Program Name : All Branches of Diploma in Engineering and Technology.

Program Code : [illegible]

Semester : First

Course Title : Fundamentals of ICT

Course Code : 22080

## 1. RATIONALE

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

## 2. COMPETENCY

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

- Use computers for internet services, electronic documentation, data analysis and slide presentation.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Use computer system and its peripherals.
b. Prepare business document using word processing tool.
c. Interpret data and represent it graphically using spreadsheet.
d. Prepare professional presentations.
e. Use different types of web browsers.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 2 | – | 2 | 4 | – | – | – | – | – | – | – | 25 | 10 | 25 | 10 | 50 | 20 |

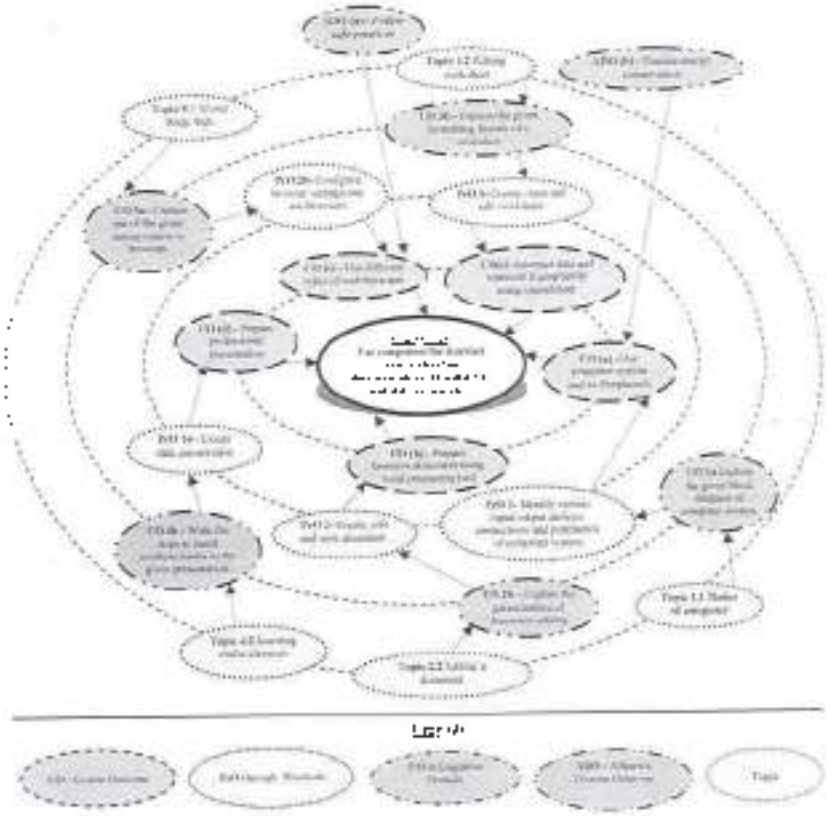
(L) Lecture Hours per week (1 hour = 60 minutes), (P) Practical Hours per week (1 hour = 60 minutes), (T) Tutorial Hours per week (1 hour = 60 minutes), (C) Credits (Lecture Hours + Practical Hours), (ESE) End Semester Examination, (PA) Progressive Assessment, (Max) Maximum Marks, (Min) Minimum Marks





