

**CURRICULUM FOR**

**DIPLOMA IN**

**CONSTRUCTION TECHNOLOGY**

**SEMESTER I, II, III, IV, V, VI, VII &**

**VIII**

**PROGRAMME STRUCTURE**

**SET I**

**Semester - I**

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
<b>GN102</b>	Engg. Maths - I	4	2	-	6	75	25			100
<b>GN103</b>	Applied Physics-I	4		2	6	75	25	-	50	150
<b>GN106</b>	Basic Engg.Skills	-	-	6	6	-	-	50	100	150
<b>GN105</b>	Comp. Fund & App.	-	-	4	4	-	-	50	50	100
<b>GN203</b>	Environmental Studies	3			3	75	25	-	-	100
<b>Total</b>		<b>11</b>	<b>2</b>	<b>12</b>	<b>25</b>	<b>225</b>	<b>75</b>	<b>100</b>	<b>200</b>	<b>600</b>

**Semester - II**

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
<b>GN202</b>	Applied Physics-II	4	-	2	6	75	25	-	50	150
<b>GN201</b>	Engg. Maths II	4	2	-	6	75	25	-	-	100
<b>GN104</b>	Applied Chemistry	3		2	5	75	25	-	50	150
<b>GN101</b>	Communication skills	-	-	2	2	-	-	50	50	100
<b>GN205</b>	Engg. Materials	4	-		4	75	25	-	-	100
<b>GN204</b>	Engg. Drawing	2	-	4	6	-		50	50	100
<b>Total</b>		<b>17</b>	<b>2</b>	<b>10</b>	<b>29</b>	<b>300</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>700</b>

## SEMESTER I

### GN 102 ENGINEERING MATHEMATICS- I

#### 1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

#### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
<b>GN-102</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/OR</b>	<b>100</b>
Engineering Mathematics	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

#### 3. DETAILED COURSE CONTENTS

##### Unit 0 Fundamentals of algebraic mathematical operations

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

<b>Unit 1</b>	<b>Co-ordinate Geometry/ Analytic Geometry;</b>
	Purposes/Applications of Co-ordinate Geometry. Coordinate systems. <i>Straight Line</i> -Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.
<b>Unit 2</b>	<b>Trigonometry</b>
	Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles( only $2A$ ). Sum & product formulae. Sine, Cosine rules. Solution of triangles
<b>Unit 3</b>	<b>Limits &amp; Functions</b>
	Functions- constants, variables. Kinds of functions ( question not to be asked ). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)
<b>Unit 4</b>	<b>Differential Calculus</b>
	Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.
<b>Unit 5</b>	<b>Application of derivatives</b>
	Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	14	20
2	Trigonometry	17	16
3	Limits & Functions	8	12
4	Differential Calculus	15	20
5	Application of derivatives	10	07
		<b>64</b>	<b>75</b>

**5. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal  Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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**GN 103 APPLIED PHYSICS-I**

**1. RATIONALE:**

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics. This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)				Total Credit	Examination Scheme				Total Marks
						Theory Marks		Practical Marks		
GN-103 Applied Physics I	L	T	P	C	TH	TM	TW	PR/OR	150	
	4	-	2	6	75	25	50	-		

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks;

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 UNITS & DIMENSIONS**

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

**Unit 2 KINEMATICS**

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.  
Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration.  $V=u+at$ ,  $S=ut + \frac{1}{2}at^2$ ,  $v^2 = u^2 + 2as$ . Velocity- time diagram, Motion under gravity.

**Unit 3 PROPERTIES OF MATTER**

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

**Unit 4 HEAT**

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of coefficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor  
Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

**Unit 5 ELECTROSTATICS**

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

**Unit 6 MAGNETISM**

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current ( no derivation), Force acting on straight conductor placed in Magnetic Field ( no derivation).

**Unit 7 (A) LAWS OF FORCES & FRICTION ( MECHANICAL AND ALLIED GROUPS)**

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components. Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose( only qualitative aspects)

**OR**

**UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)**

Energy Band structure of electronic material( conductor , semiconductor and insulator)  
Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.  
Types of semiconductors P- type and N- type, Structure of P- type and N- type, Extrinsic semiconductor using pure Si and Ge semiconductors.  
Types of carriers; N- type and P- type  
Process of recombination of carriers.  
Formation of P-N junction and depletion region.

**4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	<b>OR</b>		
7B	Semiconductors	8	12
	Total	<b>64</b>	<b>75</b>

**7A-Mechanical and allied branches**

**7BFor Electronics and allied branches**

**5. SUGGESTED LIST OF EXPERIMENTS**

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.



**6. SUGGESTED LEARNING RESOURCES**

<b>Sr.No.</b>	<b>Author</b>	<b>Title</b>	<b>Publication and Year</b>
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

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**GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS**

**1. RATIONALE**

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
<b>GN-105</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/OR</b>	<b>100</b>
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	

*Minimum passing % : Theory 40%*

**Legends:**

**L-**Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;  
**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENTS**

**UNIT 1 Computer Fundamentals**

1. Introduction to Computer
2. History, Evaluation, Classification and Generations of computers
3. Organisation of the Computer System
4. Hardware
  - Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner
  - Printers.
5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

**UNIT 2 Operating System**

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

**UNIT 3 Application Software**

**1. MS Word**

- Introduction
  - Starting MS Word
  - Creating, saving and opening a document
  - Editing commands-Cut, Copy, Paste, Paste Special
  - Text Formatting, Bullets and Numbering, Borders and shading etc.
  - Tabs, Style, Views
  - Insert Table, Picture, OLE Objects, etc.
  - Checking Spelling and Grammar, Thesaurus
  - Page Layout & Printing
  - Mail Merge.

**2. MS Excel**

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet
- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

### 3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

### UNIT 4 The Internet

#### Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

#### Email

- Manage an E-mail Account  
E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

### 4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	1	Identify Input and output devices
2	1	Calculate capacity of different storage device
3	2	Identify OS and different application software s loaded on that OS
4	3	Load Windows operating system. Configure and load relevant device drivers

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5	4	<p>Practice on Windows 95/98/2000 ;</p> <ul style="list-style-type: none"> <li>o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows</li> <li>o Study of file organization: creating, copying, moving, renaming and deleting</li> <li>o Practice on Windows Accessories- Notepad, Word Pad and Paint</li> <li>o Editing document &amp; formatting text, Previewing and printing document/Image file</li> <li>o Practice on Windows Explorer</li> <li>o Recycle bin</li> <li>o Shutting down windows</li> </ul>
6	4	<p>Practice on MS-Word ;</p> <ul style="list-style-type: none"> <li>o Create and format document</li> <li>o Edit and Modify text- changing font size type and style</li> <li>o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text</li> <li>o Open save and print a document</li> <li>o Insert, modify table</li> <li>o Insert graphics</li> <li>o Mail merge</li> </ul>
7	5	<p>Practice on Microsoft Excel</p> <ul style="list-style-type: none"> <li>o Create, save &amp; format worksheet</li> <li>o Open and save worksheet file</li> <li>o Edit &amp; modify data</li> <li>o Use formula and functions</li> <li>o Split windows and freeze pans</li> <li>o Data sort and security features</li> <li>o Create, edit, modify and print worksheet.</li> <li>o Create and edit charts</li> </ul>
8	5	<p>Practice on PowerPoint</p> <ul style="list-style-type: none"> <li>o Create, edit, insert, move, slides</li> <li>o Open and save presentation</li> <li>o Insert picture, audio slide layout, action button</li> <li>o Apply custom animation</li> <li>o Present slide show</li> </ul>
9	6	<p>Practice on:</p> <ul style="list-style-type: none"> <li>o Identification of type of Account.</li> <li>o Connecting to internet</li> <li>o Dial up access</li> <li>o Web browsing</li> <li>o Searching websites</li> <li>o Information searching</li> <li>o Email services</li> <li>o Creating email accounts &amp; Receiving and sending mails</li> </ul>

**5. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6 <sup>th</sup> Edition, 2005  ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi,  ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi,  ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi,  ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3 <sup>rd</sup> Edition,  ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003  ISBN: 8186340742

## GN 106 BASIC ENGINEERING SKILLS

### 1. Rationale:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a thorough exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

### 2. Teaching And Examination Scheme

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
(GN106) Basic Engineering Skills	L	T	P	C	TH	TM	PR/OR	TW	150
		0	0	6	6	-	-	50	

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

### 3. Detailed Course Contents

#### **Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid**

Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.

#### **Unit 2: Fitting Workshop Practice**

Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.

#### **Unit 3: Carpentry Workshop Practice**

Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.

#### **Unit 4: Electrical Workshop Practice**

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Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.

### **Unit 5: Basic Electronics Workshop Practice**

Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

**Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)**

<b>Unit No.</b>	<b>Topic</b>	<b>Hours/ Semester</b>
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	<i>Total</i>	<b>96</b>



**GN203 ENVIRONMENTAL STUDIES**

**1. RATIONALE**

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
<b>GN203</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/O R</b>	<b>100</b>
<b>Environmental Studies</b>	3	-	-	3	75	25	-	-	

*Minimum passing %: Theory 40%*

*Duration of Theory Paper: 3 Hrs.*

**3. DETAILED COURSE CONTENT**

**Unit 1 Multidisciplinary Nature Of Environmental Studies.**

Definition, scope and importance. Need for public awareness.

**Unit 2 Natural Resources**

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

### **Unit 3 Ecosystems.**

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

### **Unit 4. Biodiversity And Its Conservation.**

Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

### **Unit 5. Environmental Pollution.**

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

### **Unit 6. Social Issues And The Environment.**

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

### **Unit 7. Human Population And The Environment.**

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV /

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AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.

### Unit 8. Field Work.

Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

#### 5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).

## Directorate of Technical Education, Goa State

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4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. ( Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

### 6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

### 7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	

## SEMESTER II

### GN 101 COMMUNICATION SKILLS

#### 1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

#### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
GN-101 Communication Skills		-	2	2	-	-	50	50	100

Minimum passing % : Practical 40%

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

#### 3. DETAILED COURSE CONTENTS

##### **Unit 1 - Fundamental of Communication skills**

Definition, components (message, sender, receiver, transmission medium and protocol), types (verbal & no-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications (verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

**Unit 2 – Presentation Skills**

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

**Unit 3 - Technical Reports, Letter Writing, CVs**

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

**Unit 4 - Soft Skills**

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

**Unit 5 - Language Workshop**

The Reading, Listening, Writing, Speaking Skills will be tested

**1. Reading Skills:**

Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

**2. Listening Skills:**

Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

**3. Writing Skills:**

- a) Students to write on any given topic
- b) Students to compose their own stories
- c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

### 4. Speaking Skills:

- a) Students to speak on any given topic
- b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

### 4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

### 5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

**GN 104 APPLIED CHEMISTRY**

**1. RATIONALE**

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks	Practical Marks			
GN-104 Applied Chemistry	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

**Legends:**

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks;  
PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 Atomic Structure and Chemical Bonding**

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1<sup>st</sup> three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, CaCl<sub>2</sub>) covalent compounds (Cl<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>) and coordinate compounds (O<sub>3</sub>, SO<sub>2</sub>).



**Unit 2 Electrochemistry**

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series-concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous CuSO<sub>4</sub> using platinum electrodes iv. aqueous CuSO<sub>4</sub>, using copper electrodes);

**UNIT 3 Water and its treatment**

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation ( no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

**Unit 4 Corrosion and Its Control**

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

**Unit 5 Lubricants**

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)**

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	<b>48</b>	75

**5. SUGGESTED LIST OF EXPERIMENTS**

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permanganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

**6. SUGGESTED LIST OF ACTIVITIES**

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

**7. SUGGESTED LEARNING RESOURCES**

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Publishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

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**GN201 ENGINEERING MATHEMATICS- II**

**1. RATIONALE :**

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

**2. TEACHING AND EXAMINATION SCHEME :**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
<b>GN-201</b> Engineering Mathematics-II	4	2	-	6	75	25	-	-	100

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks; PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. DETAILED COURSE CONTENT :**

<p><b>Unit 1 Determinants</b> Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule</p>
<p><b>Unit 2 Binomial Theorem</b> - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).</p>
<p><b>Unit 3 Mensuration</b> - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule</p>
<p><b>Unit 4 Matrices</b> Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.</p>
<p><b>Unit 5 Integral Calculus</b> Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration, area under a plane curve, volume of revolution.(simple sums only)</p>

**Unit 6 Differential Equations**

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type  $d^2y/dx^2 = f(x)$  only, Application of differential equation in engineering problems

**Unit 7 Statistics (Mechanical and Allied Engg. Branches)**

Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode. Measures of dispersion for grouped and ungrouped data -range, mean deviation, standard deviation, variance and co-efficient of variation

**OR**

**Unit 7 Complex Numbers. ( Electronics engg and Allied branches)**

Definitions, Argand diagrams, polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-Moivre's theorem, roots of a complex number- Cube roots of unity, n th roots of unity, hyperbolic functions

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY) :**

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	5	7
2.	Binomial Theorem	7	10
3.	Mensuration	7	10
4.	Matrices	11	08
5.	Integral Calculus	17	20
6.	Differential equations	08	10
7.	Statistics	09	10 \$
<b>OR</b>			
7	Complex Numbers	09	10 #
	Total :	64	75

**\$-** for Mechanical and allied branches

**#** - For Electronics and allied branches

**5. SUGGESTED LEARNING RESOURCES :**

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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**GN 202 APPLIED PHYSICS-II**

**1. RATIONALE:**

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-202 Applied Physics-II	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks;

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 FORCE, WORK, POWER, AND ENERGY**

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

**Unit 2 CURRENT ELECTRICITY**

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire.

Principle of potentiometer. Comparison of EMF of a given cell by single cell method.

Comparison of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

**Unit 3 ELECTROMAGNETISM**

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

**Unit 4 LOGIC GATES**

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10  
Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

**Unit 5 SOUND**

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.  
Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

**Unit 6 CIRCULAR MOTION AND GRAVITATION**

Defination of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Defination and concept of Centripetal and Centrifugal Force. (No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

**Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES  
(MECHANICAL AND ALLIED GROUPS)**

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

**Unit 7 (B) RECTIFIERS  
(ELECTRONICS AND ALLIED GROUPS)**

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation,  $((V_{NL} - V_{FL}) / V_{FL}) \times 100$   
Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation  
Bridge rectifier, working, input and output waveforms, percentage regulation

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK, POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARENESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	<b>64</b>	<b>75</b>

**7A- for Mechanical and allied branches**

**7B- For Electronics and allied branches**

**5. LIST OF EXPERIMENTS**

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

**6. SUGGESTED LEARNING RESOURCES**

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	



**GN 204 ENGINEERING DRAWING**

**1. RATIONALE:**

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
GN-204 Engineering Drawing	2	-	4	6	-	-	50	50	100

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. DETAILED COURSE CONTENT**

<p><b>Unit 1 Introduction</b></p> <ul style="list-style-type: none"> <li>• Importance of Engineering drawing as a means of communication.</li> <li>• Introduction to drawing equipment, instruments and their uses.</li> <li>• Planning of drawing sheet as per I.S. 696 - 1972.</li> <li>• Indian standard practices of laying out and folding of drawing</li> <li>• Different types of lines used in engineering drawing.</li> <li>• Importance of scale in Engineering Drawings.</li> <li>• Lettering</li> </ul>
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**Unit 2 Dimensioning techniques and standard conventions**

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

**Unit 3 Engineering Curves & Shapes**

- Construction of an Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
  - Ellipse- by focus & directrix method and arcs of circles method
  - Parabola- by focus & directrix method and rectangle or oblong method
  - Hyperbola- by transverse axis & Focus and directrix method
  - Cycloid- by generating circle rolling on a straight line
  - Involute of a triangle, circle & pentagon
  - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

**Unit 4 Orthographic projection**

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
  - (i) Parallel to both Principal planes
  - (ii) Parallel to one and Perpendicular to other Principal plane.
  - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids  
Cylinder, cone, cube.  
  
Right regular solids such as
  - (i) Prism: Triangular & Square
  - (ii) Pyramid: Square & Pentagonal.
    - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.

- Conversion of simple pictorial views into orthographic views.
- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

**Unit 5 Section of solids**

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

**Unit 6 Development of lateral surfaces**

- Concept and importance of surface development in the engineering field.  
Methods of development of surfaces-Radial & Parallel line method.  
Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

**Unit 7 Isometric Views**

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS**

<b>Unit No.</b>	<b>Unit</b>	<b>Teaching Hours / Semester</b>
1	Introduction	<b>1</b>
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	<b>13</b>
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	<b>Total</b>	<b>32</b>

## Directorate of Technical Education, Goa State

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### 5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involute, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants.  Drawing of projections of lines in following positions  (i) Parallel to both Principal planes  (ii) Parallel to one and Perpendicular to other Principal plane.  (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube.  Right regular solids such as Prism: Triangular & Square, Pyramid: Square & Pentagonal, when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views. (atleast 2 problems each in 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)	8

## Directorate of Technical Education, Goa State

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9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids-  Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

### 6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher, Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher, Anand

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**GN 205 ENGINEERING MATERIALS**

**1. RATIONALE:-**

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
<b>G-205</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/OR</b>	<b>100</b>
Engineering Materials	4	-	-	4	75	25	-	-	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

**3. COURSE CONTENTS**

**Unit 1 Introduction to Engineering Materials**

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

## **Unit 2 Ferrous & Non-Ferrous Metals & its Alloys**

### ➤ **Ferrous alloys.**

- Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
- Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
- Alloy steels.
  - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
  - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
- Tool steel – composition, HSS, High carbon steel, properties & uses.

### ➤ **Non-ferrous Metals & alloys**

- Aluminium – Properties & uses.
- Aluminium alloys – constituents of alloy & their effect on properties of metal
- Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
- Copper – Properties & uses.
- Copper alloys – Constituents of alloy & their effect on properties of metal.
- Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
- Properties & uses of lead & its alloys.

## **Unit 3 Non – Metallic materials**

- Refractory
- Desirable properties.
- Difference between acid, basic & neutral refractories.
- Properties & uses of Fire clay refractory, silica refractory.
  - Plastic
- Classification table only.
- Properties & uses of Thermosetting & Thermoplastic.
  - Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
  - Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.



- Vulcanization process.
  - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.
  - Introduction to composite materials. Classification diagram only.

**Unit 4 Conductor, Semi Conductor, Insulating and Magnetic Materials.**

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
  - High conductivity materials
    - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
    - Their properties as conducting materials and applications.
  - High resistivity materials
    - hichrome, constantan, manganin
    - Their applications
- Insulating materials
  - Introduction
  - Characteristics of Good Insulating materials
  - Solid Insulating materials
    - Wood, paper, rubber, mica, glass fibre, porcelain, varnish, PVC, Resins.
  - Their characteristics as insulating materials and applications.
  - Liquid insulating materials
  - Mineral oil, its properties as insulating material and applications.
  - Gaseous insulating materials like air, Nitrogen, Sulphur hexafluoride & their applications.
- Semiconductor Materials.
  - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.
  - Classification as:
    - \* Dia Magnetic
    - \* Para Magnetic
    - \* Ferromagnetic
    - \* Non magnetic

List of these materials and their applications.

**Unit 5 Construction Materials**

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
  - Lime – Sources. Properties, uses.
  - Clay – Different building products from clay like tiles, pipes etc.
  - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
  - Sand – Sources: rivers, crushed aggregates, characteristics uses.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	04	09
2	Ferrous & Non-Ferrous Metals & its Alloys	16	18
3	Non – Metallic materials	12	12
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	16	18
5	Construction Materials	16	18
		<b>64</b>	<b>75</b>

## Directorate of Technical Education, Goa State

### DIPLOMA IN CONSTRUCTION TECHNOLOGY Semester - III

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
CS301	Engg. Mechanics	3	1	2	6	75	25	-	50	150
CE301	Surveying-I	3		4	7	75	25	25	50	175
CE302	Building Construction	3	1		4	75	25		25	125
CS305	Computer Aided Drafting	-		4	4			50	50	100
CE303	Concrete Technology	3		2	5	75	25	25(O)	25	150
CE304	Transportation Engg. I	4			4	75	25			100
<b>Total</b>		<b>16</b>	<b>2</b>	<b>12</b>	<b>30</b>					<b>800</b>

**CS 301 ENGINEERING MECHANICS**

**1. RATIONALE:** The focus of the course is to study rigid bodies, subjected to motion or equilibrium with the particular emphasis of engineering applications. This course plays a key role in engineering and is a pre-requisite for all design applications. Basic understanding of the concepts and principles involved in mechanics is essential. The concepts in Applied Mechanics form the base of all engineering disciplines. Applications of principles to engineering situations is emphasized in this course. Considering the level of student, concepts are difficult; hence classroom demonstration should be used to explain concepts and principles.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
<b>CS301 ENGINEERING MECHANICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>PR /OR</b>	<b>TW</b>	<b>150</b>
	<b>3</b>	<b>1</b>	<b>2</b>	<b>6</b>	<b>75</b>	<b>25</b>	<b>-</b>	<b>50</b>	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Force</b>	<p>Definition &amp; units of Force, Types of Forces, its Characteristics, Effect of Forces, System of Forces, Resolution &amp; Composition of Forces (Resolving along X &amp; Y Axis only).</p> <p>Relationship between Resultant &amp; Equilibrant Force.</p> <p>Application of Resolution to find Resultant of coplanar concurrent Force System, and Finding missing force when resultant is given.</p>
<b>Unit 2</b>	<b>Moments</b>	<p>Definition and units, Sign conventions (Take clockwise +ve, Anticlockwise -ve)</p> <p>Definition &amp; units of couple (clockwise +ve, Anticlockwise -ve)</p> <p>Characteristics of couple, Varignon's Theorem,</p> <p>Application of above to find Resultant in magnitude, direction and line of action in Coplanar Non- concurrent and parallel Force system.</p>

**Unit 3                      Equilibrium**

Concepts of Equilibrium, Conditions of Equilibrium for Two forces, Three forces, concurrent & non concurrent force system, Lami's Theorem and its application..

