

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: BUILDING MATERIALS

(Code: 3330601)

Diploma Programme in which this course is offered	Semester in which offered
Civil / Environment Engineering	THIRD

1. RATIONALE :

The selection of materials for engineering purpose is very much crucial activity. In civil engineering any material of construction, the first and for most necessity is to know its properties, suitability, strength and durability. Based on this, one can suggest the most suitable material which may fit the exact requirement of the construction items. In this course, the technology related to some of the important and widely used construction materials has been dealt with. This course will enrich civil engineering technicians in performing their jobs with ease and confidence and will be able to select appropriate material for the given item of work on site.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop with different types of skills so that students are able to acquire following competencies

1. To develop the conceptual knowledge in building material.
2. To select appropriate material in given field situation.
3. To develop awareness about latest building materials.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
03	00	02	05	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I INTRODUCTION	1. Describe important properties of building materials used in civil engineering construction	1.1 Physical , chemical and engineering properties of building materials. 1.2 Application of building materials 1.3 Alternative materials for the given items in building construction.
Unit – II CLAY PRODUCTS	2 Identify clay based products for use in building constructions based on its properties.	2.1 Classification of clay products 2.2 Types of bricks 2.3 Manufacturing process of bricks 2.4 Test on bricks 2.5 Standard requirements and grades of bricks as per BIS 2.6 Types of clay tiles and its uses
Unit – III ROCKS AND STONES	3. Select appropriate rock / stone products for different uses in building construction	3.1 Classification of rocks 3.2 Rock products 3.3 Characteristics of stones - Structure , texture , strength , gravity , porosity , absorption , hardness , durability, weight.. etc. 3.4 Standard requirement of building stone 3.5 Important stones used in construction with its suitability.
Unit – IV LIME AND POZZOLANA	4.Appreciate the uses of lime and Pozzolana products in building construction	4.1 Sources and classification of Lime 4.2 Uses of lime with specific field situation 4.3 Types of pozzolanic materials 4.4 Advantages of addition of pozzolonic material
Unit – V CEMENT CONCRETE	5 Select appropriate ingredients of proper quality for cement concrete as per required BIS codes	5.1 Types of cement with their specific use 5.2 Grade of cement as per BIS 5.3 Engineering properties of cement 5.4 Field and laboratory test of cement as per BIS 5.5 Methods of storing the cement 5.5 Types of aggregate as per BIS 5.6 Requirements of aggregate as per BIS 5.7 Engineering properties of aggregate 5.8 Test on aggregate
Unit – VI TIMBER	6. Describe timber and wood products and its uses in building construction	6.1 Types of timber 6.2 Uses and application of timber 6.3 Defects in timber and wood 6.4 Seasoning, 6.5 Wood products with specific uses
Unit – VII MISCELLANEO US CONSTRUCTIO N MATERIALS	7. Explain different types of advanced building materials and their uses in construction.	7.1 Plastics and PVC 7.2 Ceramic products 7.3 Paints and Varnish 7.4 Materials for damp proofing , water proofing 7.5 Materials for anti termite treatment 7.5 Glass and fiber 7.6 Steel and iron materials 7.7 Materials used for false ceiling 7.8 Asbestose 7.9 Concrete blocks

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	INTRODUCTION	04	03	04	00	07
II	CLAY PRODUCTS	10	03	04	07	14
III	ROCKS AND STONES	04	03	04	00	07
IV	LIME AND POZZOLANAS	04	03	04	00	07
V	MATERIALS FOR CEMENT CONCRETE	10	03	04	10	17
VI	TIMBER	04	00	03	04	07
VII	MISCELLANEOUS MATERIALS	06	00	03	08	11
Total		42	15	26	29	70

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency.

Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Conduct local market survey for different civil engineering materials with respect to applications cost , and. quality	Home assignment
2	II	Perform tests on given sample of brick such as <ul style="list-style-type: none"> • Soundness • Water absorption • Compressive strength 	06
3	III / IV	Identification of different types of stones and lime	02
4	II / V	Conduct field test on given sample of brick and cement	04
5	V	Perform lab tests on given sample of cement <ul style="list-style-type: none"> • Initial and final setting time • Compressive strength 	04
6	V	Conduct field test on given sample of fine and coarse aggregate	02
7	IV	Perform test on given sample of fine aggregate <ul style="list-style-type: none"> • Sieve analysis • Silt and clay content 	04
8	VI	Assess the quality of different types of timber and timber products (please arrange to visit nearby saw mill or timber mart)	02
9	VII	Prepare a report regarding collected miscellaneous civil engineering materials with respect to cost , quality and applications..	04
Total			28

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Prepare a list of construction materials adopted in your residence.
- Observe AND WRITE A REPORT OF SELECTION AND USE OF APPROPRIATE BUILDING MATERIAL AT GIVEN CONSTRUCTION SITE