## 5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.


Course Title
Fundamentals of ICT
Course Code
22080
Topic 1.1 Using computer system
Topic 1.2 Using Word Processing Tool
Topic 1.3 Using Spreadsheet
Topic 1.4 Using Presentation Tool
Topic 1.5 Using Internet Services
Topic 1.6 Using Electronic Communication
Topic 1.7 Using Electronic Documentation
Topic 1.8 Using Data Analysis
Topic 1.9 Using Slide Presentation
Topic 1.10 Using Web Browsers
Topic 1.11 Using Cloud Computing
Topic 1.12 Using Social Networking
Topic 1.13 Using Electronic Payment
Topic 1.14 Using Mobile Applications
Topic 1.15 Using Online Collaboration
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Topic 1.651 Using Online Cybersabotage
Topic 1.652 Using Online Cyberextortion
Topic 1.653 Using Online Cyberfraud
Topic 1.654 Using Online Cyberidentity Theft
Topic 1.655 Using Online Cyberstalking
Topic 1.656 Using Online Cyberharassment
Topic 1.657 Using Online Cyberthreats
Topic 1.658 Using Online Cybercrime
Topic 1.659 Using Online Cybersecurity
Topic 1.660 Using Online Cyberlaw
Topic 1.661 Using Online Cyberethics
Topic 1.662 Using Online Cyberprivacy
Topic 1.663 Using Online Cyberpolicy
Topic 1.664 Using Online Cybergovernance
Topic 1.665 Using Online Cyberdiplomacy
Topic 1.666 Using Online Cyberwarfare
Topic 1.667 Using Online Cyberterrorism
Topic 1.668 Using Online Cyberespionage
Topic 1.669 Using Online Cybersabotage
Topic 1.670 Using Online Cyberextortion
Topic 1.671 Using Online Cyberfraud
Topic 1.672 Using Online Cyberidentity Theft
Topic 1.673 Using Online Cyberstalking
Topic 1.674 Using Online Cyberharassment
Topic 1.675 Using Online Cyberthreats
Topic 1.676 Using Online Cybercrime
Topic 1.677 Using Online Cybersecurity
Topic 1.678 Using Online Cyberlaw
Topic 1.679 Using Online Cyberethics
Topic 1.680 Using Online Cyberprivacy
Topic 1.681 Using Online Cyberpolicy
Topic 1.682 Using Online Cybergovernance
Topic 1.683 Using Online Cyberdiplomacy
Topic 1.684 Using Online Cyberwarfare
Topic 1.685 Using Online Cyberterrorism
Topic 1.686 Using Online Cyberespionage
Topic 1.687 Using Online Cybersabotage
Topic 1.688 Using Online Cyberextortion
Topic 1.689 Using Online Cyberfraud
Topic 1.690 Using Online Cyberidentity Theft
Topic 1.691 Using Online Cyberstalking
Topic 1.692 Using Online Cyberharassment
Topic 1.693 Using Online Cyberthreats
Topic 1.694 Using Online Cybercrime
Topic 1.695 Using Online Cybersecurity
Topic 1.696 Using Online Cyberlaw
Topic 1.697 Using Online Cyberethics
Topic 1.698 Using Online Cyberprivacy
Topic 1.699 Using Online Cyberpolicy
Topic 1.700 Using Online Cybergovernance
Topic 1.701 Using Online Cyberdiplomacy
Topic 1.702 Using Online Cyberwarfare
Topic 1.703 Using Online Cyberterrorism
Topic 1.704 Using Online Cyberespionage
Topic 1.705 Using Online Cybersabotage
Topic 1.706 Using Online Cyberextortion
Topic 1.707 Using Online Cyberfraud
Topic 1.708 Using Online Cyberidentity Theft
Topic 1.709 Using Online Cyberstalking
Topic 1.710 Using Online Cyberharassment
Topic 1.711 Using Online Cyberthreats
Topic 1.712 Using Online Cybercrime
Topic 1.713 Using Online Cybersecurity
Topic 1.714 Using Online Cyberlaw
Topic 1.715 Using Online Cyberethics
Topic 1.716 Using Online Cyberprivacy
Topic 1.717 Using Online Cyberpolicy
Topic 1.718 Using Online Cybergovernance
Topic 1.719 Using Online Cyberdiplomacy
Topic 1.720 Using Online Cyberwarfare
Topic 1.721 Using Online Cyberterrorism
Topic 1.722 Using Online Cyberespionage
Topic 1.723 Using Online Cybersabotage
Topic 1.724 Using Online Cyberextortion
Topic 1.725 Using Online Cyberfraud
Topic 1.726 Using Online Cyberidentity Theft
Topic 1.727 Using Online Cyberstalking
Topic 1.728 Using Online Cyberharassment
Topic 1.729 