Concepts and drawing of Free Body Diagram involving not more than three bodies.

Definition of Beam, types of beams, types of Supports and types of loading.

Application of Equilibrium to beams ( Beams with two supports at the ends, Beams with overhangs) with Concentrated loading, UDL, Partially UDL Loading only.

Applications of Equilibrium to determine the forces in the member of the perfect simple support and cantilever truss using method of Joints. Graphical method/ Maxwell diagram for determination of forces in the member of truss.

**Unit 4                      Friction**

Definition, Coulombs Law of static friction, coefficient of friction, Angle of friction, Cone of friction, Angle of Repose

Application of Friction with a block on horizontal and inclined Plane , Ladder friction.

**Unit 5                      Kinetics**

D'Alembert's Principle and its Application

Simple problems related to Motion of Lift, Two connected bodies with a single string, suspended on horizontal and inclined planes.

**Unit 6                      Momentum, Impulse & Impact**

Definition and units of Momentum and Impulse

Definition of impulsive force

Law of Conservation of Momentum.

Simple problems related to Momentum and Impulse, impulsive force, Law of Conservation of Momentum

**Unit 7                      Work, Power & Energy**

Definition and units of Work, Power and Energy.

Forms of Energy – Kinetic and Potential Energy.

Principle of Conservation of Energy;

Simple numerical problems to calculate Work, Power, Energy & conservation of Energy

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Force	5	9
2	Moments	4	9
3	Equilibrium	12	18
4	Friction	6	9
5	Kinetics	9	12
6	Momentum, Impact & Impulse	4	6
7	Work, Power & Energy	8	12
		48	75

**5. List of Experiments**

**(A) Any 06 of the following experiments**

1. To Verify Polygonal Law of forces.
2. To Prove Lami's Theorem.
3. To find Co-efficient of Friction.(Any Two Surfaces)
4. To Determine Reactions in Beam Apparatus.
5. Four experiments on Lifting Machine to find M.A, V.R , Efficiency, and to obtain

Law

of Machine.

**(A) Graphical Analysis: - 3 sheets (Half Imperial)**

1. Determination of Resultant of Coplanar Concurrent Forces.
2. Determination of Resultant of Coplanar, Non-concurrent Forces and Parallel.
3. Analysis of Trusses (Simply supported and Cantilever) using Maxwell diagram.

**6. LEARNING REFSOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Dadhe, Jamdar, Walavalkar	Fundamental of Applied Mechanics	Sarita Prakashan, Pune
2	R.S. Khurmi	Applied Mechanics	S. Chand & Co. Ltd, New Delhi
3	A.R. Basu	Engineering Mechanics	Tata McGraw Hill Company, New Delhi
4	R.C. Patel & B.M. Patel	Applied Mechanics Vol. I	Acharya Book Depot, Vadodara
5	M N Patel, C S Sanghavi & J S Thakur	Engineering Mechanics	Mahajan Publishing House, Ahmedabad

**CE301 SURVEYING I**

**1. RATIONALE:** Surveying is one of the core subjects for civil engineering course wherein principles and method of different types of survey are studied. The course content is designed to: Train the students to study and carry out surveying & levelling operations independently on the field. Develop the ability to apply knowledge to the solution of day to day problems on construction site; to develop the skills in handling various survey instruments.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
SURVEYING -I	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	4	7	75	25	50	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Introduction</b>
Scope of surveying, classification of survey, . general principles of survey	
<b>Unit 2</b>	<b>Chain Surveying</b>
Study of 30m chain. Instruments for marking stations, ranging rods, pegs, arrows, cross staves. Ranging-Direct and indirect ranging, chaining on sloping ground. Triangulation, selection of survey stations, baseline; check-line, tie line, taking offsets to locate ground features; Conventional signs on survey maps viz. Cutting, embankment, marshy land, road, railway, stream, river etc. Calculation of areas from recorded observation in chain and cross-staff survey. Errors in chaining, precautions and obstacles in chaining	
<b>Unit 3</b>	<b>Compass Surveying</b>
Prismatic compass – Component parts, construction and use. Bearing of a line – Fore bearing and back bearing, whole circle and quadrantal system, reduced bearing, conversion of bearing, finding included angles from bearings; Open and close traversing. Local attraction - Reasons, error due to local-attraction. Correction of bearings affected by local attraction. Simple problems.	



**Unit 4                      Levelling**

Definition – Level surface, level line, horizontal line, vertical line, datum surface, reduced level, benchmark & its types – temporary, permanent, GTS benchmark. Dumpy level & its component parts, fundamental axes of dumpy level. Levelling staff – Telescopic type; Terms used in levelling - Fore sight, back sight, Intermediate sight, change point and height of collimation; Classification of levelling - Simple, differential, profile levelling and cross-sectioning, fly levelling. Recording in levelling book-Height of collimation method, rise and fall method, arithmetic checks, problems in H.I. method. Sources of errors, precautions to eliminate the errors.

**Unit 5                      Plane Table Survey**

Principles of plane table survey, accessories required. Setting of Plane table, levelling, centering and orientation. Method of plane table surveying – radiation and intersection, Use of Telescopic alidade. Merits & demerits of plane table survey.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Introduction	2	4
2	Chain Surveying	8	16
3	Compass Surveying	14	22
4	Levelling	20	27
5	Plane Table Survey	4	6
		48	75

**5. TERM WORK & PRACTICALS**

Practicals shall include following:

1. Study of Chains – 20m, 30m, tapes – metallic, steel , fibre glass, ranging rods, arrows, pegs, cross staff (all with sketches)
2. Direct ranging – measuring a distance on a sloping ground.
3. Reciprocal ranging, ranging & chaining a distance across obstacles.
4. Study of prismatic compass, measurement of bearings and calculation of included angles.
5. Study of dumpy level (Ready made sketch of the instrument to be referred & no drawing of instrument required).
6. Practice on simple levelling & differential levelling
7. Profile levelling and cross levelling – fly levelling & checks.
8. Study of plane table, adjustments. Plane table methods of intersection & radiation.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	N. N. Basak	Surveying and Levelling	McGraw Hill Education (India) Private Limited.
2	B. C. Punmia	Surveying (Volume – I & II)	Laxmi Publication Ltd.
3	S. K. Duggal	Surveying (Volume – I & II)	McGraw Hill Education
4	S. S. Bhavikatti	Surveying and Levelling(Volume – I & II)	I. K. International Publishing House Pvt Ltd.
5	S. V. Kulkarni, T. P. Kanetkar	Surveying and Levelling(Volume – I & II)	Pune Vidyarthi Griha Prakashan, Pune
6	K. R. Arora	Surveying (Volume – I & II)	Standard Publishers Distributors

**CE 302 BUILDING CONSTRUCTION**

**1. RATIONALE:** The students are required to know: Construction materials used in different components of buildings, construction methods and sequence of procedures in detail. Sketch and understand detailed drawings of parts of buildings. Students should be able to explain the procedures to workers/mistries on the site with the help of sketches.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)				Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	
BUILDING CONSTRUCTION	L	T	P	C	TH	TM	TW	PR/OR	125
	3	1	-	4	75	25	25	-	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3*

*Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Introduction</b>
	Inspection of site, preparation of double-line plan, elevation, section, foundation plan and centre line plan for a single storeyed building with four rooms, studying working drawing, collecting details such as strata available for foundation, levels of site, preliminaries required to start construction. Measuring instruments, instruments for excavation, materials for setting out, setting out methods
<b>Unit 2</b>	<b>Foundations</b>
	Introduction to load bearing structure and framed structure. Definition and purpose of foundations. Classification of foundation. Brief idea about bearing capacity, definition, bearing capacity values of different soils, use of bearing - capacity. Empirical design of shallow foundation, spread footing for walls. Different loads coming on foundation and column footings. Combined footing Mat or raft footing .
<b>Unit 3</b>	<b>Stone Masonry</b>
	Characteristics of good building stones. Common stones used in construction of walls, foundations, cladding. Construction of stone walls and foundations. Terms used such as facing, backing, hearting, headers, stretcher through lapping. Bonds in stone masonry. Types of stone masonry – Un-coursed rubble, coursed rubble, ashlar, random rubble and dry stone masonry. Dressing of stones, joints.

**Unit 4 Brick Masonry**

Requirement/characteristics of good building bricks. Classification of bricks. Terms such as bed, frog, stretcher, header, coarse, bond and its importance. Laying of bricks, soaking, mortar joints, checking the level and plumb, scaffolds, raking of joints, curing, mortar mixes to be used. Features of Flemish bond and English bond and their suitability, other bonds. Half brick thick partition walls, foundations for partitions, reinforcing the brick partition walls with R.C.C. bonds. Opening in brickwork spanned by lintels and arches. Points to be observed in construction of good brickwork.

**Unit 5 Doors and Windows**

Doors- functions, locations, standard sizes, frame sizes, shutters such as battened and edged, battened ledged and braced, panelled, flush, fixing the shutter with frame, opening direction and hinge position, glazed ventilators to doors, other types of doors such as steel, collapsible, rolling, P. V. C., door fixtures, F.R.P.

Windows - Frame sizes, common sizes of windows glazed shutters, sash windows, glazed louvers, top hung, bottom hung & middle pivoted ventilators, Steel & Aluminium windows, grills and fixtures for windows, use of synthetic materials, dormer window, bay windows.

**Unit 6 Roofs**

Pitched and flat roof, suitability and comparison. Terms used in pitched roof such as ridge, eaves, hip, gable, etc. Types of pitched roofs such as lean- to roof, couple, couple closed, collar, king post and queen post trussed roofs, steel trusses.

Roof covering – Mangalore tiles, asbestos cement sheets, G.I. sheets, PVC and FRP sheets and connections, laying procedure. Drainage of pitched roofs.

**Unit 7 Floors and Floor Finishes**

Ground Floors-Requirements of a good floor, plinth filling, rubble packing (soling), base concrete. Upper floors-Single & Double timber floors, R.C.C. floors. Mezzanine.– Location, requirements and uses. Floor finishes- Murrum flooring, I. P. S. flooring, red oxide flooring, Mosaic and Terrazo flooring, granite stone flooring, Shahabad flooring, black Cuddapah flooring, marble flooring, brick flooring, construction details. White and coloured glazed flooring. Skirting and dadoing, P.V.C. ( Vitrified), Construction & fixing.

**Unit 8 Stairs**

Function, location, common terms such as pitch, nosing, tread, riser, landing, hand rail, baluster, newel post, soffit, head room. Requirements of a good stair, thumb rules for geometrical design of stair, common dimensions of stair in residential and commercial buildings. Types of stairs based on- Geometrical shape, material: stone/ brick, timber, steel, concrete. Supporting conditions such as simply supported, cantilever. Finishes of nosing, balusters and newel-post, folded.

## **Unit 9                      Finishing Works**

Plastering mortar for plastering, preparation of surfaces for plastering, scaffolds for internal & external plaster, methods of plastering. Plaster finishes: Internal surfaces, external surfaces, sand faced plaster, roughcast plaster, pebbledash, wrinkled, neeru finish, precautionary measures to avoid cracks in plaster.

Pointing-Necessity of pointing the stone and brick masonry, flush pointing, raked pointing, weathered pointing, recessed pointing. Painting- Preparation of surface for new and old painting with oil paints, white wash and colour wash, distempering and cement paints.

Concepts of water proofing, termite control and fire proofing.

### **4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

<b>Unit No.</b>	<b>Unit</b>	<b>Teaching Hours / Semester</b>	<b>Marks</b>
1	Introduction	4	6
2	Foundations	8	15
3	Stone Masonry	4	6
4	Brick Masonry	6	9
5	Doors and Windows	6	9
6	Roofs	4	6
7	Floors and Floor Finishes	6	9
8	Stairs	4	6
9	Finishing Works	6	9
		48	75

### **5. LIST OF PRACTICALS**

1. Study of Setting out of building drawn in Chapter 1 above.
2. Study of Construction of brick-work at right angled corner in English bond and in Flemish bond, each one brick thick and 1½ brick thick.
3. Study of Construction of "T" junction in brick work;
4. Study of Form work of R.C.C. beam, slab and columns.
5. Study of Construction of stone masonry wall.
6. Study of different types of Scaffolding for walls.
7. Study of Plaster finishes and procedure.
8. Site visit & report on site visit.
9. Study of model of King post roof truss, queen post, roof-truss with all components.

- NOTE:**
1. All the above practical are to be compiled in the form of Term Work and to be submitted.
  2. In absence of Models, site visits can be arranged.

**6. LEARNING RESOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Sushil Kumar	Building Construction	Standard Publishers and Distributors, New Delhi
2	B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Building Construction	Laxmi Publications, New Delhi
3	S.C. Rangawala	Building Construction	Charotar Publishers, Gujarat
4	S. P. Arora & S P Bindra	A Text Book of Building Construction	Dhanpat Rai Publications, New Delhi

**CE 303 CONCRETE TECHNOLOGY**

**1. RATIONALE:** Concrete is the most versatile construction material which can be moulded to any size and shape and possesses special characteristics of high compressive strength, durability, fire resistance, impermeability and homogeneity. The quality of concrete governs the performance of the resulting structure and therefore the knowledge of theory and practice of good concrete making is of vital importance to civil engineers. This course gives students good knowledge of concrete composition, making of good concrete, tests on concrete, mix design and non-destructive testing.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CONCRETE TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25 (O)

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Introduction</b>
	General idea of different types of concrete: Lime Concrete, Cement Concrete, R.C.C and Prestressed Concrete.
<b>Unit 2</b>	<b>Concrete</b>
	<p><b>Cement-</b> Physical properties - Specific gravity, Fineness; Chemical composition; Hydration process; Setting and hardening; Compounds of cement. Laboratory tests on cement- fineness, consistency, setting time, compressive strength, soundness. Field test on cement; Requirements as per I. S. 269; Storage of cement; Reduction in strength of cement .</p> <p><b>Fine Aggregate-</b> Sources; Types of sand, Laboratory test- Specific gravity, sieve analysis, fineness modulus, impurities, bulking of sand and its effects. Field test. Crushed sand.</p> <p><b>Coarse Aggregate-</b> Types, Specific gravity, density, sieve analysis, fineness modulus, grading of aggregates. Properties and tests- Flakiness &amp; elongation, Los Angeles abrasion value, crushing value,</p> <p><b>Water Quality-</b> Requirements of water suitable for concrete making.</p>
<b>Unit 3</b>	<b>Concrete Making</b>
	<p>Different grades of concrete as per IS456 (latest revision). Proportioning of ingredients, volume batching, weight batching, water cement ratio, its importance. Yield of concrete per batch.</p> <p>Mixing of concrete- Object, types of mixing-hand, machine. Types of mixers, capacity, and ready-mix concrete.</p> <p>Transporting and placing of concrete, various methods, and precautions to be taken. Segregation, bleeding, concreting under water.</p> <p>Compaction of concrete- Object of compaction, hand compaction, use of vibrators, advantages, precautions to be taken.</p>

## Directorate of Technical Education, Goa State

Curing of concrete- Purpose, methods of curing under different situations, steam curing and curing period. Formwork removal and stripping time as per IS-456 (latest revision).

### **Unit 4 Properties of Concrete**

Workability- Necessity, factors affecting, measurement, test, method of improving workability. Strength- Crushing strength, factors affecting. Tests as per I. S. 516, Slump test, Flow test, Compaction factor test.

### **Unit 5 Admixtures**

Necessity and factors, types of admixtures, their uses- accelerators, retarders, air-entraining agents, pore fillers, superplasticizers, hardeners, colouring agents, pigments.

### **Unit 6 Joints in concrete**

Purpose, location and types. Construction joints, contraction and expansion joints. IS Codal Specifications for joints.

### **Unit 7 Special Types of Concrete**

Salient properties, advantages and limitations of following types of concrete- Pre-cast concrete, pre-stressed concrete, ready-mix concrete, ferro-cement concrete, light weight concrete, air-entrained concrete and fibre- reinforced concrete. High Performance Concrete, Self compacting Concrete, foam concrete, engineered cementitious composites

### **Unit 8 Concrete Mix Design**

Objectives of mix design, design methods, nominal mix and design mix both as per latest IS Standards. Codal provisions for concrete for different environmental exposure conditions. IS Code method of Mix Design, strength and workability requirements, determination of water- cement ratio, coarse and fine aggregate ratio, aggregate cement ratio, concrete mix proportioning.

### **Unit 9 Non-Destructive Tests**

Objectives, Visual inspection, NDT methods- Schmidt Rebound hammer, ultra-sonic methods-Pulse velocity test, Cover test on concrete, Carbonation test.

#### **4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

<b>Unit No.</b>	<b>Unit</b>	<b>Teaching Hours / Semester</b>	<b>Marks</b>
1	Introduction	1	3
2	Concrete	9	12
3	Concrete Making	12	18
4	Properties of Concrete	6	6
5	Admixtures	3	6
6	Joints in concrete	4	6
7	Special Types of Concrete	4	9
8	Concrete Mix Design	5	9
9	Non-Destructive Tests	4	6
		<b>48</b>	<b>75</b>



**5. LIST OF EXPERIMENTS (Any 12)**

1. Fineness of cement;
2. Standard consistency;
3. Setting times - initial, final;
4. Specific gravity of cement
5. Compression test on cement mortar cubes;
6. Soundness test;
7. Impurities in sand;
8. Fineness modulus of fine aggregates;
9. Bulking of sand;
10. Specific gravity of sand.
11. Fineness modulus of coarse aggregate;
12. Specific gravity of coarse aggregates
13. Flakiness and elongation test;
14. Aggregate crushing value;
15. Aggregate impact value;
16. Aggregate abrasion test;
17. Compacting factor test;
18. Concrete slump test;
19. Compression test;
20. Flow test.

**6. LEARNING RESOURCES**

S.No.	Author	Title of Books	Publication
1	M. S. Shetty	Concrete Technology (7 <sup>th</sup> Edition, 2009)	S. Chand & Co. Ltd, New Delhi
2	P. D. Kulkarni , R K Ghosh & Y R Phull	A Text book of Concrete Technology	New Age International (P) Limited, Publishers, New Delhi
3	M. Gambhir	Concrete Technology	Tata McGraw Hill Publishing Co Ltd., New Delhi
4	P. D. Kulkarni & L. N. Mittal	Concrete manual: Laboratory testing for quality control of concrete	Dhanpat Rai & Sons, New Delhi
5	A. M. Neville & J J Brooks	Concrete Technology	Pearson Education India

**CE 304 TRANSPORTATION ENGINEERING- I**

**1. RATIONALE:** This subject is designed to give sufficient knowledge of construction and maintenance of Highways, Traffic Engineering and Bridges and which are important for the economic development of our country. The course content has been designed in such a way that the students will have the following abilities -Understand the different transport systems, classification, component of each system and their features, have the knowledge of various recommendations and specifications, able to execute the construction work, as per the approved drawings, specification and undertake maintenance works.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
TRANSPORTATION ENGINEERING- I	L	T	P	C	TH	TM	TW	PR/OR	
	4	-	-	4	75	25	-	-	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Introduction</b>
Importance of transportation system in the National development - types and salient points of transportation systems – highways, airways, waterways. Classification of roads - according to importance, materials of construction, load carrying capacity and traffic density. Sketches of standard cross-sections of roads in full embankment, full cutting, partly in cutting and partly in embankment for a National/State Highway with all components.	
<b>Unit 2</b>	<b>Geometric Design</b>
Definition of the terms used in Highway Engineering such as carriageway, formation width, land width, shoulder, berms, spoil-banks, borrow pits, lead and lift, building line, control line, sub-grade, etc. Geometric design components such as camber, gradients, sight distance and curves – their definition, necessity, types and IRC recommendations; super elevation – definition, purpose and methods of providing super elevation and their values; widening of roads on curves – necessity and their values (Note: No problems shall be expected on the above topics).	
<b>Unit 3</b>	<b>WBM Roads and Earth Roads</b>
Construction procedure of earth roads. Soil-stabilisation – necessity and methods of soil stabilization. Rolling – precautions to be taken. Cross-section of a W.B.M. road showing different components with dimensions. Materials used, specification with size and grading with aggregate. Construction procedure. Defects in W.B.M. roads and their maintenance.	
<b>Unit 4</b>	<b>Bituminous Roads</b>
Definition of terms- Asphalt, emulsion, cut back, tar – their common grades adopted for construction of roads. Types of bituminous surfaces – Prime coat, tack coat and seal coat. Types of Bituminous surfaces, their construction procedure and brief material specification – surface	



## Directorate of Technical Education, Goa State

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Unit No.	Unit	Teaching Hours / Semester	Marks
6	Hill Roads	4	6
7	Drainage	3	6
8	Traffic Engineering	3	4
9	Bridges & Culverts	20	20
		64	75

### 5. LEARNING RESOURCES

S. No.	Author	Title of Books	Publication
1	N L Arora	A text Book of Transportation Engineering	IPH Publications, New Delhi
2	Vazirani & Chandola	Transportation Engineering Vol. I & Vol. II	Khanna Publishers, New Delhi
3	Khanna & Justo	Highway Engineering	Nemchand & Brothers, Roorkee
4	T D Ahuja	Roads, Railways, Bridges & Tunnel Engineering	Standard Publishers & Distributors, New Delhi
5	Ahuja & Birdie	Roads, Railways & Bridges	Standard Book House, New delhi
6	Kamala	Transportation Engineering	Tata McGraw Hill Publishing Company Limited, New Delhi

**(CS 305) COMPUTER AIDED DRAFTING**

**1. RATIONALE:**

The market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawings as required using various CAD software.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS305 Computer Aided Drafting	L	T	P	C	TH	TM	TW	PR/OR	100
				4	4	-	-	50	

**3. COURSE CONTENTS:**

1. Introduction and CAD Preliminaries. 2 hours

- Computer aided drafting concept.
- Hardware and various CAD software available.
- Components of a CAD software window such as Title bar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area, UCS icon.
- File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.
- Setting up new drawing : Units, Limits, Grid, Snap.
- Undoing and Redoing action.

