of Development Rights (TDR)		CO2. CO3
6	PART VI ADDITIONAL FLOOR SPACE INDEX 33. Additional Floor Space Index (FSI) which may be allowed to certain categories: 33 (5), 33(7). Etc	5	CO1, CO2
7	PART VII LAND USE CLASSIFICATION AND USES PERMITTED 34. Land use Zoning & Uses Permitted 35. Development or redevelopment of lands of cotton textile mills (mills).-	4	CO1, CO2
8	PART VIII GENERAL BUILDING REQUIREMENTS 36. Occupancy Load 37. Requirements of parts of buildings 38. Special Building Design Requirement 39. Special Regulations for Differently abled persons 40. Lighting and Ventilation 41. Open Spaces within Building Plots/ Layout 42. Features permitted in open spaces 43. Height of Buildings 44. Parking Spaces 45. Restrictions on Development in certain areas- 46. Signs and Outdoor Display Structures	4	CO1, CO2, CO3
9	PART IX URBAN SAFETY REQUIREMENTS 47. Fire Protection Requirements 48. Requirements of Exits 49. Structural Safety and Services 50. Building services 57. Temporary Construction		CO3
10	INTRODUCTION TO PART X SPECIAL PROVISIONS PART – XI MISCELLANEOUS PROVISIONS PART- XII ENVIRONMENTAL SUSTAINABILITY	5	CO3
11	INTRODUCTION TO APPENDICES ANNEXURES LIST OF TABLES	5	CO3
	TOTAL	48	



7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 10 no of experiments (marked with *) with approximate no of hours required and corresponding CO attained are specified here.

Sr. No.	Title of Assignments	COs
1.	Various permissions required to be taken before submission of development permission.	CO1, CO2
2.	Format of application to these various permissions	CO1
3.	@Competent Authorities and their offices for various permissions as per DCPR 2034 section 33 @:detailed assignment is mention as attachment in Annexure-I	CO3
4.	@Preparing a development proposal under prevailing rules and regulations of DCPR 2034, visiting the concerned offices / experts in this field for deficiencies in the proposal, correcting the proposal as per comments of concerned offices / experts and submitting the proposal. @:detailed assignment is mention as attachment in Annexure-II	CO3

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Slides / Presentation
3. Visits to Office of Architect and MCGM concerned authorities.

9. LEARNING RESOURCES


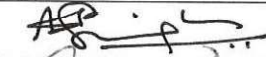
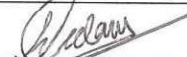


Sr. No.	Title of Book	Publication
1	Development Control and Promotion Regulations- 2034 for Greater Mumbai	MCGM, Government of Maharashtra
2	MR&TP Act, 1966	Government of Maharashtra
3	Mumbai Municipal Corporation Act, 1888	MCGM, Government of Maharashtra

10. WEB REFERENCES

1. <https://www.maharashtra.gov.in>
2. <https://www.autodesk.com/education/home>
3. <https://www.mcgm.gov.in>



11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Shri. A. K. Singh	
3	Internal	Miss. Neelam Petkar	
4	External	Architect Jaweed Ghazali Organisation:	
5	External	Bal Toraskar, Licensed Surveyor Organisation: V. B. Toraskar & Associates	



Annexure-I :

Assignment No. 3 (Course: Development Control and Promotion Regulations, DCR 190112)

- 1) Additional FSI to Religious building
- 2) Building of Medical and Educational Institutions and other Institutional Buildings covered under Regulation 2(IV)16 17(g)
- 3) Buildings of Government/MCGM/Statutory bodies, Semi-Government and PSU Offices
 - 3(A) Development/Redevelopment for construction of 243 staff quarters of Govt. or its statutory bodies (including CISF) or MCGM or its statutory bodies, on lands belonging to such Public Authorities
 - 3(B) Development/Redevelopment for construction of 245 staff quarters of Govt. or its statutory bodies (including CISF) or Municipal Corporation of Greater Mumbai or its statutory bodies on private lands
- 4) Building of Residential Hotels on independent plot
- 5) Development/Redevelopment of Housing Schemes of Maharashtra Housing & Area Development Authority (MHADA)
- 6) Reconstruction of buildings destroyed by fire or which have collapsed or which have been demolished under lawful order
- 7) Reconstruction or redevelopment of cessed buildings in the Island City by Co-operative Housing Societies or of old buildings belonging to the Corporation
 - 7(A) Reconstruction or redevelopment of Dilapidated/ unsafe existing authorized tenant occupied building in Suburbs and extended Suburbs and existing authorized non-cessed tenant occupied buildings in Mumbai City.
 - 7(B) Additional FSI for Redevelopment of existing residential housing societies excluding cessed buildings
- 8) Construction of Affordable Housing in Special Development Zone II (SDZ)
- 9) Reconstruction or redevelopment of Cluster(s) of Buildings under Urban Renewal Cluster Development Scheme(s)(CDS)
 - (A) Regulations for Dharavi Notified Area (DNA) 181
 - (B) Reconstruction or redevelopment of Cluster of BDD chawls at Naigaon, Worli, N.M. Joshi Marg and Shivdi under Urban Renewal Scheme(s).
- 10) Redevelopment for Rehabilitation of Slum Dwellers
 - (A) Slum Rehabilitation Scheme under within Dharavi Notified Area (DNA) for Dharavi Redevelopment Project (DRP)
- 11) Provisions relating to Permanent Transit Camp tenements for Slum Rehabilitation Scheme/Rental housing



- 12) Redevelopment of contravening structures included in the Final Plot of a Town Planning (TP) Scheme and Removal and re-accommodation of tolerated/protected structures falling in the alignment of road.
 - A. Redevelopment of contravening structures included in the Final Plot of a TP Scheme.
 - B. Removal and re-accommodation of tolerated /protected structures falling in the alignment of road
- 13) Buildings of Information Technology Establishments
 - (13) (A) Buildings of Smart Fin Tech Centre
- 14) Shifting of cattle sheds outside Greater Mumbai
- 15) Development of land earmarked for the MHADA/Mill Workers Housing under Regulation No 35
- 16) Reconstruction/Redevelopment in Gaothan / Koliwada / Adivasipada area
- 17) Buildings of Biotechnology Establishments
- 18) Development of Multi Storey Public Parking Lots (PPL)
- 19) Additional FSI for Commercial user development in Central Business District (CBD) or plot situated in Residential or Commercial Zone
- 20) Affordable Housing (AH) / Rehabilitation & Resettlement (R & R)
- 21) Development and Redevelopment of Municipal Market/ Public Amenities by MCGM/Government.
 - (A) Development and Redevelopment of Municipal Market
 - (B) Public Amenities by MCGM/Government
- 22) Regulation for Exhibition-cum-Convention Centres in MCGM Area
- 23) Transit oriented development



Annexure-II:

Assignment No. 4 (Course: Development Control and Promotion Regulations, DCR 190112)

- 1) Appointment from Client as an Architect or License Surveyor as per the format.
- 2) Form 337 – BMC Act
- 3) For, 44-69 – M.R.T&P Act.
- 4) P.R. Card and Property Extract.
- 5) D.R Remark 2034
- 6) Title Certificate from Solicitor or Lawyers 10 years in practise supported by SANAT.
- 7) M.R. (Mozani Record from City Survey Office from the tehsil.
- 8) Area on P.R.Card or existing area surveyed by City Survey office whichever is Less.
- 9) Check the density permissible 450 tenants per 10,000 Sq. SMts.
- 10) Check if any reservation partly affected by road set back or any reservation.
- 11) If any reservation then that will be deducted from the Plot area and the FSI permissible will be on net plot area including the permissible TDR and govt. FSI, which will be deducted from the TDR permissible.
- 12) Check the FSI permissible as per the road width from Table 20 of DCPR 30.
- 13) Open Spaces as per FSI, and the later on after the TDR is loaded then there will be deficiency which has to be calculate to pay premium, the deficiency is as per the height for Light and Ventilation H/5, for plot are less than 1000 Sq. Mts. And H/4, for Plot area more than 1000 Sq. Mts , and further more condition to be added to it.
- 14) Calculate Staircase, Lift and lift lobby to make it free by paying Premium as per the sketch enclosed (to be enclosed).
- 15) Prepare the plans for full potency as per the FSI permissible as per Road Width (Base FSI+TDR+Fungible),
- 16) Submit for CFO NOC.
- 17) Submit For EE&TC NOC.
- 18) Submit the file to MC for required Concession through Dy Chief Engineer of Respective Zone thorough Online,
- 19) After Receiving the Concession from MC. Submit the file to obtain IOD (Intimation of Disapproval). Obtain NOC from concern other MCGM departments, SWM, Hudralic, Water Sewerage, SWD, Assessment ETC.
- 20) Appointment of RCC consultant, License Plumber and Site Supervisor.
- 21) Submit the plans along with NOC for one FSI for CC Construction Commencement for Zero FSI up till Plinth or Stilt or podium.
- 22) Check the Plinth, stilt or Podium after completion.
- 23) Submit the plans for amendment for further consumption of FSI available (Base FSI+TDR+Fungible).



- 24) Fulfil the conditions issued after the plans are approved including the necessary payments.
- 25) Certain payments can be made as differ payment which is for four years along with interest charged on yearly base as reducing balance (Note The rate of interest might change time to time).
- 26) In case if differ payment is opted then 10% of the FSI area sanction will be restricted in FCC or the entire last floor.
- 27) The amended plan can be done in Phase wise also 1) Base FSI+Fungible, 2) Govt TDR+Fungible. And 3) TDR+Fungible, the above processes will have to repeated that no of times e.i. amended plans, conditions and issue of FCC.
- 28) After completion of the entire building collect NOC from all respective departments



1. COURSE DETAILS

Programme: Civil Engineering	Semester: IV
Course: #Environmental Engineering	Group: A*
Course Code: ENV190113	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	03	70	20	10	70	50	50	-	200

3. COURSE OBJECTIVE

This is application-oriented subject which is intended to teach the students core facts, concepts, principles and procedures in water and waste engineering. With this knowledge and skill, he / she will be able to analyze the characteristics of raw water, decide upon the line of treatment to be given for particular source of water. Similarly, he / she will be able to know the operational troubles in various treatment units and could be able operate and maintain the different units of treatment for water and waste water.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified

Competency through various teaching learning experiences:

- Apply principles of sedimentation for water and waste water treatment
- Apply principles of Filtration for water and waste water treatment
- Analyze the operational troubles in different units.
- Differentiate between various systems of plumbing and distribution for water and waste water.