| S. No. | Practical Outcomes (PrOs) | Unit No | Approx Hrs. required |
|---|---|---|---|
| 2 | Manage files and folders: Create, copy, rename, delete, move files and folders | I | 1 |
| | **Word Processing** | | |
| 3 | Create, edit and save a document. Apply formatting features on the text - line, paragraph | II | 2* |
| 4 | Use bullets, numbering, page formatting | II | 2 |
| 5 | Insert and edit images and shapes: sizing, cropping, colour, background, group/ungroup | II | 2 |
| 6 | Insert and apply various table formatting features on it | II | 2 |
| 7 | Apply page setup features<br>i. Themes, page background, paragraph, page setup<br>ii. Create multicolumn page<br>iii. Use different options to print the document | II | 2* |
| 8 | Use mail merge with options | II | 1 |
| | **Spreadsheets** | | |
| 9 | Create, open and edit worksheet<br>i. Enter data and format it, adjust row height and column width<br>ii. Insert and delete cells, rows and columns<br>iii. Apply wrap text, formula in feature on cell | III | 2* |
| 10 | Insert formula as "IF" conditions, functions and named ranges in worksheet | III | 2 |
| 11 | Apply Data Sort, Filter and Data Validation features | III | 2* |
| 12 | Create charts and apply various chart options | III | 2 |
| 13 | Apply Page setup and print options for worksheet to print the worksheet | III | 1 |
| | **Presentation Tool** | | |
| 14 | Create slide presentation<br>i. Apply design themes to the given presentation<br>ii. Add new slides and insert pictures/images, shapes | IV | 2* |
| 15 | i. Add tables and charts in the slides<br>ii. Run slide presentations in different modes<br>iii. Print slide presentation as handouts | IV | 2 |
| 16 | Apply animation effects in the text and slides | IV | 1 |
| 17 | Add audio and video files in the given presentation | IV | 1 |
| | **Internet Basics** | | |
| 18 | Configure Internet connection | V | 1 |
| 19 | Use internet for different web services | V | 2* |
| 20 | Configure browser settings and use browsers | V | 1* |
| | **Total** | | **32** |

** - compulsorily practicals to be performed*

*Note*

*i. A suggestive list of practical PrOs is given in the above table. More such PrOs can be added to attain the COs and competencies.*

*ii. Hence, the Teachers must Ensure to add sufficient PrOs to each unit, so that the laboratory experiences are adequate to develop the intended skills and competencies in the students. A suggested sample given below:*



| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| a. | Use of Appropriate tool to solve the problem (Process) | 40 |
| b. | Quality of output achieved (Product) | 30 |
| c. | Complete the practical in stipulated time | 10 |
| d. | Answer to sample questions | 10 |
| e. | Submit report in time | 10 |
| | **Total** | **100** |

The above PrOs also comprise of the following general skills (Cross Cutting Outcomes) which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory / field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader / a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the inculcation of the ADOs takes place gradually in the student when he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will cover in the list to conduct the PrOs as well as and to procure equipment by institutes considered.

| S. No. | Equipment Name with Broad Specifications | Exp S.No. |
|---|---|---|
| 1 | Computer system with all necessary components like motherboard, random access memory (RAM), read-only memory (ROM), chipsets, cards, internal hard disk drives, DVD drive, network interface card | 1 |
| 2 | Double sided printing laser printer. | 1,6,12,13 |
| 3 | Hubs, Switches, Modems. | 1,16,17 |
| 4 | Any operating system. | 2 to 5 |
| 5 | Any Office Software. | 2 to 15 |
| 6 | Any browser | 16,17,20 |

*Note: The above mentioned facilities should be provided to the group of students (batch) working in the laboratory. Depending on the availability of the resources they can be shared for the practicals.*