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. No.	Title of Books	Author	Publications
01	Engineering Materials	Dr. Janardan Jha	Khanna
02	Materials of Construction	A K Roy Chaudhary	
03	Building materials	S. K. Duggal	New Age International
04	Engineering Materials	Vazirani and Chandola	
05	Engineering Materials	S C Rangwala	Charotar
06	Construction Materials	D.N. Ghose	TATA Mc Graw Hill
07	Civil Engineering materials	TTTI ,Chandigarh	TTTI

Handbooks

SR. No.	Title	Author
01	PWD Handbooks for -Materials - Masonry -Building -Plastering and Pointing - Foundation	All India Council for Technical Education
02	Practical Civil Engineering Handbook	Khanna

BIS/ International Codes of Practice:

SR. No.	Title
01	National Building Code

B. List of Major Equipment/Materials

1. UTI/ Compression testing machine capacity – 40 tonne
2. Vicat apparatus for cement testing
3. Sets of sieve and sieve shaker
4. Abrasion testing machine with balls
5. Impact machine
6. Weighing machine of required capacity.

C List of Software/Learning Websites

01	Khan academy
02	Civilengineering.org

9. INSTRUCTIONAL STRATEGIES

Lecture ,Charts, Ppt, Assignments, Demonstration, Field Visits.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. Mr. Bhavesh V, Modi (Principal) BVPIT(DS) Umrakh
2. Mr. V.K.Shah (Head) Dr.S&S.Gandhi College, Surat
3. Mr. A.K.Popat (Sr.Lect) Government Polytechnic, Dahod

Coordinator and Faculty Members from NITTTR Bhopal

1. Dr.V.H.Radhakrishnan PROFESSOR , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING
2. Dr. A K JAIN , PROFESSOR , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING
3. Prof J.P.Tegar, PROFESSOR AND HEAD , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: CONSTRUCTION TECHNOLOGY
(Code: 3330602)

Diploma Programme in which this course is offered	Semester in which offered
Civil/Transportation Engineering	THIRD

1. RATIONALE

Construction technology is a core subject in civil engineering. This subject is intended for gaining useful knowledge with respect to facts, concepts, principles and procedures related to building construction system so that student can effectively able to execute building construction work and carry out repairs and maintenance of existing building with safety and quality in construction.

2. COMPETENCY :

The course content should be taught and with the aim to develop different types of skills so that are able to acquire following competencies:

- (i) Understand different types of technology used in construction works.
- (ii) Students are able to appreciate various types of construction machineries, formworks and safety measures involved in construction works.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I INTRODUCTI ON	1a. Appreciate various types of civil engineering structures. 1b. Develop concept of various types of components of building.	1.1 Introduction of various Civil Engineering structures 1.2 Functions of various components of building and other structures
Unit – II FOUNDATION S	2a. Know type of foundation and its suitability to different type of soil. 2b. Explain the failure of foundation and remedial measures	2.1 Classification and types of foundations 2.2 Selection of the suitable type of foundation for required structure and as per situation 2.3 Foundations in black cotton soil, loose soils etc. 2.4 Timbering in trenches 2.5 Failures in foundation Precautions & remedial measures
Unit – III BUILDING CONSTRUCTI ON	3a. Develop concept of different types of brick and stone masonry. 3b. Explain construction procedure. 3c. Explain different types of concrete and its type. 3d..Develop concept about various type of form work.	3.1 Brick and stone masonry 3.2 Selection of suitable type of masonry 3.3 Construction procedures. 3.4 Ingredients of concrete. 3.5 Production of concrete, transportation, placing, compaction, curing 3.6 Concrete in different situations viz. hot weather, cold weather, under water etc. 3.7 Purpose & types of scaffolding and centering 3.8 Suitability of scaffolding as per situations and type of structures. 3.9 Erection of centering for different component
Unit – IV BUILDING ITEMS	4a. Appreciate the different types of building items. 4b. Explain various construction activity like damp proof course (D.P.C) and anti termite treatment. 4c. Able to know the different types of plumbing and electric fittings and laying procedure.	4.1 Plastering & pointing- its purpose, various types, construction procedures, advantages and disadvantages, suitability of each. 4.2 Damp proof course (DPC) 4.3 Anti-termite measures and treatments 4.4 Construction joints-need and materials used. 4.5 Plumbing and electrification- various types of fittings and laying procedure.
Unit – V CONSTRUCTI ON MACHINERY	5a. Able to introduce different types of construction machinery, its features and Working.	5.1 Purpose, advantages and disadvantages. 5.2 Machineries used for earthwork and for other construction works. Mortar – Types & specific uses 5.2.1 Their details, special features, suitable uses, specifications.