5. COURSE OUTCOMES(COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO1	Analyze characteristics of water and waste water.	R, U, A
C02	Work out the different demands of water required to be supplied while planning a water treatment plant and the quantity of waste water while planning a sewage treatment plant.	R, U, A
C03	Analyze the working, operational problems and maintain different component of water and waste water treatment plants.	U, A
C04	Decide the suitable treatment to be given to the raw water and waste water based on the characteristics.	R, U, A

R-Remember, U-Understand, A-Apply and above (Bloom's revised taxonomy levels)

6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
1	Introduction to water treatment 1.1 Importance and necessity for Planned Water Supply scheme. 1.2 Planning, execution and pricing of Municipal Water Supplies	01	03	CO1
2	Demand of Water 2.1 Various types of water demands 2.2 Per Capita Demand, Factors affecting per capita demand, Variations in demand, Design periods, Population forecasting and methods of population forecasting, Arithmetic Mean, Geometric Mean, Incremental Increase, Decrease rate of growth, Simple graphical, comparative graphical, Master plan or Zoning and apportionment method.	04	06	CO2
3	Sources of water 3.1 Surface, subsurface sources 3.2 Intakes, Definition, factors governing location of an intake 3.3 wet intake tower, dry intake tower, River intake, Canal Intake, etc	03	04	CO1
4	Quality of Water 4.1 Characteristics of Water: physical, chemical and biological. 4.2 Physical characteristic, Turbidity, color, taste and odours, Temperature and specific conductivity, their determination and significance. 4.3 Chemical Characteristic, Total solids and suspended solids, pH value, Hardness', Chloride content, Nitrogen content, Metal and other substances, Dissolved gases, BOD and their determination 4.4 Biological Characteristics, Aerobic, anaerobic and facultative bacteria's, Pathogens and non-pathogens,	06	06	CO3



	Coliforms, E-coli, MPN and their methods of determining. 4.5 Quality standards for Municipal Water Supplies.			
5	Treatment of water 5.1 Screenings, Coarse and fine screens 5.2 Plain Sedimentation, Theory of Sedimentation, Sedimentation tanks, Horizontal Flow, Vertical Flow 5.3 Sedimentation Aided with Coagulation, Chemicals used for coagulation and their comparison, Coagulation sedimentation plant 5.4 Filtration, theory of filtration, Filter materials Slow sand filters, Construction, Operation and Cleaning, Rate of filtration, Efficiency and performance, Rapid Gravity filters, Construction, Working and Cleaning, Back washing, Operational Troubles in Rapid Gravity filters like formation of mud balls, Cracking of filters etc, rate of filtration, Efficiency and performance, Comparison of Slow and Rapid sand filters 5.5 Disinfection: Chlorination, Doses of chlorine, Types of Chlorination, Pre, post, Double, Break point, Super, and De-chlorination.	8	9	CO3, CO4
6	Distribution System 6.1 Necessity, Requirements of good distribution system 6.2 Layouts of Distribution System, Dead End system, Grid Iron system, Ring system, Radial system. 6.3 Methods of Distribution of Water, Gravitational System, Pumping System, pressure in the distribution system 6.4 Distribution Reservoirs, Surface, Elevated, Stand Pipes	4	6	CO3
7	Introduction to sanitation 7.1 Sanitation, importance of sanitation, principles of sanitation 7.2 Systems of Sanitation 7.3 Types of Sewerage Systems 7.4 Components of a sewerage system 7.5 Estimation of Design sewage discharge	4	4	CO1
8	Sewers: Construction, Maintenance and required Appurtenances 8.1 Construction of sewers, materials of sewers, shapes of sewers, joints in sewers, laying and testing of sewers ventilation of sewers, cleaning and maintenance of sewers, surface drains. (No numerical on design of sewers) 8.2 Appurtenances: Catch basins and clean outs, drop manholes, flushing tanks, grease and oil traps, Types of traps, Flushing cisterns, Inlets, inverted siphon, lamp holes, manholes,	6	8	CO3
9	Sewage Collection from houses and buildings 9.1 Traps, classification of traps, Requirements of good traps,	4	4	CO1



	9.2 System of Plumbing, single stack, one pipe, two pipe, one pipe partially ventilated. 9.3 Wastewater Recycling in Buildings			
10	Characteristics of Sewage: 10.1 Physical tests like colour, taste and odour, temperature, turbidity 10.2 Chemical tests like chlorine, fats grease and oil, nitrogen, oxygen, pH value, total solids, 10.3 Bacteriological tests	6	6	CO3
11	Treatment of sewage 11.1 Primary treatment, screening, disposal of screenings, grit chambers, detritus tank, plain sedimentation tanks, classification of sedimentation tanks 11.2 Secondary treatment: Trickling Filters, Activated Sludge process, Rotating Biological Contractors, oxidation ponds, Aerated Lagoons 11.3 Anaerobic stabilization Units: Septic tanks, Imhoff tanks, Clari-digesters 11.4 Chlorination of sewage	8	8	CO4
12	Disposing of the Sewage effluents, Sludge Digestion and sludge Disposal 12.1 Disposal by dilution-Conditions favoring disposal by dilution, Self-purification of streams, Standards of dilution for discharge of wastewater into rivers 12.2 Disposal in land: Disposal of sewage effluent on land for irrigation, Quality standards for wastewater effluents to be discharged on land for irrigation, Effluent irrigation and sewage farming, sewage sickness 12.1 Sludge and its moisture content 12.2 Stages in Sludge digestion Process 12.3 Sludge Digested tanks or digestors 12.4 Disposal of digested sludge	10	6	CO3
	TOTAL	64	70	

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing **minimum 06 no of experiments** and sketch book with sketches (marked with *) with approximate no of hours required and corresponding CO attained are specified here.

Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1.	*Determination of pH of water sample	01	CO1
2.	*Determination of Turbidity of water sample by Nephelometric turbidity meter	01	CO1
3.	*Determination of Hardness of water sample by EDTA method	01	CO1
4.	*Determination of Chloride content by Mohr's Method (Precipitation / Argentometric Titration)	01	CO1
5.	Determination of Chloride content by Chloride Kit	01	CO1



Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
6.	Determination of Bio-chemical Oxygen Demand of water sample.	02	CO1, CO3
7.	*Methods of water sampling	01	CO1, CO3
8.	*Determination of optimum dosage of Coagulant by Jar Test Method	01	CO1, CO3
9.	Determination of Total Solids in water sample	01	CO3
10.	Study of spectrometer for calibration of different impurities and analysing various characteristics of water.	01	CO4
	*SKETCH BOOK		
11.	1. *Flow chart of municipal water treatment plant	01	CO1
12.	2. *Intakes structures... (River Intake, Canal Intake, Reservoir Intake)	01	CO3
13.	3. Rectangular Sedimentation Tanks	01	CO3
14.	4. *Circular Sedimentation Tanks		CO3
15.	5. Slow Sand Filter	02	CO3
16.	6. *Rapid Sand Filter		CO3
17.	7. *Distribution System Radial System, Grid Iron System, Circular / Ring System, Dead End / Tree System	01	CO3
18.	8. *Plumbing Fittings	01	CO3
19.	9. Flow Chart of waste water treatment plant	01	CO3
20.	10. Different types and shapes of sewers		CO3
21.	11. *Systems of PlumbingSingle stack, One Pipe, Two Pipe	02	CO3
22.	12. *Trickling Filters	02	CO3
23.	13. *Septic Tank		CO3
24.	14. Imhoff Tank		CO3
25.	15. Oxidation pond	01	CO3
26.	16. *Visit Report on water treatment plant	05	CO1, CO2, CO3, CO4
27.	17. Visit report on sewage water treatment plant.	05	CO1, CO2, CO3, CO4
Total		32	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical/Sketches
2. Minimum no. of practical/Sketches etc.
3. Visit to Water and waste water treatment plant
4. Slides / Presentation
5. Group discussions for practical assignments
6. Self-Learning Online Resources



9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Water Supply & Sanitary Engineering	S.K. Garg	Khanna Publisher New Delhi
2	Water Supply & Sanitary Engineering	Gharpure V.N	Engg. Books Pub. Co. Pune
3	Environment Engineering Systems	Deodhar/ Pachauri/ Gokhale	Vrinda Publication Jalgaon
4	Elements of Environmental Engineering	K. N. Duggal	S.Chand & Co. New Delhi

10. WEB REFERENCES

1. <https://www.nptel.ac.in/courses/105104102/>
2. <http://www.nptelvideos.in/2012/11/water-wastewater-engineering.html>
3. <http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html>
4. <https://www.britannica.com/technology/wastewater-treatment>

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	Introduction to water treatment	3	-	-	3
2.	Demand of Water	2	4	-	6
3.	Sources of water	2	2	-	4
4.	Quality of water	-	3	3	6
5.	Treatment of water	2	2	5	9
6.	Distribution of water	-	2	4	6
7.	Introduction to sanitation	4	-	-	4
8.	Sewers: Construction, Maintenance and required Appurtenances	-	2	6	8
9.	Sewage Collection from houses and buildings	-	2	2	4
10.	Characteristics of sewage	2	4	-	6
11.	Treatment of sewage	-	4	4	8
12.	Disposing of the Sewage effluents, Sludge Digestion and sludge Disposal	-	2	4	6
	Total	15	27	28	70

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.