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub topics are to be taught and assessed in order to develop the UOs for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| **Unit – I Introduction to Computer System** | 1a. Explain the given block diagram of computer system<br>1b. Classify the given type of software<br>1c. Explain characteristics of the specified type of network<br>1d. Describe procedure to manage a file/ folder in the given case<br>1e. Describe application of the specified type of network connecting device | 1.1 **Basics of Computer Systems:** Overview of Hardware and Software, block diagram of Computer system, Input/output unit, CPU, Control Unit, Arithmetic Logic Unit (ALU), Memory Unit<br>1.2 **Internal components:** processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives<br>1.3 **External Devices:** Types of input/output devices, types of memories, keyboard, mouse, printers, Dot matrix, inkjet etc, laserjet, plotter and scanner, external storage devices (CD/DVD, Hard Disk and pen drive)<br>1.4 **Application Software:** word processing, spreadsheet, database management systems, console software, measuring software, photo-editing software, video-editing software, graphics manipulation software, system Software, compilers, linkers, device drivers, operating systems and utilities<br>1.5 **Network environments:** network interface cards, hubs, switches, routers and modems, concept of LAN, VAN, WAN, WLAN, Wi-Fi and Bluetooth<br>1.6 **Working with Operating Systems:** Create and manage file and folders, Copy, file renaming and deleting of files and folders, Searching files and folders, application installation, creating shortcut of application on the desktop |
| **Unit– II Word Processing** | 2a. Write steps to create the given text document<br>2b. Explain the specified feature for document editing<br>2c. Explain the given page setup features in a document<br>2d. Write the specified table formatting feature | 2.1 **Word Processing:** Overview of Word processor, Basics of Font type, size, colour Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application<br>2.2 **Editing a Document:** Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting Paragraphs, Line and paragraph spacing, using FIND and REPLACE, Setting the |



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| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | | spacing, Add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks<br>2.3 **Changing the Layout of a Document:** Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs<br>2.4 **Inserting Elements in Word Documents:** Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture<br>2.5 **Working with Tables:** Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells<br>2.6 **Working with Columned Layouts and Section Breaks:** Columns, Section breaks, Creating columns, Newsletter-style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks |
| **Unit– III Spreadsheets** | 3a. Write steps to create the given spreadsheet<br>3b. Explain the specified formatting feature of a worksheet<br>3c. Write steps to insert formula and functions in the given worksheet<br>3d. Write steps to create chart for the specified data set<br>3e. Explain steps to perform advance operation on the given dataset | 3.1 **Working with Spreadsheets:** Overview of workbook and worksheet, Create Workbook, Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook<br>3.2 **Editing Worksheet:** Insert row, select data, Adjust row height and column width, delete row, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Group, Undo, Special Symbols, Insert Comments, Add Text Box, Undo Changes, Freeze Panes, Inserting/deleting rows and columns<br>3.3 **Formatting Cells and sheets:** Setting Cell Type, Setting Fonts, Text options, Resize Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options, Adjust Margins, Page |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | | Orientation, Header and Footer, Insert Page Breaks, Set Background.<br>3.4. **Working with Formula:** Creating Formulas, Copying Formulas, Common Spreadsheet functions such as sum, Average, min, max, date in And/or mathematical functions such as sqrt, power, applying conditions using IF.<br>3.5. **Working with Charts:** Introduction to charts, overview of different types of charts, 3D, Pie, Line charts, creating and editing charts, Using chart options, chart title, axis title, legend, data labels, axes, grid lines, moving chart to a separate sheet.<br>3.6. **Advanced Operations:** Conditional Formatting, Data Filtering, Data Sorting, Using ranges, Data Validation, Adding Graphics to Excel, Worksheets, print area, margins, header, footer and other page setup options. |
| **Unit- IV Presentation Tool** | 4a. Write the steps to create the specified slide presentation.<br>4b. Write the steps to work on multiple options in the given presentation.<br>4c. Write steps to apply table features in the given presentation.<br>4d. Write steps to manage charts in the given presentation. | 4.1 **Creating a Presentation:** Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation, Open, Creating a Basic Presentation, Working with Textboxes, Apply Character Formats, Format Paragraphs, Views of Presentation, Saving work, creating new slides, Changing a Slide Layout, Applying a Theme, Changing Colours, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence.<br>4.2 **Inserting Media elements:** Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, Video animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add Transitions, Add Speaker Notes, Print a Presentation.<br>4.3 **Working with Tables:** Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications. |





| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | | 4.4 **Working with Charts:** Insert Charts in a Slide, Modify a Chart, Import Charts from Other Office Applications. |
| Unit– V Basics of Internet | 5a. Explain use of the given setting options in browsers.<br>5b. Explain features of the specified web services.<br>5c. Describe the given concept/process of cloud.<br>5d. Explain the specified option used for effective searching in search engine. | 5.1 **World Wide Web:** Introduction, Internet for Intranet, Cloud, Web Sites, web pages, URL, web servers, Basic settings of web browsers, history, extension, default page, default search engine, creating and removing Bookmarks, use search engine, URL tools for searching the contents.<br>5.2 **Web Services:** e-Mail, Chat, Video Conferencing, e-Banking, e-Shopping, e-Reservation, e-Groups, Social Networking. |

*Note: To attain the CO and competency, above Unit Outcomes (UOs) are to be attained in sequence as listed in the Curriculum Matrix of Section 2: Curriculum Matrix Structure.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

(Not Applicable)

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to develop the attainment of the various outcomes in this course:

a. Prepare journal of practicals.
b. Prepare a sample document with all word processing features. Course teacher shall allot appropriate document type to each student(s).
c. Undertake micro projects.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. 'L' in column No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide students in undertaking *micro-projects*.
f. Guide students in undertaking various activities in the laboratory/workshop.
g. Demonstrate students thoroughly before the start of the practical.
h. Show video/animation films to explain the functioning of various concepts.
i. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact an integration of PRA, IKS and VEEs. The micro-project could be industry application based, market survey, workshop oriented, laboratory based or internet-based. Each student will have to maintain a dated work diary consisting of individual contribution to the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he can take up the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty

a. **Word documents**: Prepare Time Table, Application, Notes, Reports (Subject teacher shall assign a document to be prepared by the each student)
b. **Slide Presentations**: Prepare slides with all Presentation features such as classroom presentation, presentation about department, presentation of report. (Subject teacher shall assign a presentation to be prepared by the each student)
c. **Spreadsheets**: Prepare Pay bills, tax statement, student's assessment record using spreadsheet. (Teacher shall assign a spreadsheet to be prepared by each student

13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Computer Fundamentals | Goel, Anita | Pearson Education, New Delhi, 2014. ISBN: 978-81-317-5063 |
| 2 | Computer Basics & Windows 7 Beginner's Guide: Windows 7 | Miller, Michael | QUE Publishing, 800 East 96th Street, 2011. ISBN: 9780-[illegible]-16 |
| 3 | Linux Easy Step for Beginners | Alvaro, Felix | CreateSpace Independent Publishing Platform, 2016. ISBN: 978-1533685237 |
| 4 | Microsoft Office 2010 On Demand | Johnson, Steve | Pearson Education, New Delhi India, 2011. ISBN: 9788131730041 |
| 5 | Microsoft Office 2013 for Windows: Visual QuickStart | Steven D. Stinson | Pearson Education, New Delhi India, 2012. ISBN: 9788-131765-65-3 |
| 6 | OpenOffice.org for Dummies | Leete, Gurdy, Thurston-Bell, Kathy, Kay, Michael | Wiley Publishing, New Delhi, 2010. ISBN: 978-0-470-49232-0 |
| 7 | Computer Fundamentals | Dr. Rajendra Kawale | Devraj Publications, Dist Solapur, Maharashtra |