Unit	Major Outcomes	Learning	Topics and Sub-topics
Unit – VI BUILDING MAINTENANCE AND SAFETY MEASURES	6a. Describe concept about the maintenance work , know causes, types and its remedial measures 6b. Understand about the important laws/norms and act of safety. 6c. Explain precautions and precautionary measures of safety.		6.1 Purpose, need, importance, methods. 6.2 Causes and types of defects in buildings. 6.3 Preparation of report on maintenance work. 6.4 Remedial measures and execution procedure of any one type of building maintenance work. 6.5 Importance of various Laws / Norms / Regulations / Acts for safety. 6.6 Precautions and precautionary Measures. 6.7 Post-accident procedures. Give Examples.

5 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	INTRODUCTION	4	04	02	00	06
II	FOUNDATIONS	6	04	02	04	10
III	BUILDING CONSTRUCTION	10	02	08	08	18
IV	BUILDING ITEMS	8	02	06	06	14
V	CONSTRUCTION MACHINERY	6	00	06	04	10
VI	BUILDING MAINTENANCE AND SAFETY MEASURES	8	02	04	06	12
Total		42	14	28	28	70

6 SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1		Sketches for	10
	II	Foundations – various types, Layout plan, timbering in trenches	
	III	Brick and stone masonry work	
	III	Scaffolding works and cantering	
	IV	Different types of Damp Proof Course	
2		Field work	
	II	Exercise for layout using foundation plan of a given building on site	8
	III	Exercise for carrying out different types of masonry	
3		Field Visit	10
		Arrange field visit at construction site where the following works are in progress	
	II	(a) Excavation for foundation <ul style="list-style-type: none"> • Describe machinery involved • Describe types of structure • Precautions and safety measures 	
	III	(b) Concreting <ul style="list-style-type: none"> • Grade of concrete • Admixtures and its effects • Batching of concreting • Transporting, placing and curing of concrete 	
	III	(c) Masonary <ul style="list-style-type: none"> • Types of masonry • Types of mortar and ratio • Types of bond and construction procedure • Methods involved in quality control of masonry work 	
	IV	(d) Flooring <ul style="list-style-type: none"> • Types of flooring • Proportion and procedure of flooring • Anti termite treatment 	
	IV	(e) Plastering & Pointing <ul style="list-style-type: none"> • Types of mortar and ratio • Types of plastering work and its suitability • Types of pointing work and its suitability • Quality check for plastering and pointing work 	
		Total	28

7 SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.

8. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Building Construction	B.C. Punmia	
2	Building Construction	Shushil Kumar	
3	Building Construction	S. C. Rangwala	
4	Building Construction	Sharma And Kaul	
5	Construction Planning, Equipments and methods	R. L. Perurifoy	

B. List of Major Equipment/Materials

C List of Software/Learning Websites

9. INSTRUCTIONAL STRATEGIES

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. Mrs. Vandana P. Pandya, Head, Civil Deptt., Parul Polytechnic Institute , Limda, Vadodara
2. Mr. Chintan D. Bhatt, Lecturer, Civil Deptt., Tolani F.G.Polytechnic, Adipur

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**HYDRAULICS
(Code: 3330603)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering, Environmental Engineering, Transportation Engineering	3 rd semester

1. RATIONALE

It is necessary for civil, environmental and transportation engineers to understand the behavior of fluid flow in different conditions in pipes, channels, canals, notches, weirs etc. In the field these conditions are very common and diploma passouts has to solve problems related to water seepage and discharge.

The basic knowledge about hydraulics and fluid mechanics will be useful in subjects like Irrigation, Water Resources Management and Public Health Engineering. In this course, basics of hydraulics and its application oriented content has been kept with a focus that students should be able to solve practical problems. Competencies developed by this course would therefore be useful for students while performing his/her job in the field of Water resources / Irrigation/PHE and Environment Engineering.

2. COMPETENCIES (Programme Outcomes as per NBA Terminology)

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- i Measure the pressure and flow of water in different conditions using various measuring devices**
- ii Compute discharge and loss of head through pipes, open channels, notches and other hydraulic structures.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	1	2	6	70	30	20	30	150