12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Mrs. Supriya Prasad Patil	
3	Internal	Miss. Neelam Nagraj Petkar	
4	External	Ms. Ashwini Wahgmare	
		Organisation:	Faculty S. H. Jondhale Polytechnic, Dombivali



1. COURSE DETAILS

Program: Civil Engineering	Semester: IV
Course: Design Practice of Steel Structures	Group: A*
Course Code: DPS190114	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per week					Examination Scheme and Maximum Marks								
Theory Hrs (L)	Practical Hrs (P)	Drawing Hrs (D)	Tutorial Hrs (T)	Credits (L+ P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	Total
					Hours	Marks							
3	-	3	-	6	04	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

To impart basic design concepts in steel structures and the use of standard structural steel sections with latest design specifications confirming to Bureau of Indian Standard. To practice the design of structural components and generating drawings of the assemblies.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Identify the tension and compression members in steel structures.
- Analyze the difference between bolted and welded connection
- Analyze the different loads coming on steel structural frames / truss.

5. COURSE OUTCOMES (COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO1	Design bolted and welded connections for tension and compression member as per IS 800:2007	R, U, A
CO2	Design beam, column and column base	R, U, A
CO3	Analyze the loads and Design roof truss as per IS 875	R, U, A

R-Remember, U-Understand, A-Apply and above (Bloom's revised taxonomy levels)



6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics	Hours	Marks	COs
1	Introduction to IS: 800 – 2007 1.1 Structural steel and properties of structural steel 1.2 Design philosophy, comparison of working stress & Limit state method. 1.3 Limit state of strength and serviceability 1.4 Load action, load combinations and design strength 1.5 Partial safety factor for materials	4	6	CO1 / CO3
2	Bolted Connections 2.1 Classification of bolts 2.2 Explain terms: Pitch of bolts, gauge distance, edge distance, end distance & tacking fasteners. 2.3 IS: 800 – 2007 Provisions for clearance for holes, spacing, edge and end distance & tacking fasteners. 2.4 Type of bolted joints and failures of bolted joint. 2.5 Design strength of bolt and efficiency of joints.	8	12	CO1 / CO3
3	Welded Joints 3.1 Types of Welds & Joints 3.2 Advantages and disadvantages of welded joints. 3.3 Strength of welds & joint, failure types of Welded Joints. 3.4 Design strength & Design of Welded joints for axially loaded members	6	8	CO1 / CO3
4	Tension member 4.1 Standard Sections used as a tension member 4.2 Design Strength of a tension member -Design Strength due to yielding of gross section -Design Strength due to rupture of critical section -Design Strength due to block shear 4.3 Design strength of members 4.4 Design of tension members for angle sections	8	12	CO1 / CO3
5	Compression member 5.1 Slender sections used as compression member 5.2 Buckling class of cross section 5.3 Effective length and slenderness ratio 5.4 Design compressive stress and strength 5.5 Design strength & Design of strut 5.6 Design of simple column and built-up column 5.7 Lacing & Battening, necessity and use (No design)	8	12	CO2 CO3



6	Column Bases 6.1 Types of column bases 6.2 Design of slab base 6.3 Gusseted base sketch, meaning & purpose (no design)	4	8	CO1 CO2
7	Beam 7.1 Classification of cross section 7.2 Laterally supported beam -Strength of beam in flexure -Strength of beam in shear -Deflection limits 7.3 Design of laterally supported beam 7.4 Beam end connections (framed & unstiffened seated connections only) 7.5 Introduction to Orientation of Pre-Engineering section (no questions to be asked in exam)	10	12	CO1 CO2
TOTAL		48	70	

Use of I.S. Codes (IS:800-2007 and IS:875-1987), Specifications, tables and handbooks to be explained to the students to make them conversant with their use and to enable them to use at the time of examination.

7. LIST OF DRAWINGS & SKETCHES

Term work consists of following drawing sheets and sketches with approximate number of hours required and corresponding COs as mentioned below.

- **Minimum 10 sketches and all the sheets to be included in term work**

Sr. No.	Title of Sheets / Sketches	Approx. Hrs required	Cos
1.	Load Analysis of Roof Truss (Sheet) (IS 875 : 1987) -Load on roof truss <ul style="list-style-type: none"> • Dead load • Impose load • Wind load • Load combinations Purlin Spacing as per strength of roof covering material -Load per panel point for DL, LL, WL -Member forces of truss graphically -Design each member of truss and check for reversal of stress -Design of joints & Purlins (Angle Purlin)	10	CO3
2.	Design of Members of Roof Truss (Sheet) -Design of Tension and Compression member	10	CO3 CO1



Sr. No.	Title of Sheets / Sketches	Approx. Hrs required	Cos
	-Drawing details of joints		
3.	Design of Framed Connection (Design of Beam and Column) Design & detailing of Beam and Column	10	CO2
LIST OF SKETCHES			
4.	Bolts – symbols	1	CO1
5.	Various dimensions of bolts, screw nuts & lock nuts	1	CO1
6.	C/s of Bolt, nut and washers assembly	1	CO1
7.	Basic types of Welds and their symbol	1	CO1
8.	C/s of Butt weld & Fillet weld	1	CO1
9.	Different types of Standard sections used as Structural Steel Sections, pre-engineering sections	1	CO1
10.	Plate Girder	2	CO2
11.	Laced Columns	1	CO2
12.	Battened Columns	1	CO2
13.	Slab base	1	CO2
15.	Gusset base	1	CO2
16.	Beam to Beam connection when flanges at same level	4	CO2
17.	Beam to Beam connection when flanges are not at same level		CO2
18.	Beam to Column connection		CO2
19.	Components of Steel Roof Truss	1	CO3
20.	Details of Roof Truss	1	CO3
TOTAL		48	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Tutorials
2. Self-Learning Online Resources
3. Slides / Presentations
4. Group discussions for practical assignments
5. Site visit for various steel connections



9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1.	Limit state Design of Steel Structures	S. K. Duggal	Tata McGraw Hill Publishers.
2.	Design of Steel Structures	S. S. Bhavikatti	I K Int. Publishing
3.	Limit State Design of Steel	Dr. V. L. Shah & Veena Gaur	Structures Publishers, Pune
4	Design of Steel Structures	N. Subramaniam	Oxford Publishers
5	Design of Steel Structures	K. S. Sai Ram	Pearson Publishers
6	Design of Steel Structures	R. R. Gadpal	Nirali Prakashan

10. WEB REFERENCES

- 1.www.nptel.ac.in
- 2.www.discovery for engineers.com
- 3.www.swayam.gov.in

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	CHAPTER	Distribution of Theory Marks			
		R Level	U Level	A LEVEL	Total Marks
1.	Introduction to IS 800:2007	3	3	-	6
2.	Bolted Connection	3	4	5	12
3.	Welded Connection	2	3	3	8
4.	Tension Member	3	4	5	12
5.	Compression Member	3	4	5	12
6.	Column Bases	2	3	3	8
7.	Beam	3	4	5	12
TOTAL		19	25	26	70

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)


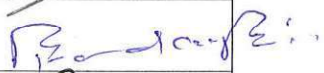
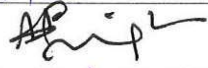
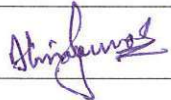
NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of Cos. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.



12. QUESTION PAPER PATTERN

Ques No.	End Sem Exam		Periodical Test Exam	
	Bits	Marks	Bits	Marks
1	Any 3 out of 5 (5 Marks each)	15	Any 1 out of 2	04
2	Any 2 out of 3 (10 Marks each)	10	Any 2 out of 3	16
3	Any 3 out of 5 (5 Marks each)	15	Total	20
4	Any 2 out of 3 (10 Marks each)	10		
	Total	70		

13. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Ms. Neelam N. Petkar	
2	Internal	Mr. K.P. Jayateerth	
3	Internal	Mr. A. K. Singh	
4	External	Mr. Dheerajkumar S. Pandirkar	
		Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	



1. COURSE DETAILS:

Program: Civil Engineering	Semester: IV
Course: Mechanics of Structures	Group: C*
Course Code: MOS190115	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per week					Theory Paper Duration and Marks (ESE)		Scheme of Examination and Maximum Marks						
L	P	D	T	Cr (L+P+D+T)	Hrs	Mks	SSL	TA	TH	TW	PR	OR	Total
4	-	-	-	4	3	70	20	10	70	-	-	-	100

3. COURSE OBJECTIVE

This is compulsory course which is intended to teach the students principles of elastic structural analysis and behavior of indeterminate structural elements, various methods involved in the analysis of indeterminate structural elements, behavior of real-life structures behave and methods to calculate slope and deflection as well as force and moments in statically determinate structural elements.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- Analysis of various structural elements like frames, beams, columns, retaining structures, etc., under the loaded condition.