2. Drawing using CAD software: 10 hours

- Drawing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon,

## Directorate of Technical Education, Goa State

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<p>Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.</p> <ul style="list-style-type: none"><li>• Methods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.</li><li>• Using Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.</li></ul>
<p>3. Edit/modify features and viewing drawings. 10 hours</p> <ul style="list-style-type: none"><li>• Object Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.</li><li>• Editing Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.</li><li>• Modify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet.</li></ul>
<p>4. Organizing Drawing: 6 hours</p> <ul style="list-style-type: none"><li>• Concepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like color, line type, line weight.</li><li>• Concept of blocks : Creating, inserting, redefining and exploding blocks.</li><li>• Concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.</li><li>• Polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.</li></ul>
<p>5. Dimensioning and Tolerancing 8 hours</p> <ul style="list-style-type: none"><li>• Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.</li><li>• Dimension scale variable, adding geometric tolerances</li><li>• Editing dimensions</li><li>• Single line text, Multiline text.</li><li>• Text styles: selecting font, size, arrows, alignment, etc.</li></ul>
<p>6. 3D-features 2 hours</p> <ul style="list-style-type: none"><li>• Right hand rule/local global co-ordinate system.</li></ul>

<ul style="list-style-type: none"><li>• Specifying 3D coordinates</li><li>• Using UCS</li><li>• Defining user coordinate system using UCS command with its options.</li><li>• Viewing in 3D</li></ul>
7. Isometric Drawing: 10 hours <ul style="list-style-type: none"><li>• Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings</li></ul>
8. Solid Modeling 12 hours <ul style="list-style-type: none"><li>• Concept of solid modeling</li><li>• Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.</li><li>• Constructing a region, creating an extruded solid, creating a revolved solid.</li><li>• Creating composite solids using union, intersection and interface commands.</li></ul>
9. Model space, Paper space, viewports and layouts 2 hours <ul style="list-style-type: none"><li>• Concept of model space and paper space.</li><li>• Creating viewports in model space and creating floating viewport in paper space.</li><li>• Shifting from model space to paper space and vice versa.</li></ul>
10. Printing/ Plotting drawing. 2 hours <ul style="list-style-type: none"><li>• Standard sizes of sheet.</li><li>• Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.</li></ul>

#### 4. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.

6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
  - a) Civil Engineering. & Architectural Engineering: Plan, elevation and section of a single story residential building.
  - b) Electrical & Electronics Engineering.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
  - c) Mechanical Engineering.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
  - d) Shipbuilding Engineering.: Body plan of a ship.
  - e) Mining Engineering.: Plan and section of an opencast mine benches, Plan and section of an underground mine.
  - f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

### 5. LEARNING RESOURCES

1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
2. Mastering AutoCAD – George Omura- BPB Publication.
3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.
4. AutoCAD 2000 – Devid Frey- BPB Publication.
5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
6. Using AutoCAD 2000 – Ron House – Prentice Hall.
7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
8. CATIA V6 Essentials by Jones & Bartlett learning.
9. Inside Catia by Paul Carman, Paul Tigwell.
10. CATIA Tutorials by Nader G. Zamani.
11. ProE/Creoelements or any equivalent reference/text books.





<b>Semester - IV</b>										
<b>Course code</b>	<b>Name of Course</b>	<b>TEACHING SCHEME in hours</b>				<b>EXAMINATION SCHEME</b>				<b>Total marks</b>
		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Theory Marks</b>		<b>Practical Marks</b>		
						<b>TH</b>	<b>T M</b>	<b>PR/OR</b>	<b>TW</b>	
CE401	Surveying-II	3		4	7	75	25	25	50	175
CE402	Materials & Structures	4		2	6	75	25		25	125
CE403	Civil Engineering Drawing	2		4	6	75	25	25	50	175
CE404	Public Health Engg.	4		2	6	75	25		25	125
CE405	Hydraulics	3		2	5	75	25		25	125
CS602	Business Communication	-		2	2			50	50	100
<b>Total</b>		<b>18</b>		<b>14</b>	<b>32</b>	<b>375</b>	<b>125</b>	<b>100</b>	<b>225</b>	<b>825</b>

**CE401 SURVEYING –II**

**1. RATIONALE:** The course content has been designed to- Enable the students to acquire skills in handling theodolite in day to day survey work. Use the plane table and its accessories. Provide the student the knowledge of tacheometric survey.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CE401 SURVEYING -II	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	4	7	75	25	50	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Theodolite</b>
<p>Parts of theodolite and their functions; Temporary adjustments. Swinging the telescope, transiting the telescope, face-left, face-right observation. Measurement of horizontal angles by repetition and reiteration method. Measurement of deflection angle. Measurement of magnetic bearing of a line by a Theodolite. Measurement of vertical angle. Prolonging of straight line – Sources of errors in theodolite work. Permanent adjustments of a transit theodolite. Traversing with a theodolite - Method of included angles, locating details, checks in closed traverse, calculation of bearings from angles. Traverse computation – Latitude, departure, consecutive co-ordinates, errors of closure, distribution of angular error, balancing the traverse by Bowditch’s rule, transit rule, and Gale’s traverse table. Simple problems on above topic. Study, purpose and use of digital theodolite. &amp; use of Total Station instrument.</p>	
<b>Unit 2</b>	<b>Tacheometric Survey</b>
<p>Principles of tachometric survey. Use of Theodolite as tacheometry with vertical staff and fixed hair system. Horizontal sight only. Determination of tachometric constants. Simple numerical problems on above.</p>	
<b>Unit 3</b>	<b>Contouring</b>
<p>Definition of contour, contour interval horizontal equivalent; Uses of contouring, characteristics of contour lines, direct and indirect methods of contouring, interpolation of contours and establishing grade contours.</p>	

**Unit 4                      Curves**

Types of curves used in road and rail alignments. Notation for simple circular curve and corresponding calculations. Methods of setting out curves by offset from long chord method, Rankine's tangential angle. Commonly used radii and degree of curves for roads and railways.

**Unit 5                      Modern Surveying Instruments**

Definition ,Principles, and applications ,

- i) Digital Level
- ii) Digital planimeter
- iii) E.D.M
- iv) Total stations
- v) GPS and DGPS

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Theodolite	18	25
2	Tacheometric Survey	8	15
3	Contouring	8	15
4	Curves	8	12
5	Modern Surveying Instruments	6	8
		48	75

**5. PRACTICALS**

- i. Contouring by direct method.
- ii. Contouring by indirect method.
- iii. Study of parts of theodolite, temporary adjustments. Practice of reading Vernier /or Micrometer.
- iv. Measurement of horizontal angles by repetition method. Measurement of vertical angles. Measurement of deflection angles. Observation of magnetic bearing. v) Prolonging a line. Locating a contour by using theodolite as tacheometer.
- v. Setting out simple curves by offsets from long chord. Setting out simple curve by Rankine's method.
- vi. Simple experiments on profile levelling using Total Station.

### TERM WORK

Drawing on an imperial or near metric size sheet finished in pencil on any two of the following project-works- Contouring by indirect method- suitable area, Theodolite traverse for a minimum 5 sided plot, computation by Gale's traverse, Plane table survey of minimum 5 sided traverse by method of intersection.

The term work shall include appropriate field book / level book containing various observations taken at the time of field-work.

### 6. LEARNING REFSOURCES

S. No.	Author	Title of Books	Publication
1	N. N. Basak	Surveying and Levelling	McGraw Hill Education (India) Private Limited, New Delhi
2	B. C. Punmia	Surveying (Volume – I & II)	Laxmi Publication Ltd., New Delhi
3	S. K. Duggal	Surveying (Volume – I & II)	McGraw Hill Education, New Delhi
4	S. S. Bhavikatti	Surveying and Levelling(Volume – I & II)	I. K. International Publishing House Pvt Ltd.
5	S. V. Kulkarni, T. P. Kanetkar	Surveying and Levelling(Volume – I & II)	Pune Vidyarthi Griha Prakashan, Pune
6	K. R. Arora	Surveying (Volume – I & II)	Standard Publishers Distributors, New Delhi

**CE 402 MATERIALS AND STRUCTURES**

**1. RATIONALE:** The course content comprises of the study of fundamentals of theory of elasticity and the response of the Structural Components when subjected to service loads of tension, compression and shear loading. The study of determination of centroid, centre of gravity and Moment of Inertia of sections is included which is pre-requisite to determining bending and shear stresses in structural components. The knowledge of the relationship between the applied loading and the resulting effects in the structural components shall assist in the realistic analysis leading to safe and economic design of structures. The laboratory exercises have been designed to study the properties of the basic structural materials and their behaviour under different types and stages of loading which is of vital importance to a successful Civil Engineer.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CE402 MATERIALS AND STRUCTURES	L	T	P	C	TH	TM	TW	PR/OR	125
	4	-	2	6	75	25	25		

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Stresses and Strains</b>
<p>Definition of rigid, elastic and plastic bodies, deformation, internal resistance, stress and strain. Axial Loading- Tension, Compression, tensile and compressive stresses and strains, stress distribution. Stress- Strain relationship, Hooke's Law, Modulus of elasticity. Concept of shear loading and deformation, shear stress, shear strain, modulus of rigidity.</p> <p>Longitudinal strain, lateral strain, Poisson's ratio, Concept of Biaxial and Triaxial stress (No derivations &amp; Numerical Problems), Volumetric strain, Bulk Modulus, relation between modulus of rigidity and Young's Modulus. Stresses and strains in composite sections subjected to axial loading. Temperature stresses and strains in homogenous section.</p>	
<b>Unit 2</b>	<b>Strain Energy</b>
<p>Concept and definition of strain energy. Strain energy stored due to gradual, sudden and impact loading, Proof resilience and modulus of resilience.</p>	

<b>Unit 3</b>	<b>Centroid, Centre of Gravity &amp; Moment of Inertia</b>
<p>Definition of Centroid, Determination of Centroid of plane regular lamina, cut-outs and built-up lamina. Definition of Centre of Gravity. Determination of Centre of Gravity of filled regular solids, solids with holes and built-up filled solids. Concept of Moment of Inertia, Parallel axis theorem and Perpendicular axis theorem, Polar Moment of Inertia, Radius of Gyration. Moment of Inertia of rectangular, circular and triangular section.(No Derivation). MI of sections –Angle section, I section, Channel, Tee section and built up section with and without flange plates.</p>	
<b>Unit 4</b>	<b>Shear Force and Bending Moment</b>
<p>Definition of beam. Types of beams- Cantilever, Simply Supported, Simply Supported with overhang, Fixed and continuous. Types of Loading- UDL, Point Load and Equivalent load. Definition of shear force and bending moment, sign convention. S.F.D. &amp; B.M.D. for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads and moments determining point of contra flexure. (Analytical &amp; graphical method, No problems on graphical method in theory paper)</p>	
<b>Unit 5</b>	<b>Bending Stresses in Beams</b>
<p>Theory of simple bending, definition of pure bending, Neutral plane, neutral-axis, bending plane and bending axis, stress and strain due to bending. Section modulus for rectangular, circular and Symmetrical I section. Assumptions made in theory of simple bending, The bending equation and its use, concept of moment of resistance, bending stress diagrams. Flexural rigidity, beam of maximum strength and beam of uniform strength, Calculation of maximum bending stress in beams of rectangular, circular, I and T section, Permissible bending stress .</p>	
<b>Unit 6</b>	<b>Shear Stress in Beams</b>
<p>Shear stress equation, Meaning of the terms in the equation, Shear stress distribution for rectangular section, hollow rectangular section, circular section, symmetrical I section and Tee section. Relation between maximum and average shear stress.</p>	

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Stresses and strains	16	15
2	Strain Energy	8	6
3	Centroid, Centre of Gravity & Moment of Inertia	12	15
4	Shear Force and Bending Moment	12	15
5	Bending Stresses in Beams	8	12
6	Shear Stress in Beams	8	12
		64	75

## 5. LIST OF EXPERIMENTS

- (A) 1. Tension test on mild steel  
2. Compression test on concrete, timber & brick.  
3. Charpy test & Izod Test  
4. Brinell hardness test & Rockwell hardness test  
5. Shear test on mild steel specimen  
6. Bend test

(B) Four Half Imperial Drawing Sheets on:

1. Graphical solution of problems on Shear Force and Bending Moment diagrams, for simply supported, cantilevers, and overhanging beams subjected to point loads

and

uniformly distributed with analytical calculations.

## 6. LEARNING REFSOURCES

S.No.	Author	Title of Books	Publication
1	S. B. Junnarkar	Mechanics of Structures volume – I	Charotar Publishing House, Anand, Gujarat
2	S. Ramamrutham	Strength of Materials	Dhanpat Rai & Sons, New Delhi
3	R. S. Khurmi	Strength of Materials	S Chand Publishers, New Delhi
4	Vazirani and Ratwani	Analysis of Structures	Khanna Publishers , New Delhi
5	M. Chakraborty	Strength of Materials	S K Kataria & Sons, New Delhi
6	S S Bhavikatti	Strength of Materials	Vikas Publishing House Pvt. Ltd., Noida (UP)



**CE 403 CIVIL ENGINEERING DRAWING**

**1. RATIONALE:** The course content is designed to enable the students to understand the principles of planning of residential and public buildings and to prepare working drawings for residential and public buildings. Students shall also acquire knowledge of various agencies in building Industry and their functions.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
<b>CE403 CIVIL ENGINEERING DRAWING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/OR</b>	<b>175</b>
	2	-	4	6	75	25	50	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 4 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Principles of Planning of Buildings</b>
<p>Principles of planning residential and public buildings, aspect, prospect, grouping, orientation, privacy, circulation, roominess, sanitation, elegance and economy. Climatic-effects, habits of people and its influence on planning. Effect of furniture and interior requirements. Building by-laws of plan sanctioning authority in respect of- Plot area (size), set backs in front, rear and sides, open spaces, plinth area, coverage, built-up area, floor-area ratio, minimum dimensions of different rooms of a building passage, stair, toilets, parking, doors and windows sizes; minimum ceiling-height, head-room, sill-height, basement-height and mezzanines. Planning of residential buildings with examples. Planning of public buildings. Following bye-laws for minimum number of toilets, urinals, passage widths, stairs etc. with examples. Requirements of different public buildings such as library, community hall, post-office, commercial complexes, school, hotels, hostels, etc.</p>	
<b>Unit 2</b>	<b>Working Drawing</b>
<p>Plan, elevation, sectional views, site plan and foundation plan, area-statement, measured drawing, Principles of sub-division of plots.</p>	

**Unit 3 Building Industry & Plan sanctioning**

Different agencies such as architects, service consultants (for electric fittings), sanitary, structural designers, contractors, suppliers, specialist in building services and role of each. Special services in building construction such as water proofing, termite proofing, soil stabilising and pile driving agencies. Air conditioning, acoustical treatments, etc. Plan sanctioning authorities- Panchayat, Municipality, Town planning, Planning and Development Authority. Procedure for submitting plans for approval, sanctioning authorities, number of copies, enclosures of plans, important documents, sales and other details.

**Unit 4 Drawing of residential & Public building**

Design of residential bungalow (G+1 only) - Plan, elevation, section  
Design of Public buildings- library, community hall, post-office, commercial complexes, health centres, school, hotels, hostels, etc (Line plans only)

**Unit 5 Introduction to Perspective Views**

One point and two point perspective.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY & Practical's)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Principles of Planning of Buildings	6	10
2	Working Drawing	4	-
3	Building Industry & Plan sanctioning	4	10
4	Drawing of residential & Public building	6	-
5	Introduction to Perspective Views	4	-
	Planning & Drawing of Residential Building		40
	Planning & Drawing of Public Building		15
		24	75

## 5. TERM WORK

### LIST OF PRACTICALS

#### (A) A sketch book containing the sketches of the following-

1. Line plans of the residential buildings with different combinations like two rooms, four rooms etc.
2. Detailed and enlarged sketches of internal units of the building like-Kitchen, Bedroom, Toilet, W. C. and Bath.
3. Plans of different types of stairs showing all the components including the supporting structure, Design and drawing of plan and sectional view of dog-legged stair with detailed dimensions. (No R.C.C. design).

#### (B) Drawing sheets on the following -

1. Planning and designing a residential building from a given data- Framed structure with partly flat and partly pitched roof ,plans, elevation sections, schedule of doors and windows, construction notes, site plan, area statement. Note: Minimum two sections to be taken - One section through stair case, another section through Bath and W.C.
2. Dimensioned Line plans of a public building –any five
3. Sub-division of plots
4. Two point perspective of single storeyed residential building.

## 6. LEARNING REFSOURCES

S.No.	Author	Title of Books	Publication
1	D. M. Mahajan	Elements of Building Drawing	Pune Vidyarthi Griha Prakashan, Pune
2	Kale,Shah & Patki	Building Drawing with Integrated Approach to Built Environment - 5th edition	Tata McGraw - Hill Education
3	R. S. Malik	Civil Engineering Drawing	New Age Publishing House, New Delhi
4	V. B. Sikka	A Course in Civil Engineering Drawing	S K Kataria and Sons, New Delhi
5	M Chakraborti	Civil Engineering Drawing including Architectural Aspect	M Chakraborty

**CE404 PUBLIC HEALTH ENGINEERING**

**1. RATIONALE:** The syllabus is divided into four parts viz- water supply, sanitary engineering, house plumbing and drainage and solid waste management. It is aimed at giving students an overview of water and waste water treatment processes and developing an understanding of conveyance and plumbing systems. curriculum is designed to give students exposure on house plumbing and drainage systems and the overview of latest technologies in solid waste management.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)				Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	
	L	T	P	C	TH	TM	TW	PR/OR	
<b>CE404 PUBLIC HEALTH ENGINEERING</b>	4	-	2	6	75	25	25		125

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>General</b>
Public health- Sanitation, hygiene and pollution. Role of public health engineer. Importance of environment protection.	
<b>Unit 2</b>	<b>Sources of Water</b>
Surface water and ground water resources. Factors controlling the selection of sources. A brief idea of rural and urban water supply schemes.	
<b>Unit 3</b>	<b>Water Quality</b>
Requirements of wholesome water. Necessity of treatment and aims of purification. Precaution against water borne diseases. Physical, chemical and biological requirements. Common important parameters to understand water quality. (Detailed procedures for conducting tests not expected ). Permissible limits of impurities as per I. S. 2296 : 1982.	
<b>Unit 4</b>	<b>Water Demand</b>
Quantity of water for domestic. Industrial and public use. Estimation of water demand. Variation of demand-Monthly, daily and hourly variations. Losses and wastage. Methods of population forecast (No problems)	
<b>Unit 5</b>	<b>Water Treatment</b>
(No designs and problems ) [Only overview of treatment expected]. Flow diagrams of a water treatment plant, necessity of various units of treatment-principles, function and use of each. Aeration of water, purpose methods. Flocculation and sedimentation - Coagulation-	



**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	General	2	3
2	Sources of Water	3	3
3	Water Quality	5	6
4	Water Demand	5	6
5	Water Treatment	8	9
6	Distribution of water	6	6
7	Plumbing	6	6
8	Sewage	8	9
9	Sewage Treatment	8	9
10	House drainage & Sanitation	8	9
11	Solid Waste Management	5	9
		64	75

**5. LIST OF EXPERIMENTS**

**(B) Any four tests on water or waste :**

pH, suspended solids, turbidity, residual chlorine, dissolved oxygen, B.O.D., colour test, jar test.

**(B) Five half imperial size drawing sheets on:**

1. Study of water treatment process including drawing of flowcharts.
2. Study of sewage treatment process including drawing of flowcharts.
3. Design and drawing of a septic-tank, soak pit.
4. Detailed drawings of water supply and sanitary plumbing systems for a two storeyed residential buildings.
5. Study on use of nomograms based on Hazen William formula and Manning`s formula – problem solving exercise to illustrate use of nomograms.

**(C) Visit to water treatment and sewage treatment plant.**

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Santosh Kumar Garg	Water Supply Engineering	Khanna Publishers , New Delhi
2	Santosh Kumar Garg	Sewage Treatment & Sewerage	Khanna Publishers , New Delhi
3	S.C. Rangawala	Water Supply & Sanitary Engineering	Charotar Publishing House, Anand, Gujarat
4	G.S. Birdi	Water Supply & Sanitary Engineering	Dhanpat Rai & Sons, New Delhi
5	Kamala & Rao	Environmental Engineering	Vikas Publishing House Pvt. Ltd., Noida (UP)

**CE 405 HYDRAULICS**

**1. RATIONALE:** Hydraulics as a branch of fluid mechanics is a basic subject for all branches of Engineering disciplines. The subject is designed to teach the students the concepts, principles and procedures of hydraulics for planning, designing, supervising, executing and maintaining of the works related to Irrigation, Environmental Engineering system and Transportation Engineering system.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
<b>CE405 HYDRAULICS</b>	3	-	2	5	75	25	25	-	125

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Introduction</b>
Definition and classification of fluids. Branches of hydraulic - Hydraulics and Hydrodynamics. Fluid properties – Density, specific gravity, specific weight, viscosity, surface tension, capillarity and compressibility.	
<b>Unit 2</b>	<b>Hydrostatics</b>
Liquid pressure, pressure head. Atmospheric pressure, Absolute pressure, Gauge pressure. Pressure measuring devices- Manometers-principle and working of Piezometer tube, simple 'U' tube, differential 'U' tube, and inverted 'U' tube manometers. Mechanical gauges- Bourdes pressure gauge-It's working principle. Pressure on plane surfaces immersed in liquid, total pressure, centre of pressure-pressure diagrams.	
<b>Unit 3</b>	<b>Hydrodynamics</b>
Types of flow- Steady, unsteady, uniform, non-uniform, laminar and turbulent flow, compressible and incompressible flow. Discharge principles of continuity, energies of liquid, pressure head, datum head and velocity head. Total energy of liquid, Bernoullis theorem, pitot tube and venturimeter.	