14. SOFTWARE/LEARNING WEBSITES

a. https://www.microsoft.com/en-in/learning/office-training.aspx
b. http://www.computerstepbystep.com
c. http://s3-ap-southeast-1.amazonaws.com/rgpvnotes.in/Subject/29/Special_Edition_Using_StarOffice_6_0.pdf

| | |
|---|---|
| Course Name | Mechanical Electrical Chemical, Civil & Textile Program Group |
| Course Code | AE CE CH RE CE TE PT EE ME PG PT PS PE DC TC TX |
| Semester | First |
| Subject Title | Engineering Graphics |
| Subject Code | 22002 |

## 1. RATIONALE

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas, conveying the instructions, which are used in carrying out the jobs on the shop floor. It covers the knowledge and application of drawing instruments and also familiarizes the learner about Bureau of Indian standards related to engineering drawing. It enriches their ways of developing the ability to draw and read various engineering curves, projections and dimensioning styles. The course primarily focuses on the use of drawing instruments, developing engineering curves and boundary lines, free sketches. The course also aims to develop the ideas of visualizing the actual object or structure on the basis of drawings and blue prints. The performance outcomes of building up knowledge in addition to the further courses related to engineering drawing and other allied courses in coming semesters.

## 2. COMPETENCY

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

- Prepare engineering drawing manually using prevailing drawing instruments.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and desired soft skills associated with this course are to be taught and implemented so that the student can demonstrate the following *Industry oriented* COs associated with the above mentioned competency:

a) Draw geometrical figures and engineering curves.
b) Draw orthographic projections and copy/make sketches of simple engineering components.
c) Draw isometric projections of given components or blocks in orthographic projections.
d) Use drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
e) Draw free hand sketches of given engineering elements.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 2 | — | 4 | 4 | — | — | — | — | — | — | — | 50 | 20 | 50 | 20 | 100 | 40 |

(**) Progress should be evaluated on the basis of practical performance during the term of 50 marks based on the appropriate sub-units given in S. No. 6.

(#) Theory course having ONLY practical examination, no PA. Hence no component should pass in theory examination. Separate passing of practical component is to be ensured. Candidate should secure 40% marks (20 marks) in practical examination to secure 32 marks out of 80 marks (i.e. 20 marks) for declaring pass in the course otherwise candidate has to appear for the examination.





*Legends: L=Lectures; T=Tutorial/ Teacher Guided Theory Practice; P=Practicals; C=Credits; ESE=End Semester Examination; PA=Progressive Assessment; *=No theory paper*

## 5. COURSE MAP (with sample COs, PrOs, UOs, ASOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course in all domains of learning in terms of the industry/ employer identified competency depicted at the centre of this map.