5. COURSE OUTCOMES (COs)

After completion of semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
CO1	Analyze the structure for Flexure, shear, deflection, etc.	U, A
CO2	Calculate the internal forces in pin jointed frames / trusses	U, A
CO3	Analyze the stability conditions of water and earth retaining structures.	U, A
CO4	Analyze columns and struts.	R, U, A
CO5	Compare and distinguish between elastic and plastic (inelastic) methods of analysis in structures.	R, U, A

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)



6. DETAILED CONTENT:

Sr. No.	Topic / Sub Topic	Hours	Marks	COs
1	<p>1.0 Columns & Struts</p> <p>1.1 Definition, types of end conditions for column, classification of column,</p> <p>1.2 Buckling of axially loaded compression member, effective length, radius of gyration, slenderness ratio</p> <p>1.3 Euler's theory, assumptions, buckling load, Rankine's Formula, factor of safety, safe load on columns, built up columns, application of Eulers's and Rankine formulae, designing solid circular or hollow circular sections</p>	8	8	CO4
2	<p>2.0 Stresses in plane (pin jointed) frames</p> <p>2.1 Introduction, Types of frames, perfect and imperfect frames, relation between joint and member, condition for perfect frame.</p> <p>2.2 Analysis for Forces in perfect frames</p> <p>2.3 Method of joints, Methods of sections. Graphical method</p>	8	8	CO2
3	<p>3.0 Dams and Retaining Walls:</p> <p>Water retaining structures:</p> <p>3.1 Rectangular dams. Trapezoidal dams having water face vertical as well as battered.</p> <p>3.2 Stability conditions of a dam section</p> <p>3.3 Minimum base width of a dam. Maximum height of a dam.</p> <p>Earth retaining masonry structures:</p> <p>3.4 Application only of Rankine's theory of earth pressure. Active and passive earth pressure.</p> <p>3.5 With earth retaining face vertical or battered. (No surcharge to be considered in all these cases).</p> <p>3.6 Stability conditions of retaining walls.</p> <p>3.7 Minimum depth of foundation by Rankine's theory.</p>	8	10	CO3
4	<p>4.0 Plastic Theory:</p> <p>4.1 Introduction to advanced developments in 'Structural Engineering analyses such as plastic theory, Limit design.</p> <p>4.2 Elastic load and Collapse load, Yield(collapse) stress distribution across the section, formation of plastic hinge, load factor, plastic moment in a section,</p> <p>4.3 Equal area axis, plastic section modulus, shape factor of sections used in structures.</p> <p>4.4 Application of plastic theory to simply supported beams, propped cantilevers, fixed beams, simple problems.</p>	8	8	CO5



Sr. No.	Topic / Sub Topic	Hours	Marks	COs
5	5.0 Slope and deflection: 5.1 Introduction, Relation between slope, deflection and radius of curvature. Slope and deflection at a point in a simply supported and cantilever beams. 5.2 Macaulay's method for combination of loads in beams. 5.3 Moment area method for slope and deflection.	6	8	CO1
6	6.0 Fixed beams: 6.1 Introduction, Advantages of fixed beams. 6.2 Fixed end moments for fixed beam with (a) point load, (b) UDL over whole / partial span, (c) Combination of loads. 6.3 Bending moment and Shear force diagrams 6.4 Application to R.C.C. beams.	8	8	CO1
7	7.0 Continuous beams: 7.1 Introduction, Clapeyron's theorem of three moments (derivation is excluded). 7.2 Application of theorem to continuous beams for combination of loads with a) simply supported ends b) fixed end supports c) end span overhanging. 7.3 Bending moment and Shear force diagrams	8	10	CO1
8	8.0 Moment Distribution Method: 8.1 Introduction. Sign conventions, Carry over factor, Stiffness factor and Distribution factor. 8.2 Application of moment distribution method to various types of Continuous beams, Bending moment and Shear force diagrams. 8.3 Application to the symmetrical non-sway single storey single bay portal frames, Bending moment diagram.	10	10	CO1
Total		64	70	

7. IMPLEMENTATION STRATEGY (PLANNING):

1. Teaching Plan
2. Assignments
3. Online self-learning videos

8. REFERENCE BOOKS:

Sr. No	Author	Title	Publisher & Address.
1	R.S. Khurmi	Theory of Structures	S.Chand & Co. New Delhi
2	Vazirani & Ratwani	Analysis of Structures Vol. II	Khanna Publishers New Delhi
3	S. B. Junnerkar & Advi	Mechanics of Structures	Charotar Pub. House
4	S. Ramamrutam	Theory of Structures	Dhanpat Rai Publishing New Delhi
5	C.S. Reddy	Basic Structural Analysis	Tata McGraw Hill.
6	Bhavikatti S.S.;	Structural Analysis Volume-I and Volume II;	Vikas Publications



9. WEB REFERENCES

- nptel.ac.in/courses/112107146/lects%20&%20pics/.../lecture30%20and%2031.htm
- www.nptel.ac.in/courses/105101085/downloads/lec-32.pdf
- https://en.wikipedia.org/wiki/Theorem_of_three_moments
- https://en.wikipedia.org/wiki/Moment_distribution_method
- www.mathalino.com/reviewer/engineering.../method-sections-analysis-simple-trusses



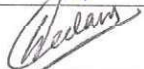
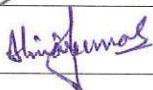
10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Columns & Struts	2	2	4	8
2	Stresses in plane (pin jointed) frames	-	2	6	8
3	Dams and Retaining Walls:	-	2	8	10
4	Plastic Theory :	2	2	4	8
5	Slope and deflection :	-	2	6	8
6	Fixed beams :	-	2	6	8
7	Continuous beams :	-	2	8	10
8	Moment Distribution Method	-	2	8	10
	Total	4	16	50	70

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Atulya Kumar Singh	
2	Internal	Shri Jayateerth K.P.	
3	Internal	Ms. Neelam Petkar	
4	External	Mr. Dheerajkumar S. Pandirkar	
		Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	



1. COURSE DETAILS

Program: Civil Engineering
Course: Concrete Technology
Course Code: CTH190116

Semester: IV
Group: A*
Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	2	-	-	5	03	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

Concrete is the most widely used construction material in the world. Concretes therefore have a much wider range of structural applications, including pavements, footings, pipes, unit masonry, floor slabs, beams, columns, walls, dams, and tanks. The course content mainly focusses on important properties of concrete, various tests on concrete and governing design of a concrete mix. It will also provide knowledge of concrete materials like cement, aggregates, water.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competencies through various teaching learning experiences:

- Use relevant types of concrete in different site conditions
- Develop supervisory skills in all concreting operations

5. COURSE OUTCOMES(COs)

At the end of the semester student will be able to :-

CO No.	COURSE OUTCOME	Bloom's Level
CO1.	Determine the properties of concrete ingredients i.e. cement, sand, coarse aggregate, admixtures by conducting different tests.	R,U
CO2.	Carry out field and laboratory tests on concrete in plastic and hardened stage & various concrete operations like batching, mixing etc.	U,A
CO3.	Design economic mix proportion for different exposure conditions and purposes	R,U,
CO4.	Supervise various concreting operations.	A

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)



6. COURSE CONTENT

Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
1	<p>Properties of Cement:</p> <p>1.1 Physical properties of Ordinary Portland cement (OPC), determination and test on OPC, Hydration of cement, physical properties of cement – fineness, standard consistency, initial & final setting times, compressive strength & soundness, different grades of opc 33, 43, 53 & their specification of physical properties as per relevant I. S. codes. Adulteration of cement (field test), storing cement at site, effect of storage of cement on properties of cement / concrete.</p> <p>1.2 Types of Cement, Physical properties, specifications as per relevant IS codes & field application of the following types of cement</p> <p>i) Rapid hardening cement</p> <p>ii) Low heat cement</p> <p>iii) Pozzolana Portland cement</p> <p>iv) Sulphate resisting cement</p> <p>vi) Blast furnace slag cement</p> <p>vii) White cement</p>	4	8	CO1
2	<p>Properties of Aggregates:</p> <p>2.1 Properties of fine aggregates: Concept of size, shape, surface texture, strength, specific gravity, bulk density, water absorption, surface moisture, soundness, bulking impurities</p> <p>2.2 Determination of fineness modulus & grading zone of sand by sieve analysis, determination of silt content in sand & their specification as per IS 383</p> <p>2.3 Bulking of sand, phenomenon of bulking, its effect on concrete mix proportion.</p> <p>2.4 Properties of coarse aggregates: Concept of size, shape, surface texture, water absorption, soundness, specific gravity & bulk density</p> <p>2.5 Determination of fineness modulus of coarse aggregate by sieve analysis, grading of Coarse Aggregates aggregate and their specification.</p>	6	8	CO1
3	<p>Admixtures</p> <p>3.1 Different types of admixtures, Chemical admixtures: Accelerators, retarders, air entraining agents, Mineral additives</p> <p>3.2 Effect of admixtures on concrete</p>	4	4	CO1
4	<p>Properties of Fresh concrete:</p>	4	6	CO2



Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
	4.1 Workability, Factors affecting workability, 4.2 Measurement of workability: Slump test and types of slump, Compaction factor test, Flow test, Flow table test, Vee-Bee consistometer Test, 4.3 Segregation, Bleeding, Temperature of concrete.			
5	Properties of hardened concrete 5.1 Compressive strength, durability, impermeability, 5.2 Elastic properties of concrete, modulus of elasticity of concrete. Creep, factors affecting creep, shrinkage, factors affecting shrinkage	4	6	CO2
6	Water cement ratio 6.1 Definition of w/c ratio, Duff Abraham w/c law, significance of w/c ratio, 6.2 selection of w/c ratio for different grades of concrete prepared from different grades of OPC as per graphs specified in IS 10262 -1982, 6.3 maximum w/c ratio for different grades of concrete for different exposure conditions.	4	8	CO2, CO3
7	Manufacturing of concrete: 7.1 Manufacturing process of concrete: Batching: Weigh batching and volumetric batching, Quantity estimate of materials, Mixing: Hand mixing and machine mixing, transporting, Pumping, Selection of pump, Placing, Compacting, Types and use of vibrators, Over-vibration, Revibration. 7.2 Curing, Curing methods, Finishing of concrete 7.3 Ready mix concrete (RMC)	6	8	CO2
8	Concrete mix design 8.1 Objectives of mix design, list of different method of mix design, study of mix design procedure by I.S. method as per I.S. 10262- 1982, determination of design mix proportion by mass for grade below M30 of concrete using I.S. Method for given data (such as grading zone of sand, proportion of 20 mm & 10 mm metals, specific gravities of cement, sand & aggregate , water absorption of sand & aggregate, compacting factor and exposure condition). 8.2 Testing of concrete Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation & co-relation of test results	8	10	CO2