<b>Unit 4</b>	<b>Orifices &amp; Mouthpieces</b>
Flow through orifices and mouthpieces: -Definition of an orifice, types, Vena-contracta. Hydraulic coefficients $C_o$ , $C_v$ & $C_d$ discharge through an orifice. Mouth-pieces-types-external, convergent, divergent, Borda's mouth piece and calculation of discharge (No numerical problems on mouthpieces)	
<b>Unit 5</b>	<b>Notches &amp; Weirs</b>
Definition- Types of notches – Rectangular, 'V' & trapezoidal discharges over notches. Discharge over a weir, end contraction, velocity of approach, Francis & Bazier's formula.	
<b>Unit 6</b>	<b>Flow Though Pipes</b>
Flow through pipes - Laws of fluid friction, Reynold's number, its significance. Various losses in pipe flow- Major and minor, friction loss, loss of head due to entrance, sudden enlargement, sudden contraction, obstruction line and total energy line. Hydraulic gradient line and total energy line. Flow through pipes in series and parallel, compound pipe and equivalent pipe. Water hammer – Causes, effect and remedial measure. (No derivation required). Use of nomogram in the distribution system.	
<b>Unit 7</b>	<b>Flow Though Open Channels</b>
Flow through open channel- Types of channel flow, different shapes of artificial channels, rectangular, trapezoidal. Wetted perimeter, Hydraulic Mean Depth. Most economic section of channel for Rectangular and Trapezoidal. Hydraulic jump-significance and application.	
<b>Unit 8</b>	<b>Hydraulic Machines</b>
(Principles of working, No mathematical treatment required). Introduction, Centrifugal pump, Reciprocating Pump, Power required to drive the pump and selection of pump.	

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Introduction	2	3
2	Hydrostatics	12	18
3	Hydrodynamics	6	9
4	Orifices & Mouthpieces	4	9
5	Notches & Weirs	4	6
6	Flow through Pipes	6	9
7	Flow through Open channel	8	12
8	Hydraulic Machines	6	9
		48	75

**5. LIST OF EXPERIMENTS**

1. Verification of Bernoulli's Theorem,
2. Determination of coefficient of Venturimeter and Orificemeter,
3. Determination of Hydraulic coefficients for circular orifice,
4. Determination of coefficient of discharge for Rectangular Notch, 'V- notch and Trapezoidal notch.
5. Determination of coefficient of friction for flow through pipes,
6. Study of simple Hydraulic Machines (Centrifugal & Reciprocating pumps)

**6. LEARNING REFSOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	R K Bansal	<b>A Textbook of Fluid Mechanics and Hydraulic Machines:</b> (in S.I. Units)	Laxmi Publications Pvt. Ltd., New Delhi
2	R.K. Rajput	A Textbook of Fluid Mechanics and Hydraulic Machines in S.I. Units	S. Chand & Co. Ltd, New Delhi
3	R.S. Khurmi	Hydraulic and Hydraulic Machines	S. Chand & Co. Ltd, New Delhi
4	Jagdish Lal	Fluid Mechanics and Hydraulics (in SI & MKS Units)	Metropolitan Book Company Ltd., New Delhi

**(CS602) BUSINESS COMMUNICATION**

**1. RATIONAL :**

The course on Business Communication will help in development of speaking, listening, writing, and reading skills in students, with special reference to business environment like writing business letters, notes, reports, documents, holding meetings and discussions, working in groups, etc. . Special provision has been made for language workshops where the communication skills of the students can be enhanced.

**2. Teaching and Examination Scheme :**

Course Code & Course title	Periods per week in hours			Total credits	Examination scheme				
					Theory Marks		Practical Marks		TOTAL Marks
	L	T	P		C	TH	TM	PR/OR	TW
<b>(CS602) Business Communication</b>	-	-	2	2	-	-	50	50	100

**3. Competences to be developed through this course :**

The course content should be taught and implemented with the aim to develop different type of skills leading to the achievement of the competency “Communicate effectively in given Business situations”.

**4. Detailed Course Content :**

<p><b>Unit 1.1: Communication Skills in the work place</b>                      Communication within the organizational, Types of communication, functions of Internal &amp; external communications                      Definition, components, importance of effective communication skills, types- verbal-non verbal, methods and hints to improve communication skills, body language, Précis and comprehension</p>
<p><b>Unit 1.2: Modern Office technology for communications:</b> Using technology and internet to <b>obtain</b> information about suppliers, their credibility, latest specification of items, contacting people, quick feedback, social networking, skype, whatsapp, spell check, <b>dissemination</b> of information, send email to staff, paperless office, etc</p>
<p><b>Unit 2.1: Seminars</b>                      Objectives, topic selection, audience, structure, tips for good beginning and end, aids to presentation.</p>
<p><b>Unit 2.2: Project work:</b> A link between the theory and the practical                      Tips: Narrow down to the topic, specific not vague, data collection, structure, critical thinking and analysis.</p>

<p><b>Unit 3.1 : Report writing:</b> Understanding Objective and Subjective report writing                  (i) <u>Feasibility report:</u> Definition, types, economic feasibility, technical feasibility, definition.                  (ii) <u>Trouble Report:</u> Purpose, instances when trouble reports are written, procedure followed in writing trouble report                  (iii) Formal Reports: Essay, Pamphlet, Booklet or Book report, Parts of a book Report, understanding how to write formal reports</p>
<p><b>Unit 3.2 : Illustrations in a report:</b> Uses, types, Use of illustrations: Tables, graphs, charts, Venn diagram, organizational charts, flow charts, maps, photographs, drawings and diagrams.</p>
<p><b>Unit 4.1: Topic -Letter writing:</b> Credit letter, Collection and sales letters</p>
<p><b>Unit 4.2: Memorandum:</b> Definition, difference from letter, examples of memorandum</p>
<p><b>Unit 5.1: Meetings:</b> Preparation, Notice for the meetings, Agenda</p>
<p><b>Unit 5.2.:</b> Note taking during meetings, minutes of meeting</p>
<p><b>Unit 6.1: Tender:</b> Procedure, Preparation, Types of tenders, Single tender, local tender, e tender, Structure, Tender Notice, Terms and conditions, Payment details, specification, Documents to be submitted, placing orders, Evaluations, drafting advertisements for tenders</p>
<p><b>Unit 7: Job Interviews:</b> Preparing for a Job Interview, guidelines on facing job interviews, ways of scouting for jobs, Writing Job Application, resume,</p>

**Marking scheme :**

<b>Term Work</b>	<b>Maximum marks</b>
Overall classroom performance.....	10
Workbook (assignments).....	25
Classroom activity (language workshop).....	15

**Term End Assessment**

<b>Components</b>	<b>Maximum marks</b>
Questions on syllabus.....	20
Activity.....	30

**4. Suggested specification table with hours and marks (Practical) :**

Unit No	Topic	Teaching hours per semester
1.	Communication Skills in the work place	04
2.	Organizing seminars, project work	04
3.	Report writing	05
4.	Letter Writing	05
5.	Meeting	05
6.	Tenders	04
7.	Job interviews	05
	Total hours	32

**5. Suggested learning resources :**

1. Business Correspondence and report writing, by R C Sharma & Krishna Mohan, Tata Mcgraw hill, New Delhi 2002,
2. Principles and practices of Business Communication ,Doctor R. Doctor A., Seth Publishers,14<sup>th</sup> edition,2006
3. The functional aspects of communication skills, P. Prasad, Sharma K. Rajendra, S. K. Kataria and Sons,2006
4. Raul R. Timm, How to make winning presentations, Sneha printers, Mumbai,
5. Stand and Deliver, how to become a masterful communicator and public speaker,
6. Dale Carnegie Training, CPI Cox & Wyman, UK.

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**SEMESTER V**

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
CT501	Civil Construction Training-I	50	50	50	50	Grade

**Semester - VI**

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
CT601	Architectural Design	4	-	4	8	75	25	25	25	150
CE502	Construction Management	4	-	-	4	75	25	-	-	100
CE503	Quantity Surveying & Costing	-	-	6	6	-	-	50	50	100
CE504	Analysis of Structures	4	-	2	6	75	25	-	25	125
CE601	Irrigation Engineering	3	-	-	3	75	25	-	-	100
CT602	Construction Techniques	3	-	-	3	75	25	25	25	150
<b>Total</b>		<b>18</b>	<b>-</b>	<b>12</b>	<b>30</b>	<b>500</b>		<b>225</b>		<b>725</b>

**FOR INDUSTRIAL TRAINING OF V<sup>TH</sup> & VIII<sup>TH</sup> SEMESTER:**

1. Grades will be awarded based on marks scored as follows:
  - a. 80% and above Marks – Grade ‘A’
  - b. 60% to 79% Marks – Grade ‘B’
  - c. 40% to 59% Marks – Grade ‘C’
  - d. Marks below 40% - Grade ‘D’
  
2. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade ‘C’ for passing.
  
3. Student with Grade D under the head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

# SEMESTER V

## (CT501) CIVIL CONSTRUCTION TRAINING I

- RATIONALE:** During the training period, students are expected to work in different established construction firms/industries. They will carry out construction activity/job requirements as per the instruction of the Sr. Engineer at site. Here the students will use the theoretical knowledge and laboratory skills gained in different courses for actual jobs, testing, billing, record keeping, maintenance of equipment, etc. The training helps in bridging the gap between theory and actual practice. The process will also help in improving communication skills, decision-making, managing men, material handling, etc. which are of prime importance for a professional construction Engineer..

### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	EXAMINATION SCHEME				Total
	TW		PR/OR		
	Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
CT501 Civil Construction Training-I	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>Grade</b>

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

### 3. DETAILED COURSE CONTENTS

**Unit 1 Students are expected to perform most of the following jobs/assignments/activities during the training period.**

- Fixing site layout/site rail.
- Marking centreline of column/walls.
- Carry out masonry operations.
- Carry out earthwork and rubble packing operations.
- Carry out concreting operations.
- Check steel reinforcements in RCC : footings, Columns, beams, slabs,
- Check structural form-work for shape, size and stability.
- Call/order for materials.
- Store the materials.
- Carry out testing for different jobs.
- Carry out and record Measurements
- Prepare Measurement sheet and Abstract sheet. For running and final bill

13. Billing/labour payments.
14. Maintain daily records.
15. Regularly check the schedule and take corrective measures.
16. Carry out flooring works.
17. Carry out painting works.
18. Check electrical works
19. Water-proofing.
20. Carry out and Check Sanitary filling/pipes/internal plumbing works.
21. Temporary services for labour/safety.
22. Carry out Maintenance and Repairs works.
23. Carry out any additional works entrusted to them in relation to the site (interaction with other authorities, banking etc.)

#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Marks
	DAIRY AND REPORT ASSESSMENT -The Daily-dairy and Report prepared shall be assessed by the internal examiner/teacher
	PROGRESSIVE ASSESSMENT- The assessment will be done periodically at least three times during training by the teachers in consultation with the industry/trainer.
	ORALS/VIVA-The appointed examiner shall assess the trainee based on their reports and performance in oral/viva. Weightage should be given to his presentation, Confidence, engineering skills, managerial skills and knowledge gained in performing job activities.

#### 5. TERM WORK & PRACTICALS

All the students undergoing training should submit- Daily dairy and Training report.

**Daily dairy-** The daily dairy should-be maintained in a bound book. It should reflect the day to day activities performed by the student ( including task, men and materials involved). It should be counter signed by the Sr. Engineer. It will become the basis for writing reports on the complete training. Based on daily dairy students will be able to work out Task work, rate of different items and compare them with market rates and Goa schedule of rates.

**Training Report** -The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately heightened, environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

#### 6. LEARNING RESOURCES

S. No.	Author	Title of Books	Publication
1	Civil Dept	Draft of project report	Civil Dept-APV



# SEMESTER VI

## (CT601) ARCHITECTURAL DESIGN

**1. RATIONALE:** Architecture is the integral part of Building Construction. Architectural planning and design precedes civil structural design. Hence it is vital for a Construction engineer to understand the architectural thought process before embarking on further work.

### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CT601 ARCHITECTURAL DESIGN	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	4	8	75	25	25	25	

Minimum passing %: Theory 40%

Duration of theory paper: 4 Hrs.

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

### 3. DETAILED COURSE CONTENTS

#### Unit 1 BASIC ARCHITECTURAL DESIGN

- **Study of lines and forms** : Visual Qualities of Lines, Composition of two Dimensional Forms, Attributes of Form and Space, Principles of Organization of Form & Space, Principles of form follows function.
- **Elements of Design:** Material And Texture, Colour, Light, Scale, Proportion(Scale), Alignment, Unity, Harmony, Contrast, Repetition, Pattern, Rhythm, Emphasis, Balance, Functionality, Proximity & Decluttering, Organization & Harmony,
- **Study of spaces:** Positive and Negative Spaces,
- **Architectural Aesthetics** Understanding and Elements of Visual Aesthetics, Aesthetic Appraisal.
- **Environmental Sensitivity.** Process of integrating environment (natural setting of the site, its contours and vegetation) into the design

**Unit 2 HISTORY OF ARCHITECTURE AND HUMAN SETTLEMENT**

\*\*One typical example of each structure to be discussed.

- **Pre – historic Period:** prehistoric Indian Cave shelters. Indus-region dwellings, settlements and community structures( great-bath, granary, port)
- **Egyptian Period:** Architectural Character, Major building types (Pyramid, Sphinx, Temples)
- **West Asiatic Architecture:** Architectural Character, Chinese, Ancient-Indian & Mogul Building Types(palaces, stupas, temples,)
- **Greek and Roman Architecture:** General Architectural Character, Major building types(Temples, Open air theatres, Tombs, Circus Amphitheatre, Palaces, Thermae)
- **Portuguese and Pre-Portuguese Goan Architecture:** General Architectural Character, Major building types (Churches, Temples, palaces,)

**Unit 3 DESIGN FUNDAMENTALS IN ARCHITECTURE**

- Architecture in relation to Art and Technology, Building design for Indian climate
- Study of building and site, orientation of internal spaces of buildings, circulation. Consideration of climate, site and circulation in designing efficient activity spaces.
- Brief outline of basic components of Architectural structure. Conceptual comparison of various structural systems. Process of Architectural Designing. Guidelines on proto-type approaches.
- Concept of urban and rural planning, satellite townships and smart cities
- Concept of Neighborhood planning
- Concept of modular planning
- Brief Introduction to vastu-shastra.
- Brief Introduction to fengsui

**Unit 4 ARCHITECTURAL DRAWING AND GRAPHICS**

**Scale Drawing**

- **Scale :** Architectural Metric scale. Introduction of various proportions of scales, necessity of scaled drawing, selection of proportions of scales while preparing architectural drawing.
- **Building Elements :** Techniques of representing building elements such as doors, windows, steps, chajja, porch, canopy, balcony, roofs, difference of levels, furniture fittings such as wash hand basins, WC pans, traps etc. on drawings.
- **Material Indications :** Symbolic representation of building materials with colour code as specified Indian Standard Code of practice.
- **Lettering :** Introduction to architectural lettering, its proportion to scale drawing simplicity of lettering.
- **Annotations :** Use of annotations on drawings titles and uses in presentations drawings.

**Perspective Drawing**

- Principles of perspective drawings
- One point perspective of interiors and two point perspective of exterior of multi-storey building

**Sciagraphy**

- Principles and Techniques of Shades and shadows. Shades & Shadows of typical building on Plan & Elevation.
- Colouring of shades and shadows using transparent colours.

- Shades and Shadows in perspective.

**Presentation Techniques**

- Techniques of representing elements graphically such as trees, lawns, shrubs, paving, pathways, flowerbed, water pools, human figures, vehicles.
- Colours theory and use of colours in presentation.

**Unit 5 MODEL MAKING WORKSHOP**

- Introduction to various materials, instruments used for model making.
- Use of various adhesives and joining techniques.
- Importance, appropriate use and methods of colors in model making.
- Use of appropriate scales, suitable to various types of models.
- Finished presentation models.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Basic Architectural Design	12	5
2	History Of Architecture And Human Settlement	12	5
3	Design Fundamentals In Architecture	12	5
4	Architectural Drawing And Graphics	16	60
5	Model Making Workshop	12	
		64	75

**Note:-** Question paper should include 60 marks drawing (as per term-work-2,3) and balance 15 marks objective questions on units 1,2,3.

**5. TERM WORK & PRACTICALS**

Practical shall include following:

1. Study assignments on units 1,2 and 3
2. Following colored drawings
  - a. Measuring and drawing to scale Ground Floor Plan along with plot boundaries, four side elevations, two sections, site plan with north point. Plinth area of such design will be maximum of 100.0 sq. Mts
  - b. Detailed Floor plan-showing furnishings:
    - i. 5 room duplex-house,
    - ii. 2 B H K flat,
    - iii. Cafeteria or restaurant,
    - iv. Gymnasia,
    - v. E-classroom,
    - vi. Office block,
    - vii. Auditorium or theatre,
    - viii. Market,
    - ix. Religious structure.
    - x. Bank or Post Office
  - c. (Garden-design for 300 m<sup>2</sup> plot with 100 m<sup>2</sup> house) or (Landscape design for 500m<sup>2</sup> factory in 1000m<sup>2</sup> plot)
  - d. Urban/rural township plan for 1000 residents (neighborhood planning)

- e. perspective of multi-storey building
3. 2D-Facade treatment for G+3 commercial complex-showing shade and surroundings
4. Preparation of model of a duplex bungalow with furnishing, compound, garden and pool.
5. A hand written photo/illustrated report of 1000 words on Architectural features, motifs, design themes and planning evolutions for a typical
  - a. Pre-Portuguese Temple
  - b. Portuguese Church in Goa.
  - c. Typical Portuguese (palatial) Residence in Goa.

### 6. LEARNING REFSOURCES

S. No.	Author	Title of Books	Publication
1	Heller Robert and Salvadori Mario	Structure in Architecture	
2	Pramar	Design Fundamentals in Architecture	
3	Francis D. K. Ching	Architecture : Form, Space and order	
4	B. Gallion	Urban Pattern	
5	Sir Bannister Fletcher	The History of Architecture	
6	Dora Crouch	History of Architecture	
7	Ching Frank	Architectural Graphics	
8	Kelsey W.E	Geometrical & Building Drawing	
9	Themes and Hadson	Perspective for the Architect	
10	Martin C. Leslie	Architectural Graphics	
11	Extra information may be obtained from Web-based resources.		

**(CE502) CONSTRUCTION MANAGEMENT**

**1. RATIONALE:** This core course of "Construction Management" provides a Civil Engineer with vital knowledge of the techniques of management and their application for the optimum utilisation of sources in the construction industries. In order that the resources are used efficiently, it is imperative that these management techniques are applied to the construction industry. The student is expected to acquire sufficient knowledge for planning, organising, scheduling and monitoring of the various activities relating to man power, finance, equipment, material and time, and hence the course content has been framed in that direction.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE502 CONSTRUCTION MANAGEMENT	L	T	P	C	TH	TM	TW	PR/OR	100
	4	-	-	4	75	25	-	-	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**1. DETAILED COURSE CONTENTS**

**Unit 1 MANAGEMENT FUNDAMENTALS**

Definition of management. Necessity and functions of management. Principle of management (Harry Foyal) and their application to civil engineering works. Leadership types. Requirement of an ideal leader. Motivation and its importance and function. Importance of communication and types of communication. Personnel, material, equipment management and their requirements. Important acts and labour laws related to construction activities.

**Unit 2 CONSTRUCTION ACTIVITY**

Agencies associated with construction industries, their functions and their inter-relationship. Definition-necessity and importance of planning. Levels and stages of planning (pre-tender and post tender). Study of drawing, design, construction materials, equipment and human resources required for planning & execution. Site layout and its importance in execution.

**Unit 3 ORGANISATION STRUCTURE**

Organisation of construction Industry. Necessity for an organisation. Principles of organisation. Types of organisation -Line organisation, line and staff organisation, functional organisation, their merits and demerits, simple organisation and chart for each. Organisational structure of P. W. D. Types of construction / contracting firms like sole proprietorship, partnership, private limited company and co-operative societies, corporations salient features of each. Definition, Importance, and necessity method of coordinating, controlling and decisions making in construction firms.

**Unit 4 CONSTRUCTION PROJECT SCHEDULING**

Scheduling and monitoring of construction projects. Methods of scheduling- Bar chart - CPM and PERT and their fields of application. Scheduling of bar chart and preparing construction schedule by bar chart for small projects, advantages and limitations of bar chart. Terms used and salient features of CPM, and plotting of critical path. (Simple problems with less than 15 activities). Brief idea about manpower and material scheduling, updating network and rescheduling of resources.