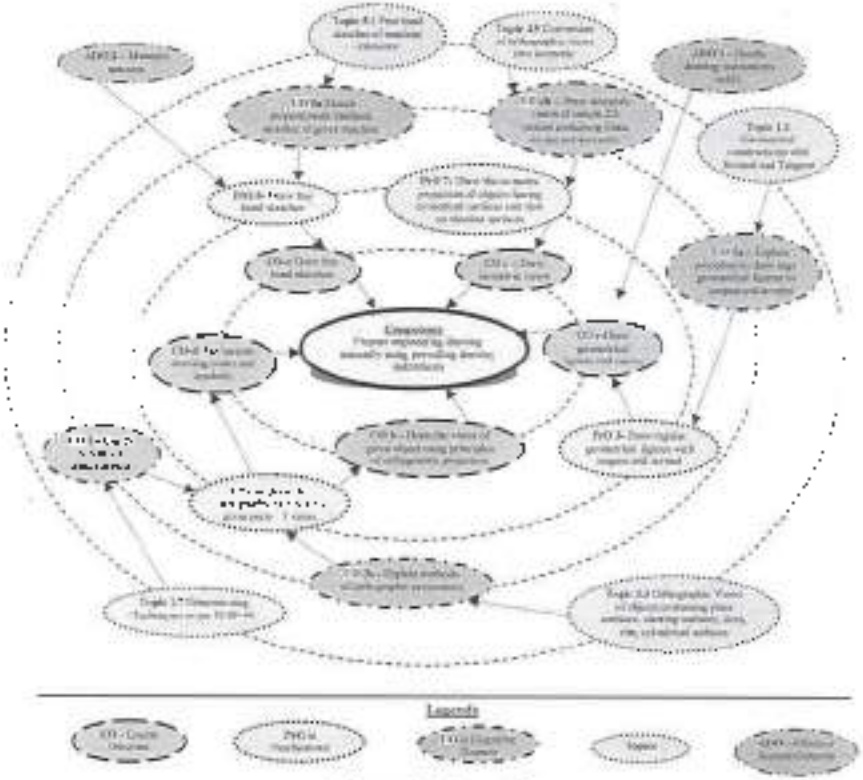


**Figure 1 - Course Map**

## 6 SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components) of the COs, to be developed and assessed in the student for the attainment of the competency. Following practicals (except 1, 2, 3, 4, 17 and 32) are to be attempted on A2 drawing sheets.

| S. No. | Practical Outcomes (PrOs)<br>(Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | **Sketch Book** | | |

| S. No. | Practical Outcomes (PrOs)<br>(Learning Outcomes in Psychomotor Domain | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 1 | Draw horizontal, vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Set squares/ drafter. | I | 02 |
| 2 | Write alphabets and numerical (Vertical only) | I | 02 |
| 3 | Draw regular geometric constructions | I | 02 |
| 4 | Redraw the given figure | I | 02 |
| **Sheet No. 1** (Three problems) | | | |
| 5 | Draw one figure showing dimensioning techniques. (Problem 1) | I | 03 |
| 6 | Draw one problem on redraw the figure. (Problem 2) | I | 03 |
| 7 | Draw one problem on loci of points - slider crank mechanism. (Problem 3) | I | 03 |
| **Sheet No. 2** (Two problems) | | | |
| 8 | Draw Engineering Curves (Problem 1) | II | 02 |
| 9 | Draw Engineering Curves (Problem 1 continued) | II | 02 |
| 10 | Draw Engineering Curves. (Problem 2) | II | 02 |
| 11 | Draw Engineering Curves. (Problem 2 continued) | II | 02 |
| **Sheet No. 3** (Two problems) | | | |
| 12 | Draw a problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 1) | III | 02 |
| 13 | Draw problem on orthographic projections using first angle method of projection having plain and slanting surfaces (Problem 1 continued) | III | 02 |
| 14 | Draw another problem on orthographic projections using first angle method of projection having plain and slanting surfaces (Problem 2) | III | 02 |
| 15 | Draw another problem on orthographic projections using first angle method of projection having plain and slanting surfaces. (Problem 2 continued) | III | 02 |
| **Sheet No. 4** (Two problems) | | | |
| 16 | Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs (Problem 1) | III | 02 |
| 17 | Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs (Problem 1 continued) | III | 02 |
| 18 | Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs (Problem 2) | III | 02 |
| 19 | Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, ribs (Problem 2 continued) | III | 02 |
| **Sheet No. 5** (Two problems) | | | |
| 20 | Draw two problems on isometric view of simple objects having plain and slanting surface by using natural scale (Problem 1) | IV | 02 |
| 21 | Draw two problems on isometric view of simple objects having plain and slanting surface by using natural scale (Problem 1 continued) | IV | 02 |