Sr. No.	Topic / Sub-topics	Hours	Marks	CO No.
	8.3 Non- destructive testing of concrete Importance of NDT, methods of NDT - rebound hammer test & ultrasonic pulse velocity test, working principle of rebound hammer and factor affecting the rebound index, specification for deciding the quality of concrete by ultrasonic pulse velocity as per I.S. 13311 (part 1 & 2). Determination of rebound index & compressive strength of concrete by rebound hammer test as per I.S. 13311, determination of quality of concrete by ultrasonic pulse velocity test			
9	Properties of Special Concrete: 9.1 Properties, Advantages & Limitation of the following types of Special concrete 9.2 i) Reinforced Concrete ii) Prestressed Concrete iii) Fiber Reinforced Concrete iv) Precast Concrete vi) High performance Concrete, vii) Self Compacting Concrete	4	6	CO2
10	Miscellaneous: - 10.1 Formwork - materials, types of formwork, requirements of good formwork, erection and removal of formwork, formwork for different structural components like slabs, beams, columns, and foundations. 10.2 Joints in concrete - joining of old and new concrete, method of joining.	4	6	CO4
	TOTAL	48	70	

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 12 no of experiments

Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1.	Conduct Slump Cone Test	2	CO2
2.	Conduct Compaction Factor Test	2	CO2
3.	To study the effect of water- cement ratio on strength of concrete.	2	CO2, CO3
4.	To study the effect of compaction.	2	CO2
5.	To study the effect of Curing on concrete	2	CO2
6.	To study effect of Various Admixtures on concrete.	2	CO2
7.	Effect of specimen size on compressive strength	4	CO2
8.	Fineness modulus of coarse and fine aggregates	2	CO2
9.	Dry Loose Bulk Density	2	CO1,



Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
			CO2
10.	Specific Gravity of Fine and Coarse Aggregate	2	CO1
11.	Concrete mix design by I.S. guideline method	4	CO3
12.	Rebound hammer test	2	CO3
13.	Ultra-sonic Pulse Velocity Test	2	CO3
14.	Core Test (demonstration)	2	CO3
15.	Concrete Cube Test	2	CO3
16.	Sketch book (minimum 6 plates) on formwork	2	CO3, CO4
	Total	36	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical
2. Minimum no. of practical/sketches etc.
3. Slides / Presentation
4. Group discussions for practical assignments
5. Self-Learning Online Resources

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Concrete Technology	M. L. Gambhir	Tata Mc Graw. Hill Publishing Co. Ltd. New Delhi
2	Concrete Technology	A. M. Neyille & J J Brooks	Pearson Education (Singapore) Pvt. Ltd. New Delhi
3	Concrete Technology	M. S. Shetty	S. Chand Publication
4	Concrete Technology	P. D. Kulkarni	M. H. Ghosh and Phull publication
5	Laboratory Manual for concrete Technology	T.T.T.I (NITTTR Chandigarh	T.T.T.I (NITTTR Chandigarh

10. WEB REFERENCES

1. <https://nptel.ac.in/courses/105107122/>
2. <https://swayam.gov.in/>
3. [http://ncbindia.com/services/concrete -mixdesign/](http://ncbindia.com/services/concrete-mixdesign/)
4. www.mtu.edu/technology/



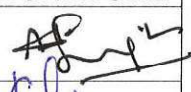

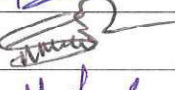

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Properties of Cement	4	4	----	8
2	Properties of Aggregates	2	----	6	8
3	Admixtures	2	2	----	4
4	Properties of Fresh concrete	2	4		6
5	Properties of hardened concrete	2	4	---	6
6	Water cement ratio	2	-	6	8
7	Manufacturing of concrete	-	2	6	8
8	Concrete mix design	2	-	8	10
9	Properties of Special concrete:	3	3	---	6
10	Miscellaneous	3	3	---	6
	Total	22	22	26	70

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Atulya kumar Singh	
2	Internal	Mrs. Supriya Prasad Patil	
3	Internal	Shri. Sandeep Narayan Ranshur	
4	External	Mr. Dheerajkumar S. Pandirkar Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	



1. COURSE DETAILS

Programme: Civil Engineering	Semester: IV
Course: Fluid Mechanics	Group: C*
Course Code: FMH190117	Duration:16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	03	70	20	10	70	25	-	50	175

3. COURSE OBJECTIVE

This course intends to teach the students concepts in Fluid Mechanics. With this knowledge and skill, the student will be able to comprehend various properties of fluids, calculate hydrostatic forces, understand various losses in pipes and choose type of pump depending upon the requirement. These concepts can be applied for designing simple hydraulic components

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competencies through various teaching learning experiences:

1. Apply principles and laws of Fluid Mechanics
2. Classify and study different pressure and flow measuring devices and pumps

5. **COURSE OUTCOMES (COs):** At the end of the semester student will be able to:

CO No.	COURSE OUTCOMES	BLOOM'S LEVELS
CO1	Determine the different types of fluid and fluid properties	R, U
CO2	Identify types of pressure gauges and calculate pressure in a pipe using manometer	R, U, A
CO3	Calculate hydrostatic forces for submerged bodies and metacentric height for floating bodies	R, U, A
CO4	Classify orifices, venturimeter, notches, weirs, mouthpieces and determine their coefficient of discharge	R, U, A
CO5	Identify and calculate major and minor losses in pipes	R, U, A
CO6	Differentiate the working of different types of pumps	R, U

R Remember, U Understand, A Apply and above (Bloom's revised taxonomy levels)



6. COURSE CONTENTS

Sr. No.	Topics/Sub-Topics	Hours	Marks	COs
1	1.0 Introduction 1.1 Definition of fluid, fluid mechanics, types of fluids 1.2 Properties of fluids like density, weight density, specific gravity, specific volume, surface tension, capillarity and their SI units 1.3 Newton's law of viscosity, Types of viscosity and their SI units 1.4 Types of Fluids	4	06	CO1
2	2.0 Pressure and its measurement 2.1 Fluid Pressure, Pascal's law, Hydrostatic law and its application 2.2 Absolute, Gauge, Atmospheric and Vacuum Pressure 2.3 Measurement of Pressure-Manometers and Mechanical Gauges	8	10	CO2
3	3.0 Hydrostatic Forces on Surfaces 3.1 Total pressure and Centre of Pressure 3.2 Total pressure and Center of Pressure for vertical and inclined plane surfaces	6	8	CO3
4	4.0 Equilibrium of floating bodies 4.1 Archimedes Principle 4.2 Buoyancy, Centre of Buoyancy 4.3 Metacentre, Metacentric Height 4.4 Stable, Unstable, Neutral Equilibrium	6	8	CO3
5	5.0 Kinematics and Dynamics of flow 5.1 Types of fluid flows 5.2 Rate of flow, Continuity Equation. 5.3 Bernoulli's Theorem. 5.4 Applications of Bernoulli's Theorem- Venturimeter and Orifice meter	8	6	CO4
6	6.0 Orifices and Mouthpieces 6.1 Classification of Orifices 6.2 Experimental determination of Hydraulic coefficients 6.3 Flow through large, fully and partially submerged Orifices 6.4 Classification of Mouthpieces 6.5 Flow through External and Internal Mouthpieces	8	8	CO4
7	7.0 Notches and weirs 7.1 Classification of Notches and Weirs. 7.2 Discharge over a rectangular, triangular and trapezoidal Notch/Weir 7.3 Velocity of Approach and End Contractions	8	8	CO4



	7.4 Cipolleti, Ogee and Submerged Weirs			
8	8.0 Flow through pipes 8.1 Loss of Energy in Pipes: Major and Minor losses 8.2 Hydraulic gradient line and Total energy line 8.3 Water hammer: Causes, Effects and Remedies 8.4 Flow through Pipes in series and parallel	10	10	CO5
9	9.0 Pumps 9.1 Definition and Use of a Pump 9.2 Centrifugal Pump: Heads and Efficiencies, Main Parts, Working, Priming 9.3 Reciprocating: Main parts, Working 9.4 Simple numerical on capacity and efficiency of Pumps	06	6	CO6
	TOTAL	64	70	

7. LIST OF PRACTICALS

Term work consists of journal containing minimum 10 no of experiments / Assignments with approximate no. of hours required and corresponding COs attained as specified here.

Sr. No.	Title of Experiment	Approximate No. of Hrs required	COs
1.	Verification of Bernoulli's Theorem	02	CO1, CO2
2.	Determination of coefficient of discharge for Venturimeter	02	CO2, CO4
3.	Determination of coefficient of discharge for Orifice meter	04	CO2, CO4
4.	Determination of Major losses in pipes	04	CO2, CO5
5.	Determination of Minor losses in pipe	02	CO2, CO5
6.	Determination of coefficient of discharge for Notches	04	CO4
7.	Determination of coefficient of discharge for Orifices	04	CO4
8.	Determination of coefficient of discharge for Mouthpieces	04	CO4
9.	Assignments on topic "Hydrostatic Forces on Surfaces"	02	CO3
10.	Assignments on topic "Equilibrium of floating bodies"	02	CO3
11.	Assignments on topic "Pumps"	02	CO6
	Total	32	

8. IMPLEMENTATION STRATEGY

1. Teaching Plan
2. Theory and Laboratory sessions
3. Self-Learning Online Resources



9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	A Textbook of fluid Mechanics and Hydraulic Machines	R K Bansal	Laxmi Publications Pvt Ltd
2	Fluid Mechanics and Hydraulic Machines	Modi and Seth	Standard Book House
3	Fluid Mechanics and Hydraulic Machines	Jagdish Lal	Metropolitan Book, New Delhi
4	Fluid Mechanics	A K Mohanty	Prentice Hall of India Pvt Ltd, New Delhi

10. WEB REFERENCES

1. <https://swayam.gov.in/>
2. <https://nptel.ac.in/courses>
3. [Khan academy fluid mechanics](#)
4. <https://youtu.be/clVwKynHpB0>
5. <https://freevidelectures.com/course/89/fluid-mechanics/2>
6. http://www.nptelvideos.com/civil_engineering/fluid_mechanics

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

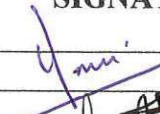
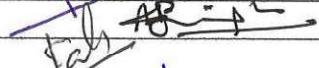
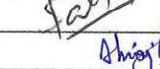
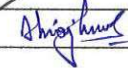
Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	03	03	-	06
2	Pressure and its measurement	02	02	06	10
3	Hydrostatic Forces on Surfaces	01	03	04	08
4	Equilibrium of floating bodies	01	03	04	08
5	Kinematics and Dynamics of flow	01	01	04	06
6	Orifices and Mouthpieces	02	02	04	08
7	Notches & weirs	02	02	04	08
8	Flow through pipes	02	02	06	10
9	Pumps	02	04	-	06
	Total	16	22	32	70

R-Remember, U-Understand, A-Apply (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table



12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	V B. Vanvari	
2	Internal	A. K. Singh	
3	Internal	Mrs. S. P. Patil	
4	External	D S. Pandirkar	
		Organisation: MHADA	



1. COURSE DETAILS:

Program: Civil Engineering	Semester: IV
Course: # Building Maintenance, Repair, Services and Urban Renewal & Redevelopment	Group: A*
Course Code: BMR190118	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	2	-	-	5	03	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

To impart knowledge of structural audit, diagnosis of repair, specifications, maintenance of building and services.