**Unit 5 CONSTRUCTION SUPERVISION AND CONTROL**

Role of supervisors in the construction site. Importance of quality control for construction work. Inspection and Supervision-techniques for different items of works such as earth-work, concreting, wood work, form-work, brick masonry, stone masonry, steel work, painting, water proofing, sanitary and water supply services. Sampling and checking techniques for testing of materials, tools, plant and equipment for ensuring quality. Introduction to ISO 9000 series-It's underlying features and drawbacks. Introduction to inventory control and stores management.

**Unit 6 CONSTRUCTION SAFETY**

Importance of safety in construction work. Cases of accidents and remedial measures. Precautions to be taken to avoid accidents. List of safety clothing and equipment needed at construction site. Importance and contents of first aid kit. List of safety measures adopted at work site for- Excavation, scaffolding and form-work, fabrication and erection and demolition. Occupational hazards in construction industry.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Construction Management	8	12
2	Construction Activity	12	9
3	Construction Industry	12	12
4	Construction Project Scheduling	12	15
5	Construction Supervision And Quality Control	12	15
6	Construction Safety	8	12
		64	75

**5. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Robert L. Parity	Construction planning, equipment and method	Tata Mac- hill publication, New Delhi
2	IS 3764 - 1966	Safety code for excavation	
3	IS 3696 (part I & II) 1966	Safety code for ladders & scaffolding	
4	IS 1647-1960	Code of particle for fire safeties of buildings	
5	IS 4081-1986	Safety code for blasting and sealed drilling operations	
6	National building codes		
7	Haripal Singh	Construction Management & Accounts 1981	Tata Publication - NewDelhi
8	V.K. Raiva	Construction Management Practice	Tata Mac- hill publication, New Delhi
9	Galbert and B.M Dhir	Construction Planning and Management	Willey Easter Ltd Publication - Delhi
10	Anarjit Agarwal	Construction Management and P.W.D. Accounts	S.K. Kateria and Sons
11	Vazirani and Chavdale	Construction Management and Accounts	Khanna Publication- Delhi

**(CE503) QUANTITY SURVEYING AND COSTING**

**1. RATIONALE:** - This is core subject in Civil Engineering. The student must acquire knowledge and skills in measurements of quantities, investigating factors affecting cost of an item of work, and preparing detailed estimates. The student is expected to gain general knowledge and awareness of valuation, functions of P.W.D., and office records. The students must also understand the salient features and relevance of tenders and contracts adopted for civil engineering works so as to gain fair knowledge of these methods. The scope of the syllabus is restricted to general aspects of the prescribed text-books.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
<b>CE503 QUANTITY SURVEYING AND COSTING</b>	-	-	<b>6</b>	<b>6</b>	-	-	<b>50</b>	<b>50</b>	<b>100</b>

*Minimum passing %: Theory 40%*

*Duration of theory paper: 4 Hrs.*

**Legends:**

*L-Lecture; T- Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*



### 3. DETAILED COURSE CONTENTS

<p><b>unit 1. INTRODUCTION</b></p> <p>Definition, of estimating and costing – purpose, data required for preparing an estimate – qualities of an ideal Quantity Surveyor.</p> <p>Types of estimates – approximate or preliminary estimate, detailed, supplementary and revised estimate with brief description of each. Purpose of approximate estimate and methods of approximate estimation of a building and highway, administrative approval, expenditure sanction and technical sanction.</p>
<p><b>unit 2. MODE OF MEASUREMENT</b></p> <p>Standard unit of measurements - modes of measurements for different items of work for buildings and road work, provision for lump sum, spot item, and provisional sums. Degree of accuracy in estimating – General rules for measurement of work as per I. S. 1200. Significance of provision for contingencies, work charged establishment, centage. Provision for water supply, sanitation, and electrification. Case studies involving the above provisions for different Civil Engineering works.</p>
<p><b>unit 3. DETAILED ESTIMATING AND ABSTRACTING</b></p> <p>Types of forms used for detailed measurement and abstracting. Methods of taking out quantities – centre line methods and long wall and short wall method. Estimate and Abstract of different items for a single storied residential building from given plan</p> <p>Road earth work – computation of earth work with no transverse slope using mean area and mean depth formula including soling area for pitching/turfing. Estimate of a road with WBM and bituminous road surface involving all basic items including computation of earth work, quantities of various items with abstract.</p> <p>Preparation of brief report on estimate both for building and road, including % cost for different stages of construction.</p>
<p><b>unit4. RATE ANALYSIS</b></p> <p>Factors considered for rate analysis – Schedule of rates and market rates for common materials and capacity – preparation of material estimate for common items of work. Rate analysis for common items of work (as specified in the term-work only).</p> <p>Task Work – definition, factors affecting, task work for common items of building construction.</p>
<p><b>unit 5. P. W. D PROCEDURES</b></p> <p>Classification of works (Original, Repair, Minor petty Maintenance deposit)</p> <p>Cash – Imprest and temporary advance, Importance of maintaining sites and office records, Types of records – Engineers diary, standard measurement book, muster- roll, work abstract, materials at site (M.A.S) account, daily labour, piece work.</p>
<p><b>unit6. SPECIFICATIONS</b>, Definition - purpose of specification – types and principles of writing specification. Case study with writing the detailed specification for 10 common items of civil engineering works. (as listed in TW)</p>
<p style="text-align: center;"><b>unit 7. TENDERS and CONTRACTS</b></p> <p>Definition and purpose of tender: salient features of process of tendering. Definition of contract. 10 clauses of contract as listed in TW. Type of contracts: salient features, obligation of the parties to a contract. Earnest Money Deposit, Security Deposit, Running Account Bill and Final Bill. Opening of tenders, E –Tendering; Process, Digital Signature, Advantages</p>

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	INTRODUCTION	8	6
2	MODE OF MEASUREMENT	10	9
3	DETAILED ESTIMATING AND ABSTRACTING	12	21
4	RATE ANALYSIS	12	12
5	P. W. D ACCOUNTS	8	6
6	SPECIFICATIONS	08	12
7	TENDERS and CONTRACTS	06	09
		64	75

**5. TERM WORK & PRACTICALS**

- 1) Detailed estimate including plumbing with abstract for a single storied building having minimum three rooms with sloping and flat RCC roof and calculation of percentage cost for foundation, Superstructure, Roofing, Woodwork, Flooring, Plumbing and Finishing. Calculation of common raw material quantities used.
- 2) Preparation of road estimates with abstract for a new bituminous road surface involving all items of work to a length of one km including calculation of earth work and turfing/pitching.
- 3) Analysis of rates for any six of the common Civil Engg. Items / Specification:
  - (a) Earth work excavation,
  - (b) Plain Cement Concrete,
  - (c) Laterite stone masonry in cement mortar,
  - (d) Brick work in cement mortar,
  - (e) RCC work including steel but excluding form work,
  - (f) Wooden doors/windows (frames and shutters) including fixtures,
  - (g) Flooring with pre casted terrace/mosaic tiles,
  - (h) Internal and external plastering in cement mortar,
  - (i) Mangalore tile roofing over wooden battens,
  - (j) Conventional water proofing and chemical water proofing,
  - (k) Form work for columns, flats/sloping slabs and beams.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	B.N. Datta	Estimation & Costing	S. Dutta & Co., Lucknow
2	M. Chakraborti	Estimation & Costing	
3	S.C. Rangawala	Elements Of Estimation and Costing	Charotar Publishing House, Anand
4	J.R. Mule	Valuation, Estimation and Costing	Charotar Publishing House, Anand
5	G.S. Birdi	Text Book of estimating	Dhanpatrai & Sons, Delhi
6	B. S. Patil	Civil Engineering Contracts and Costing	
7		C.P.W.D. Manual and Specifications and Rate Analysis	
8		Goa Schedule of Rates	

**(CE504) ANALYSIS OF STRUCTURES**

**1. RATIONALE:** The course contents have been designed to assist in the determination of forces acting on a structure and to assess the effects of these forces and the behaviour of the structure in different conditions. Furthermore, the course contents also will develop the cognitive abilities and skills to facilitate the higher level study of design of structures.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE504 ANALYSIS OF STRUCTURES	L	T	P	C	TH	TM	TW	PR/OR	125
	4	-	2	6	75	25	25	-	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

**Unit 1 FLITCHED BEAMS**  
 Definition of flitched beam, flitched beam theory, transformed section and modular ratio. Moment of resistance of composite section, permissible stresses, stress distribution across composite section. Analysis of beams of composite sections.(symmetrical and asymmetrical above the neutral axis)

**Unit 2 COMBINED BENDING AND AXIAL LOADING**  
 Typical cases of structure subjected to bending and axial loading. Eccentricity about one principal axis, Standard cases of stress distribution, extreme stress intensities, Limits of eccentricity for uniform stress distribution system, core of section, middle third rule, middle quarter rule, eccentricity about both principal axis.

**Unit 3 COMPLEX STRESS SYSTEMS**  
 One dimensional and Two dimensional stress system. Resolution of stress on oblique plane. Normal and tangential component of stress on oblique plane, magnitude and direction of resultant stress, maximum obliquity of the resultant stress, schematic representation. Magnitude and direction of oblique stress by graphical solution using Mohr's stress circle. Mohr's circle of stress for Principal stresses. Location of principal planes and planes of maximum shear. Principal stresses in beams and maximum shear stresses.

**Unit 4 SLOPE AND DEFLECTION**  
 Differential equation of elastic line for a beam subjected to bending. Derivation of formula for slopes and deflections for standard cases. Macaulay's method (Note: Cubic eqns. are not to be considered) Simple problems for cantilevers and simply supported beams with point loads and udl on full span.

**Unit 5                      FIXED BEAMS OF UNIFORM SECTIONS**

Determination of fixed end moments for the beams carrying point loads and U.D.L. on full and part span.(Derivations not expected in exam). Construction of shear force diagrams and bending moment diagrams.

**Unit 6                      MOMENT DISTRIBUTION METHOD**

Definition, Stiffness, relative stiffness distribution factor, carry over factor, Sign conventions. Analysis of continuous beams with uniform section (supports at the same level only) and carrying point-load and/or U.D.L over entire spans.(maximum four supports only). Analysis of single storeyed single horizontal span portal-frame carrying point load or U.D.L over entire span (only non-sway analysis). Construction of S.F.D. and B.M.D.

**Unit 7                      COLUMNS**

Types of columns, definition- short and long columns. Effective length for different end-conditions. Slenderness ratio, Euler's formula for crippling-load for different end-conditions (derivation not expected). Limitations of Euler's formula. Rankine's formula(derivation not expected).

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Flitched Beams	6	8
2	Combined Bending And Axial Loading	8	10
3	Complex Stress Systems	8	10
4	Slope And Deflection	8	10
5	Fixed Beams Of Uniform Sections	8	10
6	Moment Distribution Method	14	15
7	Columns	12	12
		64	75

**5. TERM WORK & PRACTICALS**

Termwork shall include following:

9. At least 4 problems on each unit above
10. At least 2 drawing sheets plotting BMD and SFD for Units 5 & 6.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	S. Ramamrutham	'Theory of Structures	Dhapant Rai publication
2	S.B. Junarkar and Alvai	Mechanics of Structure - Vol I and II	Charotar Publishing House
3	O.P. Jain and B.K. Jain	Theory and analysis of Structures	New chand and Bros 1957
4	B.C. Punmia	Analysis of Structures	Laxmi Publications, New Delhi
5	B.B. Lord	Strength of Materials	Newage International New Delhi
6	Singer	Strength of Materials	Harpercollins College Div
7	P. V. Warnock	Strength of Materials	London –Pitman-1943

**(CE601) IRRIGATION ENGINEERING**

**1. RATIONALE:** This course is considered as most important for Diploma in Civil Engineering programme because, a Civil Engineer is primarily responsible for providing well planned and systematic facilities for the development of agriculture; water shed management and efficient water distribution. The student is expected to gain knowledge of major and minor irrigation schemes, dams and its related structures. Majority of the rural population of our country is dependent on agriculture for their livelihood and therefore, this course of Irrigation Engineering forms a core subject for civil engineers. The scope of the syllabus is restricted to the prescribed text-books only.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE601 IRRIGATION ENGINEERING	L	T	P	C	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	--	--	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L-Lecture; T- Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

**Unit 1 INTRODUCTION**

Necessity and importance of irrigation. Advantages and disadvantages of irrigation. Types of Irrigation -flow and lift, perennial and inundation, direct and storage irrigation. Single and multi-purpose projects. Investigation for an irrigation project- Preliminary and detailed engineering surveys. Geological and hydrological surveys.

**Unit 2 HYDROLOGY**

Definition of hydrology and hydrologic cycle. Rainfall-factors affecting rainfall, measurement of rainfall by symons rain gauge, weighing bucket type automatic rain gauge. methods of calculation of average annual rainfall over a basin: Arithmetic average method, Theissons polygon method and Isohyetel method. Catchment area- Definition. Definition of Run-off and factors affecting run-off, Computation of run-off: run-off co-efficients, Ingli's formula for ghat and non-ghat areas.

**Unit 3 WATER REQUIREMENTS**

Crop seasons such as kharif, rabi, and perennial and their period types of crops grown in each season with their crop period. Definitions of terms - Duty, Delta, Crop period, Base-period, time factor, capacity factor, intensity of irrigation, Gross Commanded Area, Culturalble Commanded Area, un-culturable commanded area. Relation between duty and delta with derivation. Factors affecting duty, methods of improving duty. Rotation of crop, purpose. Problems in calculation of discharge of canal from crop water requirement and finding the reservoir capacity or tank

considering the losses and crop water requirements.

**Unit 4 GRAVITY DAMS**

Definition of a dam, classification and types of dams, Preliminary surveys, Final surveys and data to be collected before site selection for a dam, factors to be considered for site selection of a dam. Definition of a gravity dam, forces acting on a gravity dam, resisting force and acting forces on a gravity dam, expressions for self weight, water pressure and uplift pressure in gravity dams, Types of failures of gravity dams: sliding, overturning and tensile or crushing failures, derivation of expression for no sliding condition, no tension condition and no overturning condition, theoretical profile and practical profile. Openings in gravity dams: drainage gallery and other galleries, their functions. Joints in gravity dams.

**Unit 5 EARTH DAMS**

Types of Earth dams: Hydraulic filled dams and rolled filled dams. Brief method of construction, Homogeneous, core type and diaphragm type, suitability and limitations of earth dams. Types of failure of earth dams: Hydraulic failure, seepage failure and structural failure. Seepage through earth dams, phreatic line, drainage in earth dams such as rock toe. Remedial measures for strengthening dams.

**Unit 6 STORAGE RESERVOIR**

Functions of storage reservoir, factors to be considered for the selection of site for a reservoir. Definition of terms- Bed level, lowest supply level, max water level, High Flood Level, flood lift, free board, top of bund-level, water shed area, dead storage, live storage, gross storage, problems on fixing various levels of a reservoir. Sedimentation in reservoirs. Preventive measures to control sedimentation. Losses in reservoir-Evaporation and absorption losses, factors affecting these losses and measures to control reservoir losses.

**Unit 7 SPILLWAYS:**

Definition, types and their location, straight drop spillway, ogee type, duck bill type. Types of gates, Energy dissipaters: definition, types.

**Unit 8 MINOR IRRIGATION SCHEMES**

Bandhara-Layout and component parts. Advantages and disadvantages.

**Unit 9 CANALS**

Classification of canals, factors to be considered during alignment, method of alignment of canals: ridge and contour alignment. Typical cross-sections of canal in cutting, embankment, partial-cutting and partial embankment. Canal lining, necessity, types of lining, advantages and disadvantages of canal lining, maintenance of canals.

**Unit 10 CROSS DRAINAGE WORKS**

Definition of C.D works, types: Canal crossing over a drain, Drain crossing over a canal, Canal and a stream crossing at same level.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**



## Directorate of Technical Education, Goa State

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Introduction	2	3
2	Hydrology	8	9
3	Water Requirements	9	9
4	Gravity dams	8	12
5	Earth dams	5	9
6	Storage Reservoir	6	9
7	Spillways	3	4
8	Minor Irrigation Schemes	2	6
9	Canals	3	8
10	Cross Drainage Works	2	6
		48	75

### 5. TERM WORK & PRACTICALS

termwork shall include following:

1. At least 3 Study assignments of each of the units.
2. Study of models of various storage and irrigation works and projects.
3. Study visit or tour to a irrigation project site.

### 6. LEARNING RESOURCES

S. No.	Author	Title of Books	Publication
1	V.P Periyar	The foundation principle of Irrigation Engg.	
2	Varshney S.C Gupta	Theory and Design of Irrigation Engineering and hydraulic structures	Oxford IBH Pub. Co. Delhi
3	Bharat singh	Fundamentals of Irrigation Engg	Nanchand and Bros, Roorkee
4	B.C. Punmia, Pande, & B.B.Lal	Irrigation and Water Power Engineers	9th-Standard probe distributors Delhi-6
5	K.R Sharm	Irrigation Engg vol I, II & III	
6	Birdi & Das	Irrigation Engineering	
7	IG Dahigaonkar	Textbook of Irrigation Engineering	
8	S.K Garg	Irrigation and Hydraulic Structure	Khanna publication, Delhi-6

**(CT602) CONSTRUCTION TECHNIQUES**

**1. RATIONALE:** - Construction Industry needs many problems to be tackled on site as we encounter them. Thus, it is imperative for all construction students to be well versed in the techniques used in construction Industry. This subject is a reinforcement of many Civil engineering subjects that will be studied in specific application to the site conditions..after studying this subject the student will be able to direct and check the many common Site-activities of construction Industry.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CT602 Construction Techniques	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	-	3	75	25	25	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>Site Management Techniques</b>
	<p>Site layout, list of construction activities. Typical site organizational chart.                  Planning and scheduling of Construction Activities, Labour and materials. Use of Bar-charts.                  Records and books maintained at site( for materials, labour, works carried out etc.).                  Checklists for Inspection and quality control of materials at site (cement, sand, aggregates, steel, wood)                  Storage and protection of construction material(cement, sand, aggregates, steel, wood) Inventory and stores management.                  Temporary arrangement housing for labour and storing materials at site.</p>
<b>Unit 2</b>	<b>Building Services</b>
	<p><b>Plumbing and Water Supply:</b> Calculation of Over head tank capacity, pump capacity, and sump capacity for a construction project. Layout of a typical plumbing arrangement for a housing project. Types of pipes commonly used for water supply in a house. Location and use of common plumbing fittings and appurtenances. Layout of a typical House water connection. Provision for solar water heating system. Checklist for laying and testing of plumbing-services.  <b>Electrical</b> various electrical wires, and connections found in a house, Location and use of common electrical fittings and appurtenances. sketch of typical electrical connection from light pole to meter box. Sketch of a typical electrical layout of a house. Checklist for laying and testing of electrical services.  <b>Sanitation</b> Calculation of septic tank sump capacity for a construction project. Layout of a typical two stack sanitary arrangement for a housing project. Types of pipes commonly used for sewage. Layout of a typical House sewage connection to septic tank and to municipal sewers. Checklist for</p>

laying and testing of sanitation services.

**Air Conditioning** Comparison between window, split and central air-conditioners. Requirements for ducting for air-conditioning. Checklist for laying and testing of Air-conditioning services

**Roofing**, types of roofing. Checklist for laying manglore tile and asbestos roofing.

**Fire Services** list of fire-fighting equipment for multi storied building. Sketch of a typical fire hydrant layout for multi-storied building. Checklist for laying and testing of fire fighting services.

**Unit 3 Construction Equipment**

Check lists of Equipment needed for different construction activities(earth-work in excavation, earth-work in back filling, concreting at below-ground-level, concreting at ground-level, concreting at above-ground-level, wood work, form-work, brick masonry, stone masonry, bar-bending, steel work, plastering, flooring, painting, water proofing, sanitary and water supply services)

Use and working of tilting drum concrete mixers. Use and working concrete vibrators.

Need and methods of Dewatering.

Need and use of soil compaction equipment. Need and use of soil excavation equipment.

**Unit 4 Supervision and Control of Construction Site**

Hierarchy of labour at site. Role of supervisors in the construction site. Importance of supervision for quality of work. Procedure and Checklists for quality and execution of different items of works (earth-work in excavation, earth-work in back filling, PCC, concreting at below-ground-level, concreting at ground-level, concreting at above-ground-level, wood work for doors and windows, form-work, brick masonry, stone masonry, steel work, plastering, flooring, tiling, painting, water proofing, sanitary and water supply services).

**Unit 5 Construction Safety**

Importance of safety in construction work. Checklist of safety clothing and equipment needed at construction site. Checklist of safety measures adopted at work site for- Excavation, scaffolding and form-work, fabrication and erection and demolition. Use of safety warnings and notices.

Cleanliness and waste disposal.

**Unit 6 Measurement and Estimation**

List of various drawings needed for estimation. Estimation from drawings versus actual measurements. Difficulties in actual measurement. Standard units of measurements for various items at site. Basic geometric formulae used in calculation for area, volume. Running account Bill and Final Bill. Item-rate and lump-sum billing. Day-work and Task-work for common items of building construction.

Schedule (Daily, weekly, monthly and final) and mode of Labour and material payments.

Estimation of various items for single storied building an abstract sheet(not for exam)

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Site Management Techniques	9	12
2	Building Services	9	12
3	Construction Equipment	6	15
4	Supervision and Control of Construction Site	9	18
5	Construction Safety	6	9
6	Measurement and Estimation	9	9
		48	75

### 5. TERM WORK & PRACTICALS

Term-work shall include following:

1. Various Checklists as per units above
2. Estimation of various items for single storied building an abstract sheet from given plan
3. Day-work and Task works for 10 items for a typical house.
4. Sketch book with the following
  - a. Bar-Charts for Construction activities for buildings, and Roads
  - b. Site layout for multistoried building
  - c. Sketches of various layouts as per unit 2 above
  - d. Sketches of various tools used in construction.