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Introduction, Pressure and pressure measurement	1a.Explain the terms associated with Hydraulics 1b.Clarity different properties of liquid 1c. Describe different types of pressure and methods of measurement	1.1 Technical terms used in Hydraulics – Fluid Mechanics, Hydrostatics, Hydro-kinematics, Hydro-Dynamics-Ideal and Real Fluid. 1.2 Properties of liquid – Viscosity-Density-Specific Gravity-Surface Tension-Capillarity Vapour Pressure-Elasticity. 1.3 Various types of pressure – Atmospheric Pressure-Gauge Pressure-Absolute Pressure Vacuum Pressure-Separation Pressure/s 1.4 Measurement of pressure/s by different methods 1.5 Measurement of difference of pressure using “U” tube Manometer and inverted “U” tube Manometer
Unit – II Hydrostatics	2a Explain the Relationship between pressure and depth of liquid 2b.Compute total Pressure and Centre of pressure	2.1 Relationship between pressure and depth of liquid 2.1.1 Pressure diagram for different conditions 2.2 Total pressure and center of pressure 2.2.1 Computation of Total Pressure and depth of centre of pressure
Unit – III Hydro kinematics & Hydrodynamics	3a. Explain different types of flow 3b. Derive Continuity Equation 3c. Explain different kinds of energy 3d Apply Bernoulli’s theorem to measure the pressure and Discharge.	3.1 Types of flow - Laminar --Turbulent --Uniform -- Non-uniform --Steady--Un-steady --Rotational and irrotational --One, Two and Three Dimensional flow 3.2 Reynold’s number 3.3 Continuity Equation 3.4 Types of Energy – Potential, Pressure and kinematics 3.5 Bernoulli’s Equation and its applications. 3.6 Momentum Equation
Unit – IV Hydraulic coefficient, notches and weirs	4a. Compute different Hydraulic Coefficient for different types of orifice 4b. Identify types of Notches and weirs. 4c. Calculate discharge through notches and weirs.	4.1 Definition and types of orifice 4.2 Various Hydraulic Coefficient and its relation - Coefficient of Contraction, Velocity, Discharge. 4.3 Types of notches and weirs 4.4 Computation of discharge through notches 4.4.1 Rectangular Notch 4.4.2 V -Notch. 4.5 Computation of discharge through weirs 4.5.1 Discharge through narrow crested and broad Crested weir. 4.5.2 Discharge through Cipolletti weir.
Unit – V Flow through pipes	5a. Explain Energy (Head) losses 5b. Draw Hydraulic Gradient Line (HGL) and Total Energy Line (TEL) 5c. Design Pipeline	5.1 Characteristics of flow through pipes 5.2 Major and Minor Energy (Head) losses in pipe Flow- frictional loss, loss of head at entry, exit, Sudden enlargement and contraction and at bend. 5.2.1 Computation of major head by Darcy Weisbach Equation. 5.3 Hydraulic Gradient Line (HGL) and Total Energy

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	network using formula and nomogram	Line (TEL) 5.4 Design of Pipeline-using formula & Nomogram
Unit – VI Flow through Open Channel	6a. Analyse uniform flow 6b. Understand Specific Energy Diagram 6c. Describe Procedure for measuring Velocity of flow 6d. Calculate discharge.	6.1 Characteristics of open channel flow 6.1.1 Comparison of pipe flow and channel flow. 6.1.2 Field examples of open channel 6.2 Analyse uniform flow 6.2.1 Froud's number, 6.2.2 Hydraulic mean depth- concept & computation 6.2.3 Use of Chezy's and Manning's formulae. 6.2.4 Most economical sections of channel 6.2.4.1 Rectangular, Trapezoidal and circular shapes. 6.3 Specific Energy Diagram 6.4 River Gauging 6.4.1 Measurement of mean velocity using surface float, velocity rod and current meter.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction, Pressure and pressure measurement	7	3	4	4	11
II	Hydrostatics	5	3	4	-	7
III	Hydro kinematics & Hydrodynamics	8	2	7	7	16
IV	Hydraulic coefficient, notches and weirs	8	2	5	7	14
V	Flow through pipes	7	3	4	4	11
VI	Flow through Open Channel	7	3	4	4	11
Total		42	16	28	26	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (Course Outcomes in psychomotor and affective domain) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of Programme Outcomes/Course Outcomes in affective domain as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA terminology)	Apprx. Hrs. Required
1	I	Measure the pressure of water in pipe using (a) Piezometer (b) Different types of manometers	4
2	III	Determine discharge through a given venturimeter.	4
3	IV	Determine coefficient such as C_c , C_v , and C_d for different types of orifices	4
4	IV	Compute coefficient of discharge for V notch and Preparation of calibration graph for interpolation and extrapolation	4
5	IV	Compute coefficient of discharge for Rectangular notch and Preparation of calibration graph for interpolation and extrapolation	4
6	V	Determine loss of head in various diameter of pipes and effect of material of pipe on loss of head	4
7	III	Demonstrate functioning of Bernoulli's Apparatus	2
8	III	Demonstrate use of Reynold's number	2
Total			28
TUTORIALS			
1	I	Solve numerical problems based Pressure measurement	2
2	II	Solve numerical problems based on Hydrostatics	2
3	III	Solve numerical problems based on Hydrodynamic and Hydro kinematics	4
4	IV	Solve numerical problems based on Hydraulic coefficient, notches and weirs	2
5	V	Solve numerical problems based on Flow through pipes	2
6	VI	Solve numerical problems based on Flow through Open Channel	2
Total			14

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

1. Student will visit nearby Canal Structure and Submit report consisting flow data, cross sections, hydraulic data etc. for the same.
2. Student will Survey an industry / Department for handling or using pressure measuring devices.