4. SKILL COMPETENCY

Aim of this course is to help the students to attain industry identified psychomotor and cognitive competency through structural audit, Non-destructive tests and diagnosis, specification understanding, planning repairs, safety at repair sites, building services, urban renewal and redevelopment of buildings. etc.

5. COURSE OUTCOMES (COs): at the end of the course, students will be able to

CO No.	COURSE OUTCOMES	BLOOM'S LEVELS
CO1	Differentiate the routine, incidental, periodic and service contract maintenance works of building structure, plumbing, HVAC and external and internal electrical systems, fire detection and firefighting.	R, U, A
CO2	Identify and evaluate scientifically the root cause of decay/deterioration, plan and implement maintenance related repair works and correct use of repair materials for effective result.	R, U, A
CO3	Classify various building services and upkeep the same.	R, U
CO4	Understand different elements of urban planning and redevelopment of buildings	R, U

R-Remember, U-Understand, A-Apply (Bloom's revised taxonomy levels)



6. DETAILED CONTENTS:

Sr. No.	Topics	Hours	Marks	CO
1	<p>1.0 Introduction to maintenance and repairs</p> <p>1.1 Types of maintenance: Routine maintenance, incidental maintenance, periodic maintenance, service contract maintenance.</p> <p>1.2 Legislation and byelaws related to building maintenance and repair.</p> <p>1.3 Scope of maintenance: Structural Stability, water tightness and durability</p>	2	3	CO1
2	<p>2.0 Common problems in building structures</p> <p>2.1 Statutory requirements: Structural audit and revelation in structural audit.</p> <p>2.4 Common problem in buildings: Leakage, dampness, RCC deterioration, façade deterioration</p>	4	5	CO1
3	<p>3.0 Factors affecting durability and diagnosis</p> <p>3.1 Causes that leads to distress in buildings: In-built factors, damage, environmental impact</p> <p>3.2 Defects in building structures: Design, material and construction</p> <p>3.3 Damages to structures: Overloading, earthquake, fire, accidental catastrophe</p> <p>3.4 Deterioration: Corrosion, carbonation, chloride, sulphate attack, AA reaction</p> <p>3.5 Effects of defects, damage and deterioration: Leakage, settlement, deflection, spalling / Delamination, disintegration, cracking, scaling</p> <p>3.6 Non-Destructive Tests (NDT): Need for testing, NDT on concrete, partially destructive tests, selection of NDT method, test requirements, number of tests necessary for various test methods: Ultrasonic Pulse Velocity Test, Rebound Hammer Test, Carbonation depth test, Half-cell potential test, Core Test, interpretation of NDT results.</p>	6	9	CO2
4	<p>4.0 Planning repair</p> <p>4.1 Factors making repair work successful</p> <p>4.2 Financial planning</p> <p>4.3 Fund mobilization</p> <p>4.4 Execution of repair work: Pre-repair planning, Appointment process of contractor</p>	4	6	CO2



Sr. No.	Topics	Hours	Marks	CO
	4.5 Some Dos & Don's in planning and execution of repair work			
5	5.0 Specifications for repair work 5.1 Essential parameters / properties of repair materials 5.1 Selection of materials for proper and effective repair 5.2 Materials for repairs: Rust passivates, antirust coatings, polymer modified mortar / concrete, superfluid micro concrete, fiber composite, surface coat / paint, grouts, cathodic protection. 5.3 Testing of repair materials	4	6	CO2
6	6.0 Methodology and execution of repair work 6.1 Surface based repair: Reinforcement cover restoration, façade restoration, surface protection 6.2 Strengthening technique: Shear strengthening, compression strength enhancement, flexural strengthening 6.4 Tools, tackles and machineries 6.3 Placement methods: Dry packing, form and cast in place, form and pump, grouted preplaced aggregate, dry / wet mix shotcrete, full depth repair, hand applied, special techniques 6.4 Safety at repair site	6	8	CO2
7	7.0 Waterproofing 7.1 Diagnostic techniques for post construction seepage / leakage maladies, reasons for failure of existing waterproofing 7.2 Frequency of checking and maintenance of wet locations in buildings 7.3 Methods of waterproofing: Conventional and non-conventional waterproofing of locations like toilet, basement, terrace, 7.4 Overhead / underground tanks, rising dampness and osmosis in flooring, expansion joint treatment.	4	6	CO2
8	8.0 Electricity: 8.1 Importance of maintenance of electrical appliances / equipment's in buildings 8.2 Purpose of maintenance 8.3 Periodic inspection and testing of electrical installations, emergency maintenance and planned maintenance 8.4 Electrical safety signs, MCB, ELCB / RCCB 8.5 Main panel board, sub-panel board	2	3	CO3



Sr. No.	Topics	Hours	Marks	CO
	8.6 Introduction to Energy Efficiency Audit			
9	<p>9.0 Heating, ventilation & air conditioning (HVAC):</p> <p>9.1 Basic components of an HVAC system, Classification of HVAC systems, Central HVAC systems (All-air systems, All-water systems, Air-water systems)</p> <p>9.2 Local air-conditioning systems (Window air-conditioner, Split systems)</p> <p>9.3 Maintenance of HVAC systems</p>	2	3	CO3
10	<p>10.0 Building Plumbing System Maintenance:</p> <p>10.1 Major elements in plumbing systems, Important Terminologies used in plumbing</p> <p>10.2 Different types of plumbing pipes (Supply/ service pipes, Drain pipes / waste disposal pipes), one pipe system, two pipe system, single stack system, double stack system, Up feed distribution (Simple, Pumped and Down feed),</p> <p>10.3 Domestic plumbing installations (traps, Soil pipes, Waste pipes, Vent pipes, change of direction- no right-angle connection; use single / double 45° Y, 45° / 90° elbow, valves, PRV, Water Closets, flushing Cistern / tank, Flush meter Valves, Union, Reducers, Nipple, etc.)</p> <p>10.4 Water distribution system, wing type /loop type, concealment / ducting / open.</p> <p>10.5 Pipe Joints: Threaded joint, welded joint (butt welded, socket welded), Brazed joint, soldered joint, Grooved joint, Flanged joint, Compression joint</p> <p>10.6 Gravity and Hydro pneumatic system</p> <p>10.7 Types of Pumps</p>	4	6	CO3
11	<p>11.0 Fire Protection:</p> <p>11.1 Fire proofing, materials, fire- escape routes and provision.</p> <p>11.2 Insurance for fire hazard.</p> <p>11.3 Type of Fire Pumps</p> <p>11.4 Sprinkler and Hydrant system</p> <p>11.5 Fire alarm</p>	2	3	CO3
12	<p>12.0 Vertical circulation:</p> <p>12.1 Importance, Classification of vertical circulation</p> <p>12.2 Ramp, staircase, lift, escalator</p>	2	3	CO3



Sr. No.	Topics	Hours	Marks	CO
	13.3 Maintenance of lift, escalator			
13	13.0 Urban Renewal & Redevelopment 13.1 Urbanization: Urbanization with reference to growth of cities, pattern, its trends, prospects of urbanization, Spatial pattern of urbanization, problems of metropolitan cities 13.2 Urbanization of cities, suburbs, region and hinterland 13.3 Notifications: CRZ coastal and marine areas, Norms pertaining to civil aviation, Central ordinance depot, Railways 13.4 Smart cities and intelligent & green buildings: Urban renewal through smart cities concept, Need of smart cities and township, smart technologies deployable 13.5 Redevelopment of Buildings: Components of building, Viability, 13.6 Building Demolition: demolition plan, special safety consideration, segregation of hazardous materials, debris planning, Methods of demolition (manual, mechanized, Hydraulic long arm booms, wrecking ball, controlled implosion, robot)	6	9	CO4
	TOTAL	48	70	

7. LIST OF PRACTICALS / ASSIGNMENTS / REPORTS

Term work consists of minimum 10 assignments / reports of visits and guest lectures



Sr. No.	Practical's, Assignments and Reports	Approx. Hrs required	COs
1	Practical on study of instruments for structural audit: PVC Hammer and NDT equipment's	02	CO1
2	Practical on study of repair materials: micro concrete, plasticizers, epoxy, polymer, meshes.	02	CO2
3	Practical cum visit to building repair to observe methodology and safety during repair	02	CO2
4	Practical cum visit to building being structurally audited	02	CO2
5	Practical cum visit to building under redevelopment	02	CO4
6	Practical on study and interpretation of structural audit report	02	CO2
7	Set of five assignments on building maintenance and repairs as given by subject teacher.	05	CO1 CO2

8	Set of five assignments on building services	05	CO3
9	Set of five assignments on urban renewal and redevelopment	05	CO4
10	Any three reports on site visits or guest lectures organized.	05	CO1
	Total	32	