### 6. LEARNING REFSOURCES

S. No.	Author	Title of Books	Publication
1	Mahesh Verma,	Construction Equipment	
2	BN Dutta	Estimation and Costing	
3	Sushil Kumar	Watersupply and Sanitation	
4	PS Ghelot	Construction management and Planning	
5	R,L Peurifoy.	Construction Planning Equipment and Methods	

## Directorate of Technical Education, Goa State

### Semester - VII

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
CT701	Soil Engineering	3	-	2	5	75	25	25	25	150
CT702	Construction Structure Design	4	-	4	8	75	25	25	25	150
E1	Elective I	-	-	4	4	-	-	50	50	100
E2	Elective II	3	-	2	5	75	25	25	25	150
CT703	Construction Project	-	-	8	4	-	-	50	50	100
CT704	Construction Equipment	4	-	2	6	75	25	-	25	125
<b>Total</b>		<b>14</b>	<b>-</b>	<b>18</b>	<b>32</b>	<b>400</b>		<b>375</b>		<b>775</b>

#### Elective I

CE511 Structural Drawing  
 CE512 Advanced CAD  
 CE513 Comp Aided Civil Engg.  
 CE515 Advanced Construction Tech.  
 CE516 Interior Design  
 CS503- 3D Printing

#### Elective II

CE621 Transportation Engineering-II  
 CE622 Construction Advanced  
 CE623 Geotechnical Engineering  
 CE625 Maintenance & Repairs of Civil Structures  
 CE626 Solid Waste Management  
 CE627 Airport Planning & Design  
 CE628 Planning & Construction of Marine Structures  
 IE6\*\* Institutional Elective

**SEMESTER VIII**

<b>Course code</b>	<b>Name of Course</b>	<b>EXAMINATION SCHEME</b>				<b>Total</b>
		<b>TW</b>		<b>PR/OR</b>		
		<b>Daily Dairy</b>	<b>Progressive Assessment</b>	<b>Training Report</b>	<b>Report Assessment &amp; Seminar/Viva</b>	
CT801	Civil Construction Training-II	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>Grade</b>

FOR INDUSTRIAL TRAINING OF V<sup>TH</sup> & VIII<sup>TH</sup> SEMESTER:

4. Grades will be awarded based on marks scored as follows:
  - e. 80% and above Marks – Grade ‘A’
  - f. 60% to 79% Marks – Grade ‘B’
  - g. 40% to 59% Marks – Grade ‘C’
  - h. Marks below 40% - Grade ‘D’
  
5. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade ‘C’ for passing.
  
6. Student with Grade D under the head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

## SEMESTER VII

### (CT701) SOIL ENGINEERING

**1. RATIONALE:** Soil engineering helps to engineer the soil behaviour for construction purpose. A sound understanding of the fundamental engineering principles of soil is needed to predict the behaviour and performance of soil as a construction material and / or as a supporting medium of engineering structures. The course content has been designed to acquaint the students with the behaviour of different types of soils and their properties and to enable him to engineer soil in-the design and construction of foundations to various structures, pavements, earth retaining structures, embankments, earth dams, etc.

#### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CT701 SOIL ENGINEERING	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

#### 3. DETAILED COURSE CONTENTS

##### Unit 1 GENERAL PROPERTIES AND CLASSIFICATION

- a) **Introduction:** Soil as an engineering material, importance of soil mechanics as applied to various Construction Engineering Problems. Use of soil as a construction material and foundation bed and fields of application, Soil mass, three-phase system,
- b) **Properties of soil :** Properties like void ratio, porosity, water content, degree of saturation, bulk density, dry density, saturated density, submerged density, unit weight, specific- gravity, Interrelation between the properties.
- c) **Mechanical analysis of soil** - Particle size distribution; sieve analysis, sedimentation analysis, pipette analysis. Consistency of soil, Atterbergs limits and their determination, plasticity index, liquidity Index and consistency index.
- d) **Identification of soil.** Field identification of soil. I. S. classification of soils - Plasticity chart and A-line diagram. Classification of rocks ( Igneous, Sedimentary, Metamorphic rocks), properties and uses of important rocks. Introduction to Faults and Folds and their impact on construction activities. Soils and rocks available in Goa. Properties of Latterite stone and latterite soil.

**Unit 2 PERMEABILITY**

Definition, Darcy's law, factors affecting permeability, permeability tests by constant -head and falling head parameters. Application of permeability to filtration and drainage control of soils at construction site.

- Concept of flow lines and equi-potential lines. Construction importance of flow and equi-potential lines.
- Concept of quick condition.
- (No problems on this unit).

**Unit 3 STRENGTH**

- Concept of Shearing strength and bearing capacity of soil- Coulomb's law,
- Tests to determine shearing strength, direct shear test, tri-axial shear test, drained and un-drained conditions, suitability of these tests.
- Ultimate, safe allowable bearing capacity of soil, effect of water table, plate load test, and its limitations.
- Typical values of bearing capacity of different soils and rocks found in Goa.
- (No problems on this unit).

**Unit 4 COMPACTION**

- Concepts of compaction, standard compaction tests, light and heavy compaction, OMC, field application and methods of compaction. Concept of ground modification by Compaction.
- Measurement of field density, core cutter method and sand replacement method.
- Concepts of consolidation, difference between compaction and consolidation, laboratory consolidation tests. Concept of ground modification by consolidation.
- (No problems on this unit).

**Unit 5 LATERAL EARTH PRESSURE**

- Earth pressure on retaining walls. Introduction to Rankine's theory of earth pressure. Introduction to Coulomb's theory of earth pressure.
- Methods of slope stabilization against earth pressure of cuts and landfills.
- (No problems on this unit).

**Unit 6 SOIL EXPLORATION AND STABILIZATION**

- a) Objectives of soil exploration. Different methods of soil exploration (pits, auger boring, wash boring, sounding, seismic refraction and electrical resistivity). Disturbed and undisturbed samples. Borehole logs.
- b) Definition and necessity of soil stabilisation. Methods (mechanical, lime, cement, bitumen and electrochemical) of soil stabilisation.



#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Properties And Classification Of Soils	12	18
2	Permeability	8	12
3	Strength	8	12
4	Compaction	8	12
5	Pressure	4	9
6	Soil Exploration And Stabilization	8	12
		48	75

#### 5. TERM WORK & PRACTICALS

Practicals shall include Journal containing the following tests (Minimum ten)

1. Determination of specific gravity of soil by Pycnometer.
2. Determination of field-density of soil by Core cutter method.
3. Determination of field-density of soil by sand replacement method.
4. Determination of Liquid Limit.
5. Determination of Plastic Limit.
6. Determination of Shrinkage Limit.
7. Grain size distribution by Sieve analysis.
8. Standard Proctor Compaction (Light) test.
9. Direct Shear Test
10. Unconfined Compression test.
11. Triaxial-test- (Study experiment).
12. O.C.B.R. test.
13. Vane shear test (Demonstration).
14. Consolidation test.

#### 6. LEARNING RESOURCES

S. No.	Author	Title of Books	Publication
1	C. Venkataramaiah	Geo-Technical Engineering	
2	Alam Singh	Soil Engineering-Theory & Practicals	
3	Gopal Ranjan & A.R. Rao	Basic and Applied Soil Mechanics	
4	B.C. Purnima	Soil Mechanics & Foundation Engineering	
5	Bharat Singh	Soil Mechanics & Foundation Engineering	

**(CT702) CONSTRUCTION STRUCTURE DESIGN**

**1. RATIONALE:** Reinforced concrete and Structural Steel is widely used in residential, public buildings and other civil engineering structures. To keep the pace confidently in construction industry, students should be acquainted with new method of design, such as limit state method of design. Reading and interpretation of structural drawings is basic skill required to be developed in students. The course content has been designed to enable the student to acquire the knowledge of fundamentals, principles of design in construction structures. This course content will teach the student elementary knowledge in design of common elements he will come across in real life in the construction industry. Student should acquaint himself with latest relevant Indian standard codes and methods of design and detailing of structures..

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CT702 Construction Structure Design	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	4	8	75	25	25	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 4 Hrs.*

**Legends:**

*L-Lecture; T- Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>INTRODUCTION TO RCC DESIGN</b>
	<ul style="list-style-type: none"> <li>• Applications of RCC structures. Advantages and disadvantages of RCC structures</li> <li>• Grades of concrete and steel. Loads and load combinations. Characteristic values and design values for material and loads. Partial safety factors for materials and loads.</li> <li>• Comparison of working stress method, ultimate load method and limit state method of RCC design.</li> <li>• Definition and objectives-of different Limit states (collapse, flexure, compression and shear, serviceability, deflection etc).</li> </ul>
<b>Unit 2</b>	<b>SINGLY REINFORCED SECTION DESIGN</b>
	<ul style="list-style-type: none"> <li>• Assumptions in Limit State of collapse in flexure, stress-strain relationship for concrete and steel. Neutral axis, stress-block diagrams and strain diagram. Derivation of expressions for depth of neutral axis and limit value of neutral axis. Percentage of steel, minimum and maximum percentage, lever arm and limiting moment of resistance. Concept of under-</li> </ul>

reinforced over-reinforced and balanced-sections. Neutral axis, co-efficient, limiting value of moment of resistance and percentage of steel required for balanced section.

- Shear stress in R.C.C section, nominal shear stress, shear strength of concrete, maximum shear stress, truss analogy, minimum shear reinforcement, Design of shear reinforcement in beams using stirrups, bent-up bars and their combinations. Concept of bond and development length.
- Simple numerical problem on design of singly reinforced beam with check for of shear and development length.
- Simple numerical problems on design of cantilever slabs, one-way slabs and two-way slabs only with check for of shear and development length.

**Unit 3 OTHER RCC DESIGN**

General features of doubly reinforced sections, necessity of providing doubly reinforced sections, reinforcement limitations, steel beam theory and its application. No problems for exams.

- Analysis and design of axially loaded short rectangular and circular columns with lateral ties, check for minimum eccentricity.
- Design procedure of square and rectangular footings with check for shear.
- Design procedure of dog- legged stair slab. No problems for exams.
- General design procedure of cantilever type retaining walls earth level up-to top. Checks for stability and curtailment of stem reinforcement. No problems for exams.
- General features and advantages of flanged beams. Effective width of flanges as per I. S. Code. General design procedure of T- beams and L - beams. No problems for exams.
- Simple numerical problems on design of axially loaded short columns (without helical reinforcement and moments)
- Simple numerical problems on design of square and rectangular footings with check for one way and two way shear only.

**Unit 4 INTRODUCTION TO STEEL STRUCTURES**

- Applications of structural steel. Sections used in structural steel. Types of loads on structural steel. Advantages and disadvantages of steel structures. Types of end connections. Comparison of welded and riveted joints. Types of welds and welding symbols.
- Strength of welded joint.
- Simple numerical problems on Strength of welded joint subjected to axial load.

**Unit 5 STEEL TENSION AND COMPRESSION MEMBERS**

- Provisions for tension members as per latest IS Code. Design procedure of concentrically welded joint for tension members. Design procedure of eccentrically loaded fillet-welded joint for tension members with load in plane of weld only.
- Design procedure of tie of single and built up section with welded connections.
- Provisions for compression members as per latest IS Code. Design of column of single and built up section (no lacing and battens design) with welded connections.
- Design procedure of slab base footing for column with PCC pedestal and with welded connections,
- Simple numerical problems on concentrically welded tension members only.
- Simple numerical problems on and eccentrically loaded fillet-welded joint for tension members with load in plane of weld only
- Simple numerical problems on design of column of single section with welded connections

	<p>only</p> <ul style="list-style-type: none"> <li>• Simple numerical problems on design of slab base footing for column with PCC pedestal and with welded connection only</li> </ul>
<b>Unit 6</b>	<b>STEEL BENDING MEMBERS AND TRUSS</b>
	<ul style="list-style-type: none"> <li>• Factors governing the design of beams as per latest IS Code. Design procedure of beam of single section. Check for shear, web buckling, web crippling.</li> <li>• Types of roof coverings. Loads coming on the roof. Determination of forces in roof truss by graphical method. Design procedure of members of steel truss with welded connections. Design procedure of purlins and end bearing of truss.</li> <li>• Simple numerical problems design of beam of single section with check for shear, web buckling, web crippling only.</li> <li>• Simple numerical problems design of purlins with welded joint only.</li> <li>• Simple numerical problems on design of truss (single section ties and struts) with welded connections only</li> </ul>
<b>Unit 7</b>	<b>DETAILING (No problems for exams.)</b>
	<p>Bar bending schedule- Reinforcement layout, design drawings. Construction details at connections, column offsets, members with a break in direction, edge beams, intersection of members. Beam and column joints, rigid frame joints. Bar supports and cover to reinforcement.</p>

#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Introduction To RCC Structures	4	6
2	Single Reinforced Sections Design	12	21
3	Other RCC Design	12	18
4	Introduction To Steel Structures	6	6
5	Steel Tension And Compression Members	12	12
6	Steel Bending Members And Truss	12	12
7	Detailing	6	
		64	75

### **5. TERM WORK & PRACTICALS**

Term work shall consist of following:-

1. Design of RCC framed structure for two storey min four slabs per floor structure with staircase (showing detailed calculations with two drawing sheets showing reinforcement details)
2. Design of steel framed factory shed structure roof truss(showing detailed calculations with two drawing sheets showing structural steel details of members and joints and determination of forces in roof truss by graphical method)
3. Sketch book with following
  - a. Bar bending schedule
  - b. Typical Reinforcement plan and section for single and continuous beam, slab, staircase, column and footings.
  - c. Reinforcement details at beam-column-joint, column offsets, members with a break in direction, edge beams, intersection of members.
  - d. Typical Reinforcement drawing for cantilever retaining wall and water tank
  - e. Reinforcement details at opening in slab,
  - f. Types of welds and weld symbols.
  - g. Typical standard steel sections.
  - h. Typical steel sections, joints, bearing etc, for welded king post roof truss.

**6. LEARNING REFSOURCES**

S. No.	Author	Title of Books	Publication
1	S. R. Karve and V. L. Shah	Limit State theory and design of reinforced concrete structures	publishers and distributors, Pune
2	S. N. Sinha	Reinforced concrete design	Tata McGraw Hill Publishing Co.Ltd, New Delhi
3	Ashok K. Jain	Reinforcement concrete Limit State Design	, New' Chand and Bros Roorkee -
4	C. Syal and R. K. Ummat	Behaviour analysis and design of reinforced concrete structural elements	Wheeler puyblishing Co, Ltd, Allahabad
5	P. Purshothaman	Reinforced concrete structural elements	Tata McGraw Hill Publishing Co, Ltd, New
6	I. S. 456 - 2000	code of practice for plain and reinforced concrete	2000 edition Or Latest revision
7	I. S. 875 (part - I & part - II) - 1993	Code of practice for design loads	Or Latest revision
8	I S Code	Is Codes 456/800/875	ISI
9		Sp-16	ISI
10	Ramchandran	Design Of Steel Structures	Std Book House
11	S K Duggal	Design Of Steel Structures	Tata McGraw hill
12		Hand book on Reinforcement and detailing special publication SP 34	Bureau of Indian Standard New Delhi, 1987

**(CT703) CONSTRUCTION PROJECT**

**1. RATIONALE:** In order to develop self confidence and attain professional competence, the students, based on the knowledge gained already in different courses will be required to integrate, in order to take up and solve the real live problems in Civil Engineering. They are required to acquire skills in site investigation, collection of data, simple designing, drawing and estimating and prepare a comprehensive project report, leading to the execution of the scheme beneficial to socio- economic development of the community, The students in small groups (5 to 10 per group) will select any one of the projects in consultation with the faculty member concerned. In order to properly prepare the project is divided into two phases. The first shall consist of data collection and the next of assimilation and presentation. From knowledge gained and data collected the student will be required to integrate and prepare a comprehensive project report.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
<b>CT703 CONSTRUCTION PROJECT</b>	-	-	8	4	-	-	50	50	100

Minimum passing %: Theory 40%

**Legends:**

*L-Lecture; T- Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

**Unit 1 Pre-Project Activities**

The Unit-1 shall consist of the following activities based on topic from unit-3:

1. Identifying the aims, objectives and different works to be carried out in the project.
2. Prepare a preliminary plan of the project from data-collection to execution stage.
3. Collecting data relevant to project from all possible sources including conducting interviews, data-surveys, measurements, site-surveys, references, books and internet.
4. Conducting case studies (at least one if possible) and surveys of similar projects in the immediate neighbourhood (if possible).
5. Rough assimilation of data to suit the projects aims and objectives.
6. Selection of most efficient alternative / method from the available data based on preliminary investigation.
7. Collection of additional and supplementary data if necessary.

**Unit 2 Project Activities**

The Unit-2 shall consist of the following activities based on the data collected in the previous unit:

1. Design the required elements of the project as-per standard practices.
2. Prepare the working drawings for the project.
3. Design and Detailing with a new material or technique,
4. Estimation of quantities and cost should essentially be included in all the projects.
5. Estimate the cost of the project, based on men, material and equipment required.
6. Prepare a Man-material schedule for project.
7. Prepare a Site supervision schedule,
8. Prepare a schedule of time and sequence of operations.
9. Prepare a stage-wise financial implications statement.
10. Prepare a project report.
11. Prepare Charts / Models for the project.

**Unit 3 Project topics may include following:**

The project could be on any topic covered during the course of the studies. Design of a small Residential/commercial building project is not a suitable project. The following is an indicative but not exhaustive list.

1. Study of traditional structures and local building techniques
2. Construction of water-supply and distribution system for a township,
3. Construction of a sewerage-system for a township,
4. Resurvey of existing town/village area using latest techniques/equipments
5. Construction of economical concrete mix with alternate/construction-waste/local materials
6. Construction of low cost housing schemes for rural areas,
7. Construction of low cost housing schemes for slums in urban areas,
8. Construction of solid waste disposal plant for rural or urban areas
9. Construction of rural water supply schemes,
10. Construction of rural sanitation schemes,
11. Construction of rural waste disposal schemes,
12. Construction of rural/hill road and transport schemes,
13. Construction of gobar gas plants,
14. Sub-division layout of a site
15. Construction of Water supply sanitation and drainage scheme for a 100 unit neighbourhood complex
16. Road layout of a residential/industrial complex,
17. Construction of roads using industrial/construction and mining wastes
18. Construction of shuttering and scaffolding for structural elements,
19. Construction of traffic junctions in the city,
20. Carry out and classify Soil/geotechnical study of project area and sub strata
21. Development of traditional springs,
22. Construction of Temporary structures for fairs and exhibitions,
23. Traffic design for festivals and Zatras
24. Construction of Full Beach Development
25. Construction of theme parks



26. Construction of institutional buildings
  27. Construction of public buildings
  28. Construction of green building / intelligent buildings
  29. Construction of airport
  30. Construction of ropeways and cableways
  31. Construction of helipads for tourism related activities
  32. Construction of outflow treatment plant for existing factories
  33. Construction of docks and harbours
  34. Construction of tunnels
  35. Construction of storm water drains
  36. Construction of railway station and yards
  37. Construction of warehouse complex
  38. Construction of cold storage complex for farm products
  39. Construction of silos
  40. Construction of children's park,
  41. Construction of parking lots
  42. Construction of stadia and community play/sports grounds
  43. Construction of crematoria
  44. Construction of pile foundations
  45. Construction of marine retaining walls / structures
  46. Construction of shore protection works
  47. Construction of slope protection works and soil retaining structures
  48. Construction of rural energy devices-solar/water/wind...
  49. Construction of machines to specifically aid civil engineering works.
  50. Construction of reinforced mud structures
  51. Construction of fibro-cement and ferro-cement structures
  52. Construction of Community Type Chulha cookers and stoves for rural populations
  53. Construction of shell roofing
  54. Construction of ropeways and bridges
  55. Construction of rainwater harvesting schemes
  56. Construction of waste-water recycling scheme
  57. Construction of drip irrigation scheme
  58. Construction of rehabilitation of polluted stream/lake/river
  59. Construction of mine-waste utilisation schemes.
  60. Construction of curved and shell roofs
  61. Construction of underwater aquarium/ theme park
  62. Development of Smart city
- A futuristic design using computer based simulation can also be undertaken provided it has enough work-load for the student.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

<b>Unit No.</b>	<b>Unit</b>	<b>Guidance Hours Per Semester</b>	<b>Marks</b>
1	Project activities	128	

**5. TERM WORK & PRACTICALS**

The project report must include the following: Introduction, Synopsis (500 words), acknowledgements, bibliography and reference, summary and conclusion, along with all figures/drawings/photographs/ tables as necessary. It shall include the data collected and presented in the previous semester.