3. Student will carry out market survey for pipes of different materials.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Use demonstration, video/animation films field/industry visit for explaining complex/abstract concepts of Hydraulics.
- ii. This course requires lot of practice on numerical. Students may be asked to solve the numerical during lecture periods and tutorial periods, in addition home assignments may be given. To avoid copying by students each problem must have different parameters for each student or at least there may be five to six sets of problems with different values., In other words each student will get same problem but with varied parameters. (Values of pressure, volume, flow, force, distance, speed etc may be different for each student)

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
	Hydraulics, Fluid Mechanics and Hydraulic machine	S.Ramamrutham	Dhanpat Rai
	Hydraulics, Fluid Mechanics and Hydraulic machine	R. S. Khurmi	S.Chand
2	Hydraulics, Fluid Mechanics and Hydraulic machine	R K Bansal	S.Chand
3.			
4.	Fluid Mechanics	A K Jain	Khanna Publishers
5.	Journal of experiments in Hydraulics	Rao and Hasan	New Height
6.	Hydraulic laboratory	Rao and Hasan	New Height
7.	Fluid Mechanics	Dr.M.L.Mathur	Std.Publication
8	Fluid Mechanics & Hydraulics	S.C.Gupta	Pearson Education
9.	Hydraulics and Hydraulic machine	Prof.V.P.Priyani	Charotar Publication

B. List of Major Equipment/Materials

1. Piezometer
2. U-Tube Manometer
3. Venturimeter
4. V-notch
5. U-notch
6. Pipes- PVC, G.I.,
7. Measuring Tank
8. Stop Watch
9. Gauge
10. Mercury

Or Hydraulic Bench equipped with all above equipments

C List of Software/Learning Websites

- i. www.waterbouw.tudelft.nl/
- ii. www.learnrstv.com
- iii. www.shiksha.com , IIT, Roorkee
- iv. www.blackwellpublishing.com
- v. www.hrpwa.org
- vi. www.creativeworld9.com
- vii. nptel.iitm.ac.in

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. P.A. Pandya**, Lecturer in Civil Engg. Deptt. – Govt. Polytechnic, Himatnagar
- **Prof. H. R. Mehta**, Lecturer in Civil Engg. Deptt. – C. U. Shah Polytechnic, Surendranagar
- **Prof. Anil K. Belani**, Lecturer in Civil Engg. Deptt. – Tolani F. G. Polytechnic, Adipur
- **Prof. Rina K. Chokshi**, Head, Civil Engg. Deptt. – Parul Institute of Engg. And Tech. (Diploma Studies), Limda, Vadodara.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. A K JAIN** , Professor , Department of Civil & Environmental Engineering
- **Prof J. P. Tegar**, Professor and Head Department of Civil & Environmental Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**Course Title: Structural Mechanics
(Code: 3330604)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering /Environment Engineering/Transportation Engineering	THIRD SEMESTER

1. RATIONALE

The Applied Mechanics in Second Semester was taught to study the external effects on the body due to action of force system. The behaviour of structure under different loading conditions is needed to understand so that design can do by the engineer. In this course, analysis of determinate structures under action of transverse loading, along with, analysis of members under direct loading is to be studied. Analysis of Industrial Trusses is also incorporated to give an idea of typical structure to the students. The Structural Mechanics-I, will enable the student to analyse Steel & Concrete Structures used in Civil Engineering construction.

2. COMPETENCY

Calculate various structural material properties under direct loading condition
Analyse Statically Determinate structures like Beam, Column & Truss.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	ESE	PA	ESE	PA	
04	01	02	07	70	30	20	30	150

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I DIRECT STRESS & STRAIN	1a. Calculate Material Properties Under Longitudinal & Lateral Loads 1b. Analyse Composite & Compound Sections 1c. Compute Strain Energy under Different Types of Loading	1.1 Different types of Structures and Loads 1.2 Direct Stress , linear Strain , Hook's Law Numerical Problems on Direct Stress & Linear Strain . Stress Strain curve of Mild Steel . Modulus of Elasticity. Yield , Breaking & Ultimate Stress and factor of Safety along with numerical problems 1.3 Lateral Strain and Poission's ratio with numerical problems 1.4 Basics Concepts of Shear Stress , Shear Strain & Shear Modulus 1.5 Bulk Modulus , volumetric Strain along with numerical Problems 1.6 Differentiate between Sudden , Gradual & Impact Loads Define Strain Energy , Proof Resilience for Sudden , Gradual & Impact Load along with numerical problems
Unit – II MOMENT OF INERTIA	2 Compute Moment of Inertia of Symmetric & asymmetric structural sections	2.1 Moment of Inertia & its Importance 2.2 Parallel & Perpendicular Axis Theorem 2.3 Formula of Moment of Inertia of solid & Hollow sections like Rectangle , Triangle , Circle 2.4 Moment of Inertia about C.G for I section , H section , Channel Section , Angle Section , T Section and Built up Section having flange plates to I & H Section and of Double Channels back to back & toe to toe
Unit – III S.F & B.M IN BEAM	3 Draw Shear Force & Bending Moment Diagram for Statically Determinate Beams	3.1 Statically Determinate Beam Like Cantilever , Simply Supported & Over Hang Beam 3.2 Shear Force and Bending Moment and its relationship 3.3 Sagging & Hogging Bending Moment and its importance 3.4 Point of Contra-flexure & its importance 3.5 S.F & B.M Diagram for Cantilever , Simply Supported & Over Hang Beam subjected to Point Load and/ or U.D.L
Unit – IV BENDING & SHEAR STRESSES IN BEAM	4 Apply Bending Theory. 4.1 Calculate Bending Stress 4.2 Draw stress distribution diagram	4.1 Bending Theory Equation Bending stress , Sectional Modulus , Nutral Axis Apply Bending theory to Statically determinate beams having rectangular or circular section 4.2 Shear Stress equation Shear Stress Distribution Diagram for