8. IMPLEMENTATION STRATEGY (PLANNING):

1. Teaching Plan
2. Site Visits
3. Technical Films
4. Guest lectures

9. REFERENCE BOOKS:

Sr. No.	Author	Title	Publication
1	R.N. Raikar	Technology of Building Repairs	SDCPL Mumbai
2	R.N. Raikar	Learning from failure	SDCPL Mumbai
3	Chudley	Building Maintenance	-
4	Neveille	Building Service Engg	Wiley Eastern Ltd
5	Dr. Fixit Institute & A. K. Singh	Planning Repairs for CHS Buildings	Dr. Fixit Institute of Structural Protection and Rehabilitation
6	Association of Structural Rehabilitation (A. K. Singh & others)	Guidelines for Structural Rehabilitation & Retrofitting	Allied Publishers, New Delhi
7	Nath V and Agarwal S K	Urbanization, Urban development and Metropolitan cities in	Concept Publisher, New Delhi
8	Subhash S Lala and CA Ramesh Prabhu	Compendium of SELF-Re-Development	Maharashtra societies welfare association., Mumbai
9	CEP of AICTE (V B Vanvari & N K Bhattacharyya)	Building Maintenance and Repairs – module for working professionals	CEP Cell, AICTE, UVCW campus, K R Circle, Bangalore 560001 INDIA
10	Peter H.Emmons and Gajanan M Sabnis	Concrete Repair and Maintenance	Galgotia Publications Pvt Ltd , 5 Ansari Road, New Delhi Delhi 11002 Daryaganj, New Delhi
11	Compilation from Indian concrete Journal	Repair and Rehabilitation	ICJ, ACC RCD CRS complex, Thane 400604
12	Prof S M Patil	Building services	Mrs Savita S Patil, 09/003, Nirmal Society Phone 28245966



10. WEB REFERENCES

1. Urban renewal Wikipedia en.m.wikipedia.org
2. https://en.m.wikipedia.org/wiki/urban_renewal
3. Strategy Smart cities.gov.in
4. <https://smartcities.gov.in/content/innerpage/strategy.php>
5. <https://www.redevelopmentofhousing.com/>
6. article_showcase/society_matters/39_what_are_fsi_and_tdr
7. (PDF) Redevelopment of buildings in Mumbai city: Risks and challenges
8. https://www.researchgate.net/publication/327513762_Redevelopment_of_buildings_in_Mumbai_City_Risks_and_Challenges

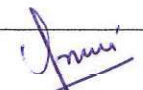
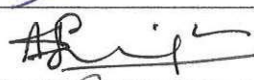

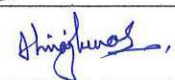

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No	CHAPTER	Distribution of Theory Marks			
		R Level	U Level	A LEVEL	Total Marks
1	Introduction to maintenance and repairs	1	2	0	3
2	Common problems in building structures	2	3	0	5
3	Factors affecting durability and diagnosis	2	7	0	9
4	Planning repair	0	3	3	6
5	Specifications for repair work	1	2	3	6
6	Methodology and execution of repair work	1	2	5	8
7	Waterproofing	1	1	4	6
8	Electricity:	2	1	0	3
9	Heating, ventilation & air conditioning (HVAC):	3	0	0	3
10	Building Plumbing System Maintenance:	2	2	2	6
11	Fire Protection:	1	2	0	3
12	Vertical circulation:	1	2	0	3
13	Urban Renewal & Redevelopment	3	6	0	9
TOTAL		20	33	17	70

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of Cos. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. V. B. Vanvari	
2	Internal	Mr. A. K. Singh	
3	Internal	Mr. S. N. Ranshur	
4	External	Mr. Dheerajkumar S. Pandirkar Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	 



1. COURSE DETAILS

Program: Civil Engineering	Semester: IV
Course: #Construction Equipment & Techniques	Group: C*
Course Code: CET190119	Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	2	-	-	5	3	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE:

This is elective course under core technology courses. The main objective of this course is to make students familiar with different types of standard and special equipment used in the construction industry, owning and operating costs, evaluate maintenance and repair costs, describe various equipment related to earthmoving, drilling and blasting, pile driving, pumping, stone crushing, air compressors and equipment for moving materials.

4. SKILL COMPETENCY: Aim of this course is to help the students to attain following industry identified skills

- Identify, compare and select the equipment required for various civil engineering applications.

5. COURSE OUTCOME: At the end of the course the students will be able to:

CO No.	COURSE OUTCOMES	BLOOM'S LEVELS
CO1	Identify the appropriate equipment for various construction activities, determine its optimal use and estimate its efficiency.	R, U, A
CO2	Differentiate Advance concreting methods and related equipment	R, U
CO3	Identify and select appropriate equipment for various Civil Engineering works	R, U, A

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)

6. DETAILED CONTENT:

Sr. No	Topic / Sub-topics	Hours	Marks	CO
1	Construction equipment: Standard types of equipment, special equipment, cost of owning and operating equipment, economic life, factors affecting selection of construction equipment, balancing of equipment. Study of equipments with reference to available	8	08	CO1



	types and their capacities, operations and factors affecting their performance.			
2	Drilling and blasting equipment, Pile driving equipment and Stone crushing equipment: Bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives, pile driving hammers: single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory pile drivers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants, portable plants.	08	08	CO1, CO3
3	Earthmoving and hauling equipment: Tractors and attachments, dozers and rippers, scrapers, shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, dozers, trenching machines, rollers and compactors. Builder's hoists, forklifts, cranes, belt-conveyors, cableways, ropeways	08	10	CO1
4	Hoisting and Conveying Equipment Principle and working of Tower Cranes, Crawler Cranes, Truck-mounted cranes, Gantry Cranes, Mast Cranes, capacity and use of dumpers, tractors and trucks.	04	08	CO1
5	Earth Moving Machinery Excavation equipment's: Working and output of bulldozers, Scrapers, Grades, Power Shovels, JCB, Draglines. Compacting equipment's: Use of Rollers types – plain rollers, sheep footed rollers, vibratory rollers, pneumatic rollers rammer – use and working of rammers.	03	08	CO1, CO3
6	Advanced Concreting Methods Under water concreting for bridge piers and bored pile construction, Tremy method for under water concreting, procedure and equipment required for tremy method. Properties Tremix Concreting Method: Definition, Application of vacuum dewatering concreting, equipment's used in tremix concreting, procedure of vacuum dewatering concreting (Tremix).	04	10	CO2
7	Advanced Construction Methods Formwork - Steel, II, Steel plates, Telescopic props, tubular formwork, Slip formwork – use of slip formwork, process of concreting with slip formwork Construction of Multi Storied Building – use of lifts, belt conveyors, pumped concrete, equipments and machinery required for construction of multi storied building, precaution & safety measures.	08	10	CO2
8	Miscellaneous Equipment's and equipment management Miscellaneous Equipment's: Pile driving equipment, pile hammers, selection of hammers, working of hot bitumen plant, bitumen paver, grouting equipment, Equipment Management. Equipment Management: Standard equipment, special equipment, selection of equipment, owning and operating cost of construction equipment, economic life of construction equipment, preventive maintenance of equipment, break down maintenance of	05	08	CO3



	equipment.			
		Total	48	70

7. LIST OF DEMONSTRATION / VISITS / ASSIGNMENTS

Term Work consists of Journal containing minimum 08 no of Assignments and corresponding CO attained are specified here.

Sr. No.	Title of Demonstration / Assignments	Approximate No. of Hrs required	COs
1.	Compare Standard types Construction equipment with respect to their capacities, operations and factors affecting their performance.	04	CO1, CO3
2.	Study of various drilling and blasting equipment, Pile driving equipment and Stone crushing equipment:	04	CO1, CO3
3.	Study of various earthmoving and hauling equipment:	04	CO1
4.	Study of various hosting and Conveying Equipment	02	CO1, CO3
5.	Study of various Earth Moving Machinery	02	CO1
6.	Study of various Advanced Concreting Methods	02	CO2
7.	Study of cost of owning and operating equipment,	02	CO3
8.	Study of various Piling equipment	04	CO1
9.	Selection of appropriate equipment for various Civil Engineering works	04	CO3
10.	Site visits	04	
	Total	32	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Practical/Sketches
 2. Visit to various sites
 3. Slides / Presentation / Demonstration of various Equipment
 4. Group discussions for practical assignments
 5. Self-Learning Online Resources

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1.	"Construction Planning, Equipment and Methods	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C	McGraw Hill, Singapore, 1995
2.	Building Construction, Planning Techniques and Method of Construction	Arora S.P. and Bindra S.P	Dhanpat Rai and Sons
3.	Building construction	Varghese, P.C	Prentice Hall of India Pvt. Ltd, New Delhi
4.	Concrete Technology, Theory and Practice	Sheety, M.S	S. Chand and Company Ltd, New Delhi
5.	Construction and Foundation Engineering	Jha J and Sinha S.K	Khanna Publishers



6.	Construction Equipment and Management	Sharma S.C	Khanna Publishers New Delhi
7.	Construction Equipment and Job Planning	Deodhar, S.V	Khanna Publishers, New Delhi
8.	Construction Equipment and its Planning and Application	Dr. Mahesh Varma	Metropolitan Book Company, New Delhi
9.	Concrete Technology	Gambhir, M.L	Tata McGraw – Hill Publishing Company Ltd, New Delhi

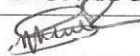


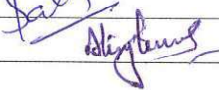
10. WEB REFERENCES:

1. [Construction methods and equipment management - Course \(nptel.ac.in\)](http://nptel.ac.in)
2. [Modern Day Construction Equipment \(engineeringcivil.com\)](http://engineeringcivil.com)
3. [Construction Equipment & Machinery Used in Construction Industry | Plant Automation Technology \(plantautomation-technology.com\)](http://plantautomation-technology.com)
4. [Type of Equipment use in construction - Basic Civil Engineering](#)

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	Construction equipment	4	4	-	8
2.	Drilling and blasting equipment, Pile driving equipment and Stone crushing equipment	4	4	-	8
3.	Earthmoving and hauling equipment	-	4	6	10
4.	Hosting and Conveying Equipment	4	4	-	8
5.	Earth Moving Machinery	-	4	4	8
6.	Advanced Concreting Methods	4	6	-	10
7.	Advanced Concreting Methods	-	4	6	10
8.	Miscellaneous Equipment's and equipment management	-	4	4	8
	Total	16	34	20	70

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Shri. Atulya kumar Singh	
3	Internal	Mrs. Supriya Prasad Patil	
4	External	Mr. Dheerajkumar S. Pandirkar Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	



1. COURSE DETAILS

Program: Civil Engineering	Semester: IV
Course: Engineering Geology	Group: A
Course Code: EGL190120	Duration: 16 Weeks

2. TEACHING & EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
3	-	-	-	3	-	-	-	-	-	50	-	50	100

3. COURSE OBJECTIVE

This subject is from application group intended to teach the students about the various basics of Engineering Geology, which is required for Geo Technical Engineering.