**6. LEARNING RESOURCES**

As per the topic of the project

**(CT704) CONSTRUCTION EQUIPMENT**

**1. RATIONALE:** - Due to increase in the magnitude and complexity of construction use of equipment has become imperative. It is necessary that Civil Engineers working on the construction project and acquired with broad construction features and working principles of various construction equipment so that he can ensure its effective use.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CT704 Construction Equipment	L	T	P	C	TH	TM	TW	PR/OR	125
	4	-	2	6	75	25	25	-	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks; PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<b>COMPRESSED AIR</b>
<p><b>Pneumatic Compressors-</b> Construction and working of different types of air compressors (reciprocating, rotary, screw and centrifugal),  <b>Pneumatic Tools-</b> Construction and working of different types of pneumatic tools (hand held drills, pavement breakers, rotary blast hole drill, jack hammer, wagon drill).</p>	
<b>Unit 2</b>	<b>STONE CRUSHING</b>
<p>Classification of stone crushers (primary, secondary, tertiary). Construction and working of following (jaw crushers, gyrator, hammer-mill cone). Construction and working of screens for crushing stone.</p>	
<b>Unit 3</b>	<b>MIXING AND COMPACTING</b>
<p><b>Mixing equipment</b> - Construction and working of concrete mixers (tilting drum, non-tilting drum, pan- mixers, agitators). Brief description of hot mix plant. Brief description of concrete batching plant for ready-mix concrete. Schematic layout of placing of ready-mix concrete on site.  <b>Compaction Equipment-</b> Necessity and methods of concrete compaction, Construction and working of following (internal and external vibrators, surface vibrators, vibrating tables). Necessity and methods of soil compaction. Construction and working of following (sheep foot rollers, vibratory rollers, smooth rollers).</p>	
<b>Unit 4</b>	<b>PUMPING, DEWATERING, DRILLING AND GROUTING</b>

**Pumps-** Classification of pumps, brief description and working of following pumps(reciprocating pumps, centrifugal pumps, diaphragm pumps, submerged pumps), principals and conditions for selection of pumps,

**Dewatering-** List of different dewatering systems, Construction and working of well point system.

**Drilling and grouting-** Brief description and working of electrical drill. Equipment used for grouting; schematic layout of grouting equipment.

**Unit 5 UNDERWATER/UNDERGROUND CONSTRUCTION**

**Piling Equipment-**Methods for driving/placing following piles- sheet, steel, timber, pre-cast concrete, cast-in-situ concrete,) Advantages and disadvantages of cast-in-situ concrete piles. Construction and working of pile hammers.

**Caisson equipment-**Methods of casting caissons. List of equipment used for open-well and box caissons.

**Tunnelling equipment.** Methods of tunnelling. List of equipment used for tunnelling

**Underground Cabling equipment-** Methods of Underground Cabling. List of equipment used for Underground Cabling.

**Unit 6 EARTH MOVING**

**Excavating Machinery-** Construction and working of following equipment (basic shovels, Hoe, Drag-lines, clamshell, hydraulic shovels), comparison between cable operated and hydraulically operated shovels. Comparison between crawler and wheel mounted shovels.

**Levelling Machinery-** Construction and working of crawler-mounted and wheel mounted bull-dozer. Comparison between hydraulically and cable operated bull-dozer.

**Transporting Machinery –** List of equipment used to transport materials. Vertical and horizontal transportation. Types and uses of trucks and dumpers.

**Conveying machinery-** Construction and working of belt conveyors, cable-way, excavators and scrapers.

**Lifting Machinery-** Construction and working of different types of cranes, lifts and winches.

**Unit 7 SAFETY EQUIPMENT**

List of safety equipment needed at construction site and situation where each is used (personal and workplace), component and use of basic first aid kit, necessity and placement of safety warnings and notices.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

<b>Unit No.</b>	<b>Unit</b>	<b>Teaching Hours Per Semester</b>	<b>Marks</b>
1	Compressed Air	12	12
2	Stone Crushing	10	9
3	Mixing and Compacting	12	12
4	Pumping, Dewatering, Drilling and Grouting	8	9
5	Underwater/Underground Construction	14	12
6	Earth Moving	16	18
7	Safety Equipment	4	3
		80	75

**5. TERM WORK & PRACTICALS**

Termwork shall include following:

1. Study assignments with Labeled Sketches of different equipment listed above
2. Study of working models and charts of different equipment listed above as available.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1.	Mahesh Verma,	Construction Equipment	
2.	R,L Peurifoy.	Construction Planning Equipment and Methods	

**(CE511) STRUCTURAL DRAWING**

**1. RATIONALE:** A passout should be able to draw (plan, C/S, L/S, details etc. from given data-size, shape, reinforcement, cover, sections etc) and interpret structural drawings fluently, also to prepare material schedule and bar bending schedule from structural drawings. He should know all symbols used in RCC and Steel fabrication works.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
<b>CE511 STRUCTURAL DRAWING</b>	-	-	4	4	-	-	50	50	<b>100</b>

*Minimum passing %: Theory 40%*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<p><b>Unit 1           BASICS</b> Necessity of structural detailing, welding symbols, riveting symbols, representation of materials, common abbreviations and symbols used in RCC plans, bar bending schedule, brief revision of taking out quantities and material schedule.</p>
<p><b>Unit 2           BASIC R.C.C STRUCTURES</b> <b>Beams</b> (rectangular and tee beams) (straight and curved) (simply supported, continuous and cantilever), edge beams , intersection of members  <b>Columns</b>-rectangular and circular ,beam-column junctions, column offsets  <b>Slabs</b>-one way and two way, openings in slabs , joint at ridge of sloping roof  <b>Footings</b>-simple rectangular and circular, combined, strap  <b>Staircase</b>-dog legged, open well, cantilever and riser-thread(without waist slab)</p>
<p><b>Unit 3           BASIC STEEL STRUCTURES</b>  Columns-compound and braced , design at connections, beam sections  Simple roof structures  Column bases-(slab, gusseted and grillage)</p>

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Basics	8	15
2	Basic R.C.C Structures	12	20
3	Basic Steel Structures	12	15
		32	50

**5. TERM WORK & PRACTICALS**

Practicals shall include following:

1. To prepare 4 RCC drawing sheets from given data (size, shape, reinforcement, cover, sections) for all items each from units 2 and 3
2. Prepare bar bending schedule from RCC structural drawings above
3. To prepare 3 steel drawing sheets from given data Prepare material schedule from steel structural drawings above. LEARNING RESOURCES

S. No.	Author	Title of Books	Publications
1	V.B. Sika	A course in civil engineering drawing	
2		Hand book of concrete reinforcement and detailing -IS 1	
3	Malik and meo	A text book of draftmen civil	
4		SP 34	

**(CE513) COMPUTER AIDED CIVIL ENGINEERING**

**1. RATIONALE:** A pass-out working in a design office should be able to plot and design civil engineering structures using a computer. He has to have the capacity to use the latest software and available software to perform office duties related to civil engineering.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE513 COMPUTER AIDED CIVIL ENGINEERING	L	T	P	C	TH	TM	TW	PR/OR	100
	-	-	4	4	-	-	50	50	

*Minimum passing %: Theory 40%*

**Legends:**

*L-Lecture; T- Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

**3. DETAILED COURSE CONTENTS**

<b>Unit 1</b>	<p style="text-align: center;"><b>INTRODUCTION</b></p> <ul style="list-style-type: none"> <li>Applications of computers in various civil engineering fields.</li> <li>Need of computers in civil engineering design and execution.</li> <li>Advantages and disadvantages of computers in civil engineering.</li> <li>Future trends in Computer Aided Civil Engineering</li> </ul>
<b>Unit 2</b>	<p style="text-align: center;"><b>STRUCTURAL DESIGN</b></p> <ul style="list-style-type: none"> <li>Various software available such as STAAD-Pro, STRUDS, SuperCivil</li> <li>analysis of portal frame, truss, space frame, girders ,</li> <li>introduction to FEM</li> <li>design of beam, Column, footings, retaining walls, slabs</li> </ul>
<b>Unit 3</b>	<p style="text-align: center;"><b>DRAFTING AND PLOTTING</b></p> <ul style="list-style-type: none"> <li>Various software available like AutoCAD,</li> <li>Computer Aided Drafting of plan, 2-elevations, section and site plan of a House with pitched-roof and flat roof</li> <li>Computer Aided Drafting of plan, 2-elevations, section and site plan of a factory shed</li> <li>Computer Aided Drafting of garden/landscaping</li> <li>Computer Aided Drafting of subdivision of plots</li> <li>3D structures like buildings, dams, bridges,</li> </ul>



**Unit 4                      PLANNING**

- Various software available like MS-Project
- Networking using CPM/PERT
- Scheduling and costing
- Break even analysis
- Inventory control

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Introduction	4	10
2	Structural Design	10	15
3	Drafting And Plotting	10	15
4	Planning	8	10

**5. TERM WORK & PRACTICALS**

Term work shall preferably consist of the following:

1. Written assignments on application, need, advantages, disadvantages and trends in use of computers in civil engineering.
2. Written assignments on utility and availability of software in civil engineering planning design and execution.
3. Written assignments on utility of information-technology and internet for effective functioning of a civil engineers office.
4. A complete submission file including application for permission letters, certificates, forms, relevant plans and drawings, structural designs and drawings, site plans, measurement and abstract sheet and bar-chart schedules for a 100m<sup>2</sup> G+2 (framed R.C.C. structure ) residential bungalow- to be done using software available with institute.
5. A complete Client-Owner file including application for tender documents, typical contract, annexure, work-order, completion certificate, relevant plans and drawings, structural designs and drawings, site plans, measurement and abstract sheet and bar-chart schedules for a steel framed structure / factory shed- to be done using software available with institute.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1		Internet Resources	
2		AutoCad Manual	
3		STAAD/STRUDS manual	
4		Ms Project & office manual	

<b>CS503 – 3D PRINTING</b>															
Teaching Schedule Per Week			TW	PR/OR										Total	
Lectures	Practical	Credits													
-	4	4	50	50										100	
Pre-requisite		Source	USERS	1	2	3	4	5	6	7	10	11	12	13	14
Nil				15	16	20	21	23	24	28	29	34	35	36	

Rationale: 3D Printing is a new technology when compared to traditional manufacturing processes and the purpose of this course is to give students a head start. The course is designed to be an introduction to the technology while at the same time explaining the concepts involved in designing parts and assemblies for manufacture by 3D printing. Traditional design concepts fall short when it comes to 3D printing and knowledge of these concepts will add significant value to students as they get ready to face the challenges of the real world.

<b>COURSE CONTENTS</b>	Hrs	Mks
<b>1. INTRODUCTION TO 3D PRINTING</b>	2	3
Introduction to 3D Printing – what is it, how it works. History of 3D Printing – who invented it and when. Processes – different 3D Printing processes available today. Application – use of 3D Printing, today and tomorrow. Course summary – what will be taught during this course?		
<b>2. FUNDAMENTALS, PROCESSES &amp; MATERIALS</b>	3	7
Basic requirements – list of basic requirements for successful 3D Printing. Processes – 3D Printing Processes in brief – FDM, EBM, SLS, SLA, etc. Materials – list of materials used and available – PLA, ABS, Metal Alloys, Ceramic powders, etc. Possibilities and Limitations. FDM – detailed knowledge of FDM process.		
<b>3. INTRODUCTION TO FDM 3D PRINTER</b>	2	4
FDM 3D Printer – process, specifications, how to use. 3D Printer in action – print bundled models to get the first experience of the FDM 3D Printer in action. Do’s and don’ts – things to be kept in mind while designing for/printing on FDM 3D Printer. Rafts & Supports – their use and how to avoid them.		
<b>4. EFFICIENT 3D PRINTING</b>	2	3
Brief introduction to 1.Orientation – meaning and purpose, 2.Clearance – meaning and use, 3.Wall thickness – meaning, purpose & importance, 4.Accuracy/inaccuracy – understand and take advantage of it, 5.Movable Parts – meaning and how to achieve them, 6.Assemblies – definition and how to build them.		
<b>5. ORIENTATION</b>	3	4
Definition. Orientation and Successful Printing. Avoid rafts & supports using appropriate orientation. Orientation for defect free printing. Experiments with Orientation.		
<b>6. CLEARANCE</b>	5	5
Definition. Effects of lack of clearance with different processes and different materials. Clearance for FDM 3D Printer and its materials. Clearance while modelling. Knowledge of Clearance and its benefits. Experiments with Clearance.		
<b>7. WALL THICKNESS</b>	5	8
Definition. Its importance in 3D Printing. How does it differ from process to process and material to material? Effects of having ‘thinner’ walls than the required minimum wall thickness. Experiments with wall thickness.		

<b>8. ACCURACY/INACCURACY</b>	7	11
Definition – accuracy in terms of different processes and materials. Accuracy of objects printed on FDM 3D Printer. Adjustments necessary in the Model to compensate the inaccuracies. Experiments with Accuracy/Inaccuracy.		
<b>9. MOVABLE PARTS</b>	10	16
Definition – what are Movable Parts and how to design them? How to achieve this on a FDM 3D Printer with the help of ‘orientation’, ‘clearance’, ‘wall thickness’, ‘accuracy’, etc. discussed earlier. Precautions – things to keep in mind while designing movable parts. Experiments with Movable Parts.		
<b>10. ASSEMBLIES</b>	12	16
Definition. How to create them. Exercise – design fully functional assemblies. Experiments with Assemblies.		
<b>11. PRINTABILITY</b>	8	13
Definition – overall printability of a given model and how it’s determined. Do’s and don’ts. Design error free models. How to diagnose and fix errors. Experiments with Printability.		
<b>12. 3D PRINTING TODAY</b>	3	5
3D Printing and its growth till date. Current application of 3D Printing in Prototyping, Jewelry, Industrial Design, Architecture, Engineering and construction, Automotive, Aerospace, Dental and Medical Industries, Education, etc. Impact of 3D Printing. Factors that affect 3D Printing today e.g. Lack of knowledge, cost, availability, etc.		
<b>13. FUTURE OF 3D PRINTING</b>	2	5
How fast is it growing. Predictions from the experts about its future. Possibilities – new processes, materials, new applications, etc.		
<b>Total</b>	64	100

## PRACTICALS

1. Print for the first time using bundled creations.
2. Model and print objects to demonstrate negative and positive effects of Orientation.
3. Model and print objects with accurate clearance.
4. Experiment with minimum wall thickness by modelling and printing objects with different wall thickness.
5. Experiment with accuracy of the prints and model objects that will be physically accurate after printing.
6. Design Movable parts and print them in one piece.
7. Create assemblies - either printed as one piece or assembled later or combination of both.

## REFERENCE

## ANALYTICAL TABLE OF CONTENTS

01 - 3D PRINTING.....	131
01. INTRODUCTION TO 3D PRINTING.....	131
02. FUNDAMENTALS, PROCESSES & MATERIALS.....	131
03. INTRODUCTION TO FDM 3D PRINTER.....	131
04. EFFICIENT 3D PRINTING.....	131
05. ORIENTATION.....	131
06. CLEARANCE.....	131
07. WALL THICKNESS.....	131
08. ACCURACY/INACCURACY.....	132
09. MOVABLE PARTS.....	132
10. ASSEMBLIES.....	132
11. PRINTABILITY.....	132
12. 3D PRINTING TODAY.....	132
13. FUTURE OF 3D PRINTING.....	132

**(CE621) TRANSPORTATION ENGINEERING**

**1. RATIONALE:** Transportation Engineering is an essential and important area of activity for the socio-economic development of any region. The Civil Engineer is actively involved in the planning and execution of transportation net works such as roads, railways, airports and related structures viz. bridges, tunnels, docks and harbours. This course content on Advanced Transportation Engineering has been designed to provide the students with sufficient understanding of different operations involved in areas of transportation other than roadways.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE621 TRANSPORTATION ENGINEERING	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T*- Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 RAILWAYS**

**Introduction-** Advantages and disadvantages of rail travel, Rail gauges(Broad gauge, meter gauge, narrow gauge) and their widths. Cross-section of B-G Railway track in full embankment and cutting for a single line and double line.

**Permanent-way** Definition and Component parts with cross-section.

**Rails-** Functions, types, standard section. Types and Functions of Rail joints. Creep of rails and remedial measures.

**Sleepers-**Functions, types, merits and demerits, fixtures used, sleeper density.

**Ballast-**Function, requirements, materials used as ballast, their suitability, renewal of ballast.

**Alignment-** Alignment of a railway track, factors controlling the alignment. Methods of laying the track.

**Points and crossings-**Necessity, types and brief description.

**Yards-**Types, function and layout.

**Bullet-trains** -Special consideration for bullet trains.

**Unit 2 TUNNELS**

**Introduction-** Definition, purpose, advantages and disadvantages, Typical cross-sections, Clearance diagram for rail and road tunnels.

**Tunnel construction** - Alignment of tunnel- factors affecting the alignment. Setting out for the tunnel and locating the centre line inside the tunnel. Method of tunnelling operation in hard rock and in soft ground, safety precautions in tunnelling.

**Lining of tunnels-** definition, objectives and types of lining.

**Ventilation-** definition, objectives and types,

**Dust control-** definition, objectives and preventive measures.

**Drainage of tunnels-** definition, objectives and methods of drainage.

**Unit 3 HARBOURS, DOCKS AND RELATED STRUCTURES**

**Harbour and ports-** Advantages and disadvantages of sea travel, Definition, function, components, Layout, types (natural and artificial), Selection of site and classification.

**Docks** -Definition, function, classification (dry dock/wet dock) and their comparison, method of construction.

**Locks and lock gates-** Definition, function, types and method of operation,

**Break-water-** Definition, function, types, method of construction,

**Jetties and quays-** Definition, function, types and method of construction.

**Warehouses and transit sheds,** Definition, function, location and method of construction.

**Unit 4 AIRPORTS**

**Introduction** –Advantages and disadvantages of air travel, classification, location, size and site selection.

**Runway and Taxiways** - Definition, functions, configuration/layout (single, parallel and divergent). Basic runway length and width, longitudinal and transverse gradient, location

**Terminal areas** – Function and location of various units in a terminal building, apron, control tower and hangers.

**Airport drainage.** Definition, function and location

**Airport lighting.** Definition, function and location

**Unit 5 ALTERNATIVE MODES OF TRANSPORTATION**

Introduction to cable-craft, hovercraft, hydrofoils, sky-bus, monorail, etc.

Future trends in transportation (space tourism, driverless cars, etc).

Automation in transportation

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Railways	16	20
2	Tunnels	8	10
3	Docks And Harbours	10	10
4	Airports	10	10
5	Alternative Modes	4	5
		48	75

**5. TERM WORK & PRACTICALS**

Term work shall include following:

1. 10 Study assignments on above topics
2. Industrial visits should be arranged for:-Railway Station, Tunnel, Harbors, Airport to support the theoretical knowledge gained in theory classes. The students should be asked to submit detailed report of the visit with sketches and photographs for progressive assessment.

**6. LEARNING REFSOURCES**

S. No.	Author	Title of Books	Publication
1	B.L. Gupta & Amit Gupta	Roads, Railways, Bridges Tunnel Engg	standared publications, 1705- B, Naisarak Delhi- 6
2	N. Vaziram & S.P Chandola	Transportation Engg. Vol I & II	Khisna Publishers, 2-B, Nath market, Nai sarak Delhi
3	Birdi & Asuja	Roads, Railways, & Bridges	standard book house, New-Delhi



## Directorate of Technical Education, Goa State

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4	Saxena & Arora	A Textbook of Railway Engg	Dhanpat Rai s. Sons 1682, Naisarak, New Delhi- 110006
5	S.P Bridra	Dock & Harbour Engg	Dhanpat Rai s. Sons 1682, Naisarak, New Delhi- 110006
6	S.P Bridra	Tunnel Engg	Dhanpat Rai s. Sons 1682, Naisarak, New Delhi- 110006

# Directorate of Technical Education, Goa State

## (CE622) CONSTRUCTION (ADVANCED)

**1. RATIONALE:** The course content is designed to give various aspects of modern and advanced methods of construction of Civil Engineering. This course stresses on construction activities other than the normal buildings and houses that an engineer comes across.

### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE622 CONSTRUCTION (ADVANCED)	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

### 3. DETAILED COURSE CONTENTS

<p><b>Unit 1 DEEP TRENCH EXCAVATIONS</b> Introduction, basement excavations -perimeter trench methods, raking, struts, cofferdams ,diaphragm walls.</p>
<p><b>Unit 2 TALL CHIMNEYS, SILOS, ETC</b> General aspects of construction. Form-work -Slip-forms, jump-forms. Lining.</p>
<p><b>Unit 3 BRIDGE CONSTRUCTION TECHNIQUES</b> Introduction. Construction techniques-Fully supported on staging, partly supported on staging. Cantilever construction. Arch rib constructed with cable supports. Continuous deck construction with movable forms. Incremental push launching method. Form-work and false-work.</p>
<p><b>Unit 4 SPECIAL CONCRETING OPERATIONS</b> Introduction. Short-crete, pump-crete, grouting, guniting, tremie concreting, mass concreting. Sources.</p>
<p><b>Unit 5 CLADDINGS</b> Definition. Functions. Requirements. In- fill panels. Types of claddings -Asbestos cement sheet wall cladding. Sheet metal wall cladding. Brick and block walling. Jointing- Mastics and sealant, types and requirements.</p>
<p><b>Unit 6 FACTORY BUILDINGS</b> Introduction. Roofs- North light roofs, Monitor roofs, Special type of steel roofs, Lattice truss, Portal frame, Shell roof.</p>
<p><b>Unit 7 PREFABRICATED CONSTRUCTION</b> Introduction. Advantages. Areas of application, Various pre-fabricated units. Constructional details.</p>
<p><b>Unit8 REINFORCED EARTH CONSTRUCTION</b> Introduction. Advantages. Reinforcing materials, characteristics. Application areas. Constructional- details.</p>

**Unit 9                      DEMOLITION OF STRUCTURE**

Introduction. Safety precautions. Demolition-techniques -Hand demolition, push arm demolition, deliberate collapse demolition, demolition ball techniques, wire rope pulling demolition, demolition by explosives, other methods

**Unit 10                      SPECIAL ASPECTS OF CONSTRUCTION:**

Dampness sources and effects, water proofing,terrace, parapets,toilets, damp preventions.