Unit	Major Learning Outcomes	Topics and Sub-topics
		Solid & Hollow Rectangular And Circular Section Apply shear Stress Equation & Draw Shear Stress Distribution Diagram for I , H , T , Channel & Angle Section
Unit – V ANALYSIS OF TRUSS	5. Analyse Statically Determinate Trusses	5.1 Perfect & Imperfect Truss 5.2 Various trusses for different spans and application 5.3 Analysis of Triangle , Howe , North Light & Fan trusses under Panel Point Loads using Graphical & Method of Joint
Unit – VI COLUMN & STRUT	6 Calculate Load carrying Capacity of Columns & Struts	6.1 Column & Strut 6.2 Short & Long Column 6.3 End Condition of Column and effective Length of Column & Modes of Failure in column 6.4 Radius of Gyration , Slenderness Ratio 6.5 Euler's Crippling Load 6.6 Rankin's load / Buckling Load of Column

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	DIRECT STRESS & STRAIN	10	02	02	06	10
II	MOMENT OF INERTIA	06	02	00	08	10
III	S.F & B.M IN BEAM	14	04	00	16	20
IV	BENDING & SHEAR STRESSES IN BEAM	10	04	00	06	10
V	ANALYSIS OF TRUSS	10	04	02	06	12
VI	COLUMN & STRUT	06	02	02	04	08
Total		56	18	06	46	70

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency.

Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Conduct Tension test on a given sample of mild steel and draw Stress Strain Curve	04
2	I	Determine Young's Modulus of wire of given material	02
3	I	Calculate impact value of mild steel using IZOD impact test apparatus	02
4	I	Calculate impact value of mild steel using Charpy impact test apparatus	02
5	I	Solve at least six problems pertaining to Unit – I	02
6	II	Work out Moment of Inertia of Fly Wheel	02
7	II	Solve Four Problems of Moment of Inertia	02
8	IV	Solve at Least Eight numerical Problems of Unit- IV	02
9	V	Analyse Truss using Graphical Method (At least THREE Trusses) and verify using analytical method.	06
10	VI	Demonstrate End Conditions of Column using suitable model/example	02
11	VI	Solve Least Six numerical Problems pertaining Unit - VI	02
		TOTAL	28
TUTORIAL			
1	III	Solve few problems of UNIT III and give similar exercises at least 12 to the students to practice	08
11	V	Solve PROBLEMS OF UNIT V and ask students to practice for at least 04 problems based on Method of Joint	06
		Total	14

7. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Visit Industrial Shed and submit a brief report of Different Types of Trusses and its Components are in use .
2. Survey the market and prepare a list of various type of Structural Steel Sections commonly used.

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1.	Strength of Material & Mechanics of Structures	Dr. B C Punamia	

2.	Strength of Material	S RAMAMURTHAN	
3.	Strength of Material	Timo Shanku	
4.	Theory of Structures	R S KHURMI	

B. List of Major Equipment/Materials

1. Universal Testing Machine
2. SEARL'S Apparatus to find Young's Modulus
3. Working Model of End Conditions of Column
4. IZOD Impact Test Apparatus
5. CHARPY Test Apparatus
6. FLY WHEEL

C List of Software/Learning Websites

1. nptel.iitm.ac.in/courses/.../IIT.../lecture%202023%20and%2024.htm
2. en.wikipedia.org/wiki/Shear_and_moment_diagram
3. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
4. www.engineerstudent.co.uk/stress_and_strain.html
5. https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

9. INSTRUCTIONAL STRATEGICS:

Subject Teacher may use Lecture, demonstration, video films field/industry visit as instructional strategies.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. **PROF. B G RAJGOR, H.O.D, APP. MECH. , BBIT , V V NAGAR**
2. **PROF. K VENKATESHWARLU , H.O.D, APP. MECH. , TFG POLYTECHNIC , ADIPUR**
3. **PROF. J H GABRA , I/C H.O.D , APP. MECH. , G.P , GODHARA**

Coordinator and Faculty Members from NITTTR Bhopal

1. **Dr. A K JAIN , PROFESSOR , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING**
2. **Prof J.P.Tegar, PROFESSOR AND HEAD , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING**

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

**SURVEYING
(Code: 3330605)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering, Environmental Engineering, Mining Engineering, Transportation Engineering	3 rd Semester

1. RATIONALE

Before development and planning process for any civil engineering or mining project, at first field survey of that area is carried out and various type of survey maps are prepared. These maps and drawing are used for taking various decisions regarding the planning, designing, estimation, execution and construction process etc.