4. SKILL COMPETANCY

The aim of this course is to help the student to attain the following Competency through various teaching learning experiences:

- Apply basic knowledge about natural material like rocks and their usage as well as their availability.
- Compare the influence of natural processes and geological factors on civil structures and help them to take decision while planning, design and execution stage of the structures in their professional life.
- Know the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports.

5. **COURSE OUTCOME:** After the successful completion of the course, the student will be able to:

CO No.	COURSE OUTCOME	Bloom's Level
CO 1	Differentiate different types of rocks encountered in Foundation Strata	R, U, A
CO 2	Read and Interpret the soil investigation report	R, U, A
CO 3	Analyze various properties of rock	R, U, A

R-Remembering, U-Understanding, A-Applying and above (Bloom's revised taxonomy levels)



6. COURSE CONTENT

Sr. No.	Topics / Sub Topics	Hours	CO
1.	General: 1.1 Brief history of formation of earth and earth crust 1.2 Relationship of geology to Civil Engineering (Introduction)	06	CO1
2.	Physical Geology: 2.1 Natural agencies such as wind, running water, sub surface water, lakes, oceans, glaciers, organisms, volcanoes, earth quakes. 2.2 taking part in changing the surface of the earth	06	CO1
3.	Structural Geology: 3.1 Faults, folds, anticlines, synclines, domes,	06	CO3
4.	Mineralogy, Petrology and Economic Geology: 4.1 Study of minerals 4.2 Study of rocks 4.3 Economic mineral deposits Outlines of Indian stratigraphy	06	CO3
5	Engineering Geology for Civil Engineering Structures: 5.1 Earthquakes 5.2 Geological investigations 5.3 Geology of dam sites, reservoirs, roads, bridge sites and tunnels (broad outlines) 5.4 General Stability of hills slopes, landslides, their causes and precautions against them 5.5 Improvement of site	24	CO2, CO1
TOTAL		48	

7. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan
2. Technical Videos
3. Assignments with continuous Assessment

8. LIST OF ASSIGNMENTS

Term Work consists of Journal containing minimum 10 no of Assignments (marked with *) with approximate no of hours required and corresponding CO attained are specified here.



Sr. No.	Title of Assignments	Approximate No. of Hrs required	Cos
1.	*Fundamentals of Geology	02	CO1
2.	*Study of Physical Properties of Minerals	02	CO2
3.	*Identification of Minerals and Rock samples	02	CO2
4.	*Study of Rock Forming Minerals (Hand Specimen Study)	02	CO2
5.	*Study of Igneous Rocks	02	CO2
6.	*Study of Sedimentary Rocks	02	CO2
7.	*Study of Metamorphic Rocks	02	CO2
8.	*Study of Geological investigation of Dam sites, Reservoirs	02	CO3
9.	*Study of Geological investigation of Bridge sites, Tunnels	02	CO3
10.	*Sketches of Minerals & Rock samples	02	CO2, CO3
Total		20	

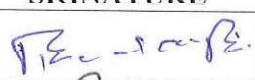


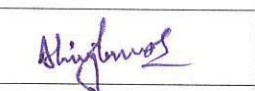
9. LEARNINIG RESOURCES

Sr. No.	Author	Title	Publisher & Address
1.	Parbin Singh	Engineering & General Geology	S K Kataria and Sons
2.	Mukharjee, P.K	A text book of Geology	The World Press Pvt. Ltd.
3.	C Keshavulu	Textbook of Engineering Geology	Macmillan India Ltd
4.	Reddy V	Engineering Geology for Civil Engineers	Oxford & IBH,

10. WEB REFERENCES

1. (505) [Lecture 40 Identification of minerals and rock samples - YouTube](#)
2. (505) [Rocks and Minerals - YouTube](#)
3. (505) [Lecture 23 : Geotechnical Investigation - YouTube](#)
4. (505) [Folds and Faults - YouTube](#)
5. (505) [GEOGRAPHY OPTIONAL- FOLDS, ANTICLINES, SYNCLINES UPSC/UPPSC/TGT/PGT/UGC #dreamcampus - YouTube](#)

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. K P Jayateerth	
2	Internal	Shri. S N Ranshur	
3	Internal	Shri. A K Singh	
4	External	Mr. Dheerajkumar S. Pandirkar	
		Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	



1. COURSE DETAILS

Programme: Civil Engineering
Course: Advance Survey
Course Code: TSS190121

Semester: IV
Group: A
Duration: 16 Weeks

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
-	3	-	-	3	-	-	-	-	-	50	50	-	100

3. COURSE OBJECTIVE

This is advance technology subject which is intended to teach the students applications of core facts, concepts, principles procedures they have studied in surveying-I and surveying-II course. In search of precision and accuracy surveyor has to use more precise instruments like Total Station, Distance Meter, GPS, GPR and Robotics. With this knowledge and skill, he will be able to choose appropriate surveying methods depending upon requirement to carry out survey work in Building Construction system, Transportation Engineering system, Environmental Engineering system and Irrigation Engineering system for investigation of projects before and during execution of work, while serving as investigator for design department, supervisor on the site of work, draftsman in the drawing office and estimator in the estimating office.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- To provide knowledge of various survey that are required with the use of Total Station, GPS, GPR, Robotics.
- To develop ability to apply surveying knowledge to various problems on site related to survey using Total Station
- Undertake civil engineering surveys



5. **COURSE OUTCOMES(COs):** At the end of the course, student will be able to: -

CO No.	COURSE OUTCOME	Bloom's Level
C01.	Operate the Total Station for measurement of distances in horizontal and vertical plane	R,U,A
CO2.	Setting out for building using total station	R,U,A
CO3.	Uses of GPS, GPR and robotics in civil engineering surveys	R,U,A

6. COURSE CONTENTS

Sr. No.	Topic / Sub-topics to be taught during respective practical session
1	Introduction of Total Station Different parts of the Total Station, temporary adjustments, centering, leveling, different uses of the Total Station, survey station description by codes, instrument station entry, data retrieval, field generated graphics, data transfer etc.
2	Point Measurement The measurement of an unlimited number of points
3	Contour map: Preparing the contour map of a given area, calculating the instrument station, along with the orientation of the horizontal circle from measurements to at least two points, the co-ordinates, which are known.
4	Tie distance Computing slope distance, horizontal distance and azimuth of two target points measured on line, selected from the memory or entered using the keypad.
5	Stake out Calculating the required elements to stakeout points from co-ordinates or manually entered angles, horizontal distance and heights.
6	Cogo Creating, editing and examine points, lines, splines, polygons, text and alignments
7	Remote height Calculation of the height difference h between the ground point and the high point.

7. LIST OF PRACTICALS AND DRAWINGS

Term Work consists of Journal containing minimum 06 no of experiments (marked with *) with approximate no of hours required and corresponding CO attained are specified here.

Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
1.	*Introduction to Total Station	6	CO1
2.	*Measurement of unlimited no of points	6	CO2
3.	Uses of GPS, GPR and robotics in civil engineering surveys	4	CO3
4.	* Computing slope distance, horizontal distance and azimuth of two target points measured on line, selected from the memory or entered using the keypad.		CO1, CO2



Sr. No.	Title of Experiments and Drawings	Approximate No. of Hrs required	COs
5.	*Stake out: Calculating the required elements to stakeout points from co-ordinates or manually entered angles, horizontal distance and heights.	6	CO1, CO2
6.	Cogo : Creating, editing and examine points, lines, splines, polygons, text and alignments	6	CO1, CO2
7.	Remote height: Calculation of the height difference h between the ground point and the high point	2	CO1, CO2
8.	* Preparing the contour map of a given area	6	CO2
9.	*Traversing with Total Station	6	CO2
Total		48	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Practical Plan
2. Survey Project for 1 days on site
3. Slides / Presentation
4. Group discussions for practical assignments of setting out.
5. Self-Learning Online Resources


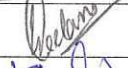
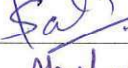
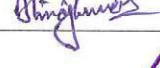
9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Trimble M3 Users Manual	Trimble	Trimble

10. WEB REFERENCES

1. <https://www.youtube.com/watch?v=6KRKD8ffdLY>
2. <https://www.youtube.com/watch?v=3-RyPDEMvWg>
3. <https://www.youtube.com/watch?v=Lj7Gj2KqMKg>
4. <https://www.youtube.com/watch?v=R2CBjQwMGec>
5. <https://www.youtube.com/watch?v=Gp83fIE1aFQ>

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Shri. Sandeep Narayan Ranshur	
2	Internal	Miss. Neelam Nagraj Petkar	
3	Internal	Mrs. Supriya Prasad Patil	
4	External	Mr. Dheerajkumar S. Pandirkar	
		Organization: Deputy Chief Engineer, Maharashtra Housing & Area Development Authority (MHADA)	