Acoustics in building: Use of acoustic materials, acoustics defects and remedial measures.

Fire proofing: Use of Fire proofing materials, planning to minimize fire hazards in multi-storeyed, public building.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Deep Trench Excavations	3	06
2	Tall Chimneys, Silos,	4	06
3	Bridge Construction Techniques	5	09
4	Special Concreting Operations	5	09
5	Claddings	5	09
6	Factory Buildings	4	06
7	Prefabricated Construction	5	06
8	Reinforced Earth Construction	4	06
9	Demolition Of Structure	5	06
10	Special Aspects of Construction:	8	12
		48	75

**5. TERM WORK & PRACTICALS**

Term work shall include following:

1. Study tour if possible with written report on the same of 10-25 pages
2. Written assignments on the above.

**6. LEARNING REFSOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Chudley	Construction Technology(vol. 1 to 4 )	Longman Scientfic TechnicalPublications
2	R, Barry	Construction of Buildings (vo1.1 to 4 )	The English Language London
3	W. B. Mackey	Building Construction(vo1.1 to 4 )	The English Language London
4	D. Johnson Victor	Essentials of Bridge Engineering	Oxford&IBH Publishing Co.PVt.LTD
5	Robert Bowen	Ground water	
6	Neville	Concrete technology	Newyark longman Scientfic
7	M . S. Shetty	Concrete technology	S.Chand and Company Ram Nagar New Delhi
8	S. N. Manohar	Tall chimney design and construction	Tata Mc Graw-Hill New Delhi

**(CE625) MAINTENANCE AND REPAIRS OF CIVIL STRUCTURES**

**1. RATIONALE:** All Civil Engineering structures such as buildings, roads, bridges, dams, canals etc. require routine maintenance and repairs in achieving their desired life span. Lack of maintenance may lead to improper performance or even failure of structure of structure leading loss of economy and even life. Hence it is very essential to study the importance of methodology of repairs and maintenance of various civil engineering structures.

**2. TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
<b>CE625 MAINTENANCE AND REPAIRS OF CIVIL STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>TH</b>	<b>TM</b>	<b>TW</b>	<b>PR/OR</b>	<b>150</b>
	<b>3</b>	<b>-</b>	<b>2</b>	<b>5</b>	<b>75</b>	<b>25</b>	<b>25</b>	<b>25</b>	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 PRINCIPLES OF REPAIRS AND MAINTENANCE**

Necessity for repairs and maintenance.

Sources and causes of deterioration and decay of structures.

Adaptation

- Part of structures for partial use
- Structures for alternate use.
- Temporary arrangements pending repairs and maintenance.

Classification of repairs and maintenance.

- Routine and
- Emergency
- Annual

Maintenance management

- Necessity for management.
- Organisation structure of Specialized Repairs and Maintenance Firm.
- Direct Contract, sub-contract and labour-contract.
- Health and safety requirements.

Planning and Design consideration

- How to plan for repairs and maintenance.
- suitable materials
- Selection and Availability of suitable materials.
- Estimate for maintenance.

Access for maintenance.

**Unit 2 BUILDINGS**

Defects, causes and maintenance of

- Structural Elements- Foundation, RCC-frame parts (beam, column, slab, stairs), walls, roofs,
- Non-Structural Elements- doors, windows, Grillage,
- Surface-finishes- Plastering, painting, waterproofing.
- Building services- Light, ventilation, electricity, plumbing, water tanks, drainage, lifts.

Maintenance of multi-storeyed buildings-

Introduction to Non-destructive testing

Safety and special precautions.

Fire protection.

**Unit 3 WATER SUPPLY AND SEWERAGE SYSTEMS**

Need for Repair and Maintenance.

Inspection and safety precautions.

Leakage and losses in pipes.

Cleaning of water tanks.

Repair and Maintenance of piping used in water supply and sewage system.

Repair and Maintenance of treatment plants.

Repair and Maintenance of pumps and appurtenances.

**Unit 4 ROADS**

Defects, and their causes

Inspection practices.

Repair methodology.

Repairs and maintenance pavement, permanent-way, shoulders, pot holes,

subsidence of roads

special machinery

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**Unit 5                    IRRIGATION STRUCTURES**

Problem identification

Causes of inefficient working of bandharas, dams, canals, gates and weirs.

Silt removal and strengthening of canal banks

Algal and weed control

Maintenance of service roads.

Routine inspection.

Special repairs, such as :cement grouting, soil stabilisation, repairs of Filters, pitching etc.

Silt removal and strengthening

Repair of sluice gates,

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**Unit 6                    MARINE STRUCTURES**

Types of maintenance works, brief description, necessity and method.

Inspection and testing of marine structures

Dredging of docks, jetties, dry-docks, harbours

Introduction to Non-destructive testing

Repair and rehabilitation of marine structures

Planning guidelines for maintenance of ocean structures

Structural health monitoring of ocean structures

Shore protection works

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**Unit 7                    OTHER STRUCTURES**

Defects and their causes of -rails, permanent-way and level crossing, earth retaining works, airport runways and aprons, trusses and steel structures, tunnels and underground shafts, bridges.

Inspection practices, Inspection of defects, Duties and responsibilities of inspectors.

Repair and maintenance methodology

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Principles Of Repairs And Maintenance	8	10
2	Buildings	12	15
3	Water Supply And Sewerage Systems	10	15
4	Roads	6	10
5	Irrigation Structures	4	10
6	Marine Structures	4	10
7	Other Structures	4	5
		48	75

**5. TERM WORK & PRACTICALS**

Term work shall consist of

- Health and safety requirements,
  - Schedule,
  - List of materials,
  - List of tools and equipment and special equipment (including brief description of working)
  - Check list for faults,
  - Check list for maintenance and repairs
- for the following:

1. Masonry structures
2. RCC structures
3. Steel structures
4. Roads
5. Railways
6. Canals
7. Docks and jetties
8. Earth retaining works
9. Shore protection works
10. Airports
11. tunnels
12. Dams and bandharas



**6. LEARNING REFSOURCES**

S. No.	Author	Title of Books	Publication
1		Indian standard code of practice for maintenance of canal	
2	Johnson Victor	Bridge Engineering	
3	Khanna & Justo	Highway Engineering	
4	S. K. Garg	Water supply Engineering	
5	IS: 12054:1987	Code of practice for application of silicon based water repellent	
6	IS 4839 Part I Part II Part III	(unlined canals) (lined canals) (Canals drains outlets etc.)	
7	S. K. Hussain	Water supply & Sanitary Engineering	
8	Y. K. Raina	Concrete for construction Facts & Practice	
9	IS: 4365: 1967	Code of practice for application of bitumen mastic for water-proofing of roofs	
10	IS: 7198: 1974.	Code of practice for damp-proofing using bitumen mastic	
11	P.K. Guha	Mainrainence and repairs of buildings	New Central Book Agency, 8/1 Chintamani Das Lane, Calcutta 700009

## CE626 Solid Waste Management

- RATIONALE:** Solid waste management is a pressing issue, and lack of know how in solid waste management is a great concern for all the Local Self Govt. units & community Additionally, there is still little awareness on the importance of sound environmental management within the majority of the population. The course on Solid Waste Management gives the student an overview of municipal solid waste management including collection, transfer, transport, and disposal. Methods of processing, basic disposal facilities, disposal options, and the environmental issues of solid waste management will be covered in this course. In addition, this course provides the student with relevant information about municipal solid waste reduction and on hazardous waste management. This course is therefore an essential course for diploma programme in Civil Construction Engineering.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE516 Interior Design	L	T	P	C	TH	TM	TW	PR/O R	150
	3	-	2	5	75	25	25	25	

### 3.DETAILED COURSE CONTENTS

#### Unit 1 SOURCES AND COMPOSITION OF MUNICIPAL SOLID WASTE

- 1.1 Introduction
- 1.2 Sources of solid waste
- 1.3 Types of solid waste
- 1.4 Composition of solid waste and its determination.
- 1.5 Types of materials recovered from MSW.

#### Unit 2 PROPERTIES OF MUNICIPAL SOLID WASTE

- 2.1 Physical properties of Municipal Solid waste
- 2.2 Chemical properties of Municipal Solid Waste
- 2.3 Biological properties of Municipal Solid Waste
- 2.4 Transformation of Municipal Solid Waste

**Unit 3 SOLID WASTE GENERATION AND COLLECTION**

3.1 Quantities of Solid Waste

3.2 Measurements and methods to measure solid waste quantities.

3.3 Solid waste generation and collection.

3.4 Factors affecting solid waste generation rate.

3.5 Quantities of materials recovered from MSW

**Unit 4 HANDLING, SEPARATION AND STORAGE SOLID WASTE**

4.1 Handling and separation of solid waste at site. Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation.

4.2 Waste handling and separation at Commercial and industrial facilities.

4.3 Storage of solid waste at the sources.

**Unit 5 PROCESSING OF SOLID WASTE**

5.1 Processing of solid waste at residence e.g. Storage, conveying , compacting, Shredding, pulping , granulating etc.

5.2 Processing of solid waste at Commercial and industrial site.

**Unit 6 DISPOSAL OF MUNICIPAL SOLID WASTE**

6.1 Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion.

6.2 Landfill: Classification, planning, siting, permitting, landfill processes, landfill design landfill operation, use of old landfill.

6.3 Differentiate sanitary land fill and incineration as final disposal system for solid waste.

6.4 Biochemical processes: Methane generation by anaerobic digestion, composting and other biochemical Processes.

**Unit 7. HAZARDOUS SOLID WASTE**

7.1 Definition, identification and classification of hazardous solid waste.

7.2 Characteristics: Hazardous waste toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness.

7.3 Bio-medical waste, its sources, generation, storage, transportation and Disposal.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	Marks
6	Sources and composition of Municipal Solid Waste	6	8
7	Properties of Municipal Solid Waste	6	8
8	Solid Waste Generation and Collection	6	11
9	Handling, Separation and Storage of Solid waste	6	12
10	Processing of Solid Waste	8	12
11	Disposal of Municipal Solid Waste	8	12
12	Hazardous Solid Waste	8	12
	TOTAL	<b>48</b>	<b>75</b>

**5. TERM WORK & PRACTICALS**

Practical shall include Journal containing the following:

1. Survey the MSW of your locality and identify its sources and write composition of MSW.
2. Survey your locality and based on it suggest methods of solid waste collection.
3. Survey your locality and based on it suggest suitable methods of handling, separation and storage of solid waste.
4. Identify Compare & discuss the methods of processing different types of solid waste (search internet for latest methods).
5. Identify methods of hazardous waste disposal during a site visit and follow safety precautions.
6. Report of visit to solid waste treatment plant.
7. Prepare 2 charts and 2 models of different method of treatment of MSW.

**6. LEARNING RESOURCES**

Sr.No.	Author	Title of Books	Publication
1	George Tchobanoglous and Hillary Theisen Samuel Vigil.	Integrated solid waste management	McGraw Hill
2	P Aarne Vesiling	Solid waste management	
3	Micahael E Henstock Butterworths, Ann Arbor Science	Disposal and recovery and municipal solid waste	
4	Environmental engineering	Mackenzie L Davis, David A Cornwell	
5	Software/Learning Websites	En. wikipedia.org/wiki/waste management <a href="http://www.cyen.org/innovaeditor/assests/Solid%20waste%20management.pdf">http://www.cyen.org/innovaeditor/assests/Solid%20waste%20management.pdf</a> <a href="http://www.ilo.org/oshenc/part-vii/environmental-pollution-control/item/514-solid-waste-mangement-and-recycling">http://www.ilo.org/oshenc/part-vii/environmental-pollution-control/item/514-solid-waste-mangement-and-recycling</a> <a href="http://www.houstontc.gov/solid-waste">www.houstontc.gov/solid-waste</a>	

# Directorate of Technical Education, Goa State

## (CE627) AIRPORT PLANNING & DESIGN

**1. RATIONALE:** Airport Engineering involves design and construction of a wide variety of facilities for landing, take-off movement on ground and handling of passengers, This also is an essential and important area of activity for the socio-economic development of any region. The Civil Engineer is actively involved in the planning and execution of transportation net works such as roads, railways, airports and related structures viz. bridges, tunnels, docks and harbours. This course content on **airport planning & design** has been designed to provide the students with sufficient understanding of different operations , execution and maintenance of various components in airport .

### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE627 Airport Planning & Design	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

*Minimum passing %: Theory 40%*

*Duration of theory paper: 3 Hrs.*

**Legends:**

*L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:*

*PR/OR - End Semester Practical / Oral Examinations; TW- Term Work*

### 3. DETAILED COURSE CONTENTS

<b>UNIT 1</b>	<b>INTRODUCTION TO AIRPORT PLANNING AND DESIGN</b>
<p>Air transport and the national economy; Types of airport studies; elements of airport planning studies.</p> <p>History of Airport Engineering, Aircraft Technology in Airport Engineering, Aeronautical Terms, Aircraft types &amp; general characteristics, Operating costs , Aircraft Weight definitions ,Payload &amp; range, Airport Classification</p>	
<b>UNIT 2</b>	<b>FORECASTING TECHNIQUES</b>
<p>Demand parameters for airport design; Airport Master Planning, Forecasting in Airport Planning ( data requirements , expert judgement , trend extrapolation, nonlinear extrapolation) Methodologies and Levels of forecasting; Market study, Market share/top-down models</p>	
<b>UNIT 3</b>	<b>AIR TRAFFIC CONTROL AND AIRPORT CAPACITY</b>
<p>Structure of air space; Airways and navigation systems; Air Traffic Control Systems. Air Cargo Terminals</p> <p>Airport Capacity (Practical capacity and ultimate capacity, Gate capacity)</p> <p>Air separation criteria; Queuing theory; Space time diagrams; FAA charts;</p>	
<b>UNIT 4</b>	<b>AIRPORT AND AIRFIELD CONFIGURATION</b>
<p>Aircraft characteristics related to airport design –( Trends in size, speed, productivity; Payload, range, runway requirements), Principles of Airport configuration, Airport Configuration Design procedure,</p> <p>Runway configuration, Runway types and capacities, Runway length, Takeoff &amp; landing</p>	

distance;  
 Relation of runway & terminal Runway and exit taxiway design (longitudinal and transverse design)  
 Holding bays; bay design, Holding aprons, apron design  
 Analysis of wind data and runway orientation (Wind analysis concepts), Wind Rose  
 Analysis/Site Selection, Obstruction requirements  
 Airport Geometric Design, Geometric Design (Runways) Geometric Design (Taxiways/Aprons)  
 Standards; runway spacing and exits; taxiways and taxi-lanes; apron area, Airfield Capacity and Delay, hanger design, Lighting and Marking.

**UNIT 5                      TERMINAL SYSTEM DESIGN**

Terminal Design considerations; Terminal concepts; Design of terminal components; Passenger and baggage processing times, Passenger and baggage processing system; Airport Terminal Configurations, Terminal Design, Queuing Theory to Estimate Delay, airport parking design.

**UNIT 6                      DESIGN OF AIRPORT PAVEMENTS**

Pavement Design (Flexible Pavement), Pavement Design (Rigid Pavements)

**UNIT 7                      AIRPORT SECURITY AND OTHER FACTORS**

Environmental Factors, Land use compatibility, Land use planning, Social factors, Noise Modeling, Noise Concepts (Day-night average sound level, Qualitative noise factors )  
 Airport security, Runway protection  
 Airport Financing and Economic Analysis, Policy Alternatives/Economics

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Unit	Teaching Hours Per Semester	Marks
1	Introduction To Airport Planning And Design	6	12
2	Forecasting Techniques	6	9
3	Air Traffic Control And Airport Capacity	6	9
4	Airport And Airfeild Configuration	12	18
5	Terminal System Design	8	12
6	Design Of Airport Pavements	6	9
7	Airport Security And Other Factors	4	6
		48	75

**5. TERM WORK & PRACTICALS**

Practicals shall include following:

1. At least two Study assignments on each unit
2. Plotting a wind rose diagram.
3. At least 4 drawing sheets with airport master-plan and runway configurations.
4. At least 1 Problem each on airport pavement design (flexible pavement and rigid pavement).

**6. LEARNING RESOURCES**

<b>S. No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication</b>
1	Robert Horonjeff, Francis McKelvey, William Sproule and Seth Young	Planning and Design of Airports: 5th Edition	McGraw-Hill 2010
2	Norman J. Ashford, Saleh Mumayiz, Paul H. Wright	Airport Engineering: Planning, Design, and Development	2011
3	Alastair Gordon	Naked Airport	2008
4	Marcus Binney	Airport Builders	1999
5	Brian Edwards	The Modern Airport Terminal: New Approaches to Airport Architecture	2005
6	Walter Hart	The Airport Passenger Terminal	1992
7			



## (IE6\*\*) INSTIUTIONAL ELECTIVE

### 1. RATIONALE :

It has been observed that the curriculum prescribed, is many times out of context of Industry, on account of the pace with which technology development is taking place at Industry end. Due to this, gap exists between the Industry requirement of manpower and manpower produced by the Polytechnics. Board takes some time to incorporate the development of technology in the curriculum and many a times technology becomes outdated when it is incorporated in the curriculum. Further the expertise to train students as per Industry current requirement is available at the institute, but the same cannot be taught to students, as it is not a part of curriculum.

To address this situation, Board has decided to permit Institutions affiliated to Board, to identify such technologies or other aspects and teach the same to the students as an elective subject called “Institutional Elective”. Through this Institutional Elective subject, Institutions will be able to cater to the requirements of Industry by identifying their immediate requirement and prepare the students for the requirement by developing the curriculum in consultation with the Industry.

As many a time’s same subject may not be offered more than one or two years, a non conventional way of teaching – learning may be required to be adopted. Participation of Industry experts, guest lecturers, visit to Industry, exploring the knowledge available on net, etc may be essential to achieve the objectives.

### 2. TEACHING AND EXAMINATION SCHEME :

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory		Practical		
IE6** INSTIUTIONAL ELECTIVE	L	T	P	C	TH	TM	PR/OR	TW	150
	3	-	2	5	75	25	25	25	

### 3. DETAILED COURSE CONTENTS :

- a) Curriculum shall be drafted by the concerned department by interacting with Industry counterpart in regards to the Newer Technology required to be transferred for purpose of Teaching /Learning process.
- b) Department shall work out the modalities of execution of the curriculum at Industry/Institute Level.
- c) Curriculum shall be forwarded to Board for approval before its implementation.

## Directorate of Technical Education, Goa State

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1. For Industrial training of V<sup>th</sup> & VIII<sup>th</sup> Semester Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade ‘A’

60% to 79% Marks – Grade ‘B’

40% to 59% Marks – Grade ‘C’

Marks below 40% - Grade ‘D’

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade ‘C’ for passing.

## SEMESTER VIII

### (CT801) CIVIL CONSTRUCTION TRAINING II

**1. RATIONALE:** During the training period, students will improve knowledge and skills gained during their work in different established construction firms/industries in the previous training. They will carry out job as per the instruction of the Sr. Engineer at site for: construction activity, testing, billing, record keeping, maintenance of equipment, etc. which are of prime importance for a professional construction Engineer.

#### 2. TEACHING AND EXAMINATION SCHEME

Course code & course title	EXAMINATION SCHEME				Total
	TW		PR/OR		
	Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
CT501 Civil Construction Training-I	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>Grade</b>

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

**Legends:**

**L**-Lecture; **T**- Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

#### 3. DETAILED COURSE CONTENTS

**Unit 1** Students are expected to perform most of the following jobs/assignments/activities during the training period.

1. Fixing site layout/site rail.
2. Marking centreline of column/walls.
3. Carry out masonry operations.
4. Carry out earthwork and rubble packing operations.
5. Carry out concreting operations.
6. Check steel reinforcements in RCC : footings, Columns, beams, slabs,
7. Check structural form-work for shape, size and stability.
8. Call/order for materials.
9. Store the materials.
10. Carry out testing for different jobs.
11. Carry out and record Measurements
12. Prepare Measurement sheet and Abstract sheet. For running and final bill
13. Billing/labour payments.
14. Maintain daily records.
15. Regularly check the schedule and take corrective measures.
16. Carry out flooring works.
17. Carry out painting works.
18. Check electrical works

## Directorate of Technical Education, Goa State

19. Water-proofing.
20. Carry out and Check Sanitary filling/pipes/internal plumbing works.
21. Temporary services for labour/safety.
22. Carry out Maintenance and Repairs works.
23. Carry out any additional works entrusted to them in relation to the site (interaction with other authorities, banking etc.)

#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Marks
	DAIRY AND REPORT ASSESSMENT -The Daily-dairy and Report prepared shall be assessed by the internal examiner/teacher
	PROGRESSIVE ASSESSMENT- The assessment will be done periodically at least three times during training by the teachers in consultation with the industry/trainer.
	ORALS/VIVA-The appointed examiner shall assess the trainee based on their reports and performance in oral/viva. Weightage should be given to his presentation, Confidence, engineering skills, managerial skills and knowledge gained in performing job activities.

#### 5. TERM WORK & PRACTICALS

All the students undergoing training should submit- Daily dairy and Training report.

**Daily dairy-** The daily dairy should-be maintained in a bound book. It should reflect the day to day activities performed by the student( including task, men and materials involved). It should be counter signed by the Sr. Engineer. It will become the basis for writing reports on the complete training. Based on daily dairy students will be able to work out Task work, rate of different items and compare them with market rates and Goa schedule of rates.

**Training Report** -The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately heightened, environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

#### 6. LEARNING RESOURCES

S. No.	Author	Title of Books	Publication
1	Civil Dept	Draft of project report	Civil Dept-APV