The diploma pass outs/technicians should therefore know the various methods and instruments required for surveying. They should also have the skill and information to handle and operate the needed survey instruments. It is also important for them to be well aware about the use of advance surveying instrument such as total station, GPS and related software to enhance the knowledge and abilities required for surveying in field.

This course is therefore one of the core courses required for civil, mining, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey related works.

2. COMPETENCIES (Programme Outcomes according to NBA Terminology):

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies.

- 1. Carry out civil engineering survey to prepare drawings & maps**
- 2. Interpret the drawings and maps for calculating different physical quantities like length, area, volume, elevations etc.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	250
3	0	6	9	70	30	60	90	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Introduction and Scale	1.a Explain the basics of surveying. 1.b Apply various types of scale as per needs.	1.1 Definitions 1.2 Objective and uses of surveying 1.3 Plain and Geodetic Survey 1.4 Classification of Survey 1.5 Principals of Survey 1.6 Types of Scale and selection of scale 1.7 Construction of diagonal scale
Unit – II Chain Survey	2.a Explain procedure for linear measurements. 2.b Prepare drawing as per recorded measurements in the field book.	2.1 Introduction 2.2 Instruments used in chain survey Metric Chain, Tapes, Arrow, Tapes, Ranging rod, Offset rod, Open cross staff, optical square 2.3 Technical terms related with chain survey Survey Station, Base line, Check line, Tie line, Offset, Tie station 2.4 Method of Chaining 2.5 Errors in length due to incorrect length and related problems. 2.6 Obstacles in chaining 2.7 Ranging -Direct Ranging & Indirect Ranging 2.8 Types of offsets -Perpendicular & Oblique 2.9 Location Sketch of survey station and running measurements of building. 2.10 Conventional Signs 2.11 Recording of measurements in a field book
Unit – III Compass Survey	3.a Explain procedure for angular measurements. 3.b Record bearing accurately 3.c Prepare drawing as per recorded and corrected measurements of bearings with chain and compass survey	3.1 Introduction - Triangulation Survey & Traversing 3.2 Components of Prismatic Compass 3.3 Functions of different parts of prismatic compass 3.4 Differentiate Prismatic and Surveyor compass 3.5 Method to use Prismatic Compass 3.6 Technical Terms - True Meridian & Bearing, - Magnetic Meridian & Bearing, - Arbitrary Meridian & Bearing, - Dip of Magnetic needle - Declination, - Fore Bearing & Back Bearing 3.7 Whole Circle Bearing System and

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		Reduced Bearing System & examples on conversion of given bearing to another bearing (from one form to another) 3.8 Method of finding included angles from bearings & examples 3.9 Local attraction and Closing error with relevant examples 3.10 Errors in compass survey and elimination of errors
Unit – IV Levelling	4.a Explain different methods and their procedure for levelling. 4.b Explain procedure for using the instruments and levelling staff and entering level in proper table 4.c Carryout corrections for errors in levelling records if any 4.d Prepare contour maps by calculating Reduce level as per data book.	4.1 Introduction 4.2 Basic terminology related with levelling like Level surfaces, Horizontal & vertical surfaces, Datum, Bench Marks, Reduced Level, Rise, Fall, Line of collimation, Axis of Telescope, Axis of bubble tube, Station, Back sight, Fore sight, intermediate sight, Change point, Height of instruments, Focusing and parallax, etc. 4.3 Types of Level Dumpy Level, Tilting Level, Auto Level, Digital Level 4.4 Components of Dumpy Level with neat sketch 4.5 Types of Levelling Staffs Self-reading staff & Target staff 4.6 Temporary adjustment of Level 4.7 Classification of Levelling - Simple Levelling, Differential Levelling, Fly Levelling, Profile Levelling, Reciprocal Levelling and Precise Levelling 4.8 Examples & methods of finding out the R. L. in Level Book by H.I. Methods and Rise & Fall Methods with necessary check. 4.9 Correction for Curvature and refraction and related examples 4.10 Errors in Levelling 4.11 Contour 4.12 Uses of contours 4.13 Characteristics of contours 4.14 Methods of Contouring

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		4.15 Interpolation of contours 4.16 Preparing drawing & estimation of gradients 4.17 Calculation of capacity of reservoirs & related examples
Unit – V Plane Table Survey	5.a Explain procedure for plain table survey 5.b Prepare drawing as per field conditions and requirements. 5.c Find the areas from prepared drawings	5.1 Introduction to Plane Table surveying 5.2 Equipments and accessories of plane table survey 5.3 Advantages and disadvantages of plane table survey 5.4 Orientation of plane table survey 5.5 Methods of setting up plane table over the station 5.6 Points to be kept in mind during plane table surveying 5.7 Errors in plane table surveying
Unit – VI Introduction to Global Positioning System (GPS)	6.a Appreciate the applications of GPS in civil engineering	6.1 Introduction to GPS 6.2 Maps & types of digital map 6.3 Fundamentals of GPS 6.4 Uses of GPS 6.5 GPS Receivers(Hand Held GPS Receivers) 6.6 Field procedures of GPS 6.7 Observations and applications in Civil Engineering

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction and Scale	04	00	04	03	07
2	Chain Survey	06	02	02	06	10
3	Compass Survey	08	04	04	06	14
4	Levelling	14	04	10	12	26
5	Plane Table Survey	06	03	03	03	09
6	Introduction to Global Positioning System (GPS)	04	02	02	00	04
Total		42	15	25	30	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

Unit No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA terminology)	Approx. Hrs. Required	
		For lab./Field	For Project
II and III	Perform ranging and chaining operations in different field conditions.	04	
	Perform chaining and ranging where different types of obstructions are present.	04	
	Take offsets (Perpendicular and Oblique) in different field conditions.	04	
	Perform temporary adjustments of Prismatic Compass	04	
	Determine bearings of different survey lines by using Prismatic Compass	04	
	Determine included angles from measured bearings.	04	
	Project in chain, tape and compass Survey: survey the given area /field and prepare the drawing sheet - Minimum Five Station		08
IV	Perform temporary adjustments of Level	04	
	Take and record the level reading in the level book	04	
	Determine Reduced level using both methods by applying checks	04	
	Carry out fly levelling in different field conditions.	04	
	Carry out profile levelling in different field conditions	04	
	Project in Profile Levelling: Carry out the levelling survey on an undulated ground and prepare the drawing sheet (minimum area under survey 100m X 60 m)		12
V	Set plane table by different orientation methods on given survey station	04	
	Project in Plane Table Survey: - Prepare map of open vacant land (min 1000 sq.m) using any plane table method		12
VI	Demonstrate use of Global Positioning System (GPS)	04	--
Total(84)		52	32

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.

	Unit No.	Student Activities
1	I	Prepare a list of tools and equipment used in chain and Tap survey
2	II	Interpret the old map/drawing prepared using compass survey
3	III	Practice for temporary adjustment of Level
4	IV	Read and interpret the old field book data of fly levelling survey
5	V	Handle the GPS under supervision of teachers

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- a. Lecture cum demonstration of handy tools of surveying
- b. Field demonstration
- c. Hands on experience
- d. Case study of old survey maps and contours

9. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Surveying and levelling Vol-I	T. P. Kanetkar & S. V. Kulkarni	Puna Vidyarthi Griha Prakashan
2	Surveying and Levelling Vol-I	Dr. B. C. Punmia	Laxmi Publications Pvt. Ltd.
4	Surveying and Levelling Vol-I	Hussain & Nagrani	S. Chand New Delhi
5	Surveying	Mimi Das Saikia	PHI Learning Pvt. Ltd
6	Fundamentals of Surveying	S. K. Roy	PHI Learning Pvt. Ltd
7	CD Programme on GPS and GIS	Learning Materials Development Project	NITTTR, Taramani, Chennai

B. List of Major Equipment/Materials:

- i. Metric Chain, Tapes, Open Cross staff, Optical Square, Prismatic Compass, Surveyor's
- ii. Compass, Dumpy Level, Tilting Level, Auto Level, Levelling Staff, Target Staff, Plane Table And its accessories, GPS, other misc. equipments, etc.

C. List of Software/Learning Websites

- i. www.Autodesk.com
- ii. www.drawingnow.com
- iii. www.learn-to-draw.com

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

1. **Dr. K. G. Mehta**, Principal, Merchant Engg. College, Visnagar
2. **Prof. Prakash Kalyani**, L.C.E, Tolani FG Polytechnic, Adipur
3. **Prof. Prakash D. Gohil**, L.C.E, Sir B. P. T. I., Bhavanagar
4. **Prof. Vyom B. Pathak**, L.C.E, BVPIT (DS) Umarakh Ta-Bardoli

Coordinator and Faculty Members from NITTTR Bhopal

1. **Dr. J. P. Tegar**, Professor & Head Department of Civil and Environment Engineering
2. **Dr. K. K. Pathak**, Professor, Department of Civil and Environmental Engineering