| S. No. | Practical Outcomes (PrOs)<br>(Learning Outcomes in Psychomotor Domain | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 22 | Draw two problems on Isometric view of simple objects having slant and slanting surface by using natural scale (Problem 2) | IV | 02 |
| 23 | Draw two problems on Isometric views of simple objects having plain and slanting surface by using natural scale (Problem 2 continued) | | |
| **Sheet No. 6** (Two problems) | | | |
| 24 | Draw a problem on Isometric Projection of objects having cylindrical surface by using isometric scale. (Problem 1) | IV | 02 |
| 25 | Draw a problem on Isometric Projection of objects having cylindrical surface by using isometric scale. (Problem 1 continued) | IV | 02 |
| 26 | Draw a problem on Isometric Projection of objects having slot on slanting surface by using isometric scale. (Problem 2) | IV | 02 |
| 27 | Draw a problem on Isometric Projection of objects having slot on slanting surface by using isometric scale. (Problem 2 continued) | IV | 02 |
| **Sheet No. 7** (Six problems) | | | |
| 28 | Draw Free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs set screws, washers, Locking arrangements. (Problem 1,2) | V | 02 |
| 29 | Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs set screws, washers, Locking arrangements. (Problem 3,4) | V | 02 |
| 30 | Draw free hand sketches/conventional representation of machine elements in sketch book such as thread profiles, nuts, bolts, studs set screws, washers, Locking arrangements. (Problem 5,6) | V | 02 |
| **Sketch Book** (Two problems) | | | |
| 31 | Problem Based Learning.<br>Given the 3D model of an object student will try to imagine the three views and draw them in the sketch book (Problem 1) | III, IV | 02 |
| 32 | Problem Based Learning.<br>Given the 3D model of an object student will try to imagine the three views and draw them in the sketch book (Problem 2) | III, IV | 02 |
| | **Total** | | 64 |

*All practicals are to be performed*

*Note*

- *A suggested list of PrOs is given in the above table, more such PrOs can be added to attain the COs and competency.*
- *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Neatness, Cleanliness on drawing sheet | 10 |
| 2 | Uniformness in drawing and line work | 10 |

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 3 | Creating given drawing | 50 |
| 4 | Dimensioning the given drawing and writing text | 20 |
| 5 | Answers to sample questions | 10 |
| 6 | submission of drawing in time | 10 |
| | Total | 100 |

The above PIs will comprise of the following Affective Domain Outcomes (ADOs) that are to be developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Follow ethics and standards.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as mentioned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| S. No. | Equipment Name with Broad Specifications | Exp. S. No. |
|---|---|---|
| 1 | Drawing Table with Drawing Board of Full Imperial 'A' Size | All |
| 2 | Models of objects for orthographic / isometric projections | 4,5,6,7 |
| 3 | Models/ Charts of objects mentioned in unit no. 5 | - |
| 4 | Set of various industrial drawings being used by industries | All |
| 5 | Set of drawings sheets mentioned in section 6.0 could be developed by experienced teachers and made available on the MSBTE portal to be used as reference standards | All |
| 6 | Drawing equipment's and instruments for class room teaching-large size:<br>a. Tee square or drafter (Drafting Machine)<br>b. Set squares (45° and 30°- 60°)<br>c. Protractor<br>d. Drawing instrument box (containing set of compasses and dividers) | All |
| 7 | Interactive board with LCD overhead projector | All |

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.





| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Basic elements of Drawing | 1a. Prepare drawing using drawing instruments<br>1b. Use IS SP-46 for dimensioning.<br>1c. Use different types of lines.<br>1d. Draw regular geometrical figures.<br>1e. Draw figures having tangency constructions. | 1.1 Drawing Instruments and supporting material: method to use them with applications<br>1.2 Standard sizes of drawing sheets (ISO-A series)<br>1.3 I.S. codes for planning and layout<br>1.4 Letters and numbers (single stroke vertical)<br>1.5 Convention of lines and their applications<br>1.6 Scale - reduced, enlarged and full size<br>1.7 Dimensioning techniques as per SP-46 (latest revision) – types and applications of chain, parallel and coordinate dimensioning.<br>1.8 Geometrical constructions |
| Unit– II Engineering curves and Loci of Points | 2a. Explain & Repair engineering curves with uses of application.<br>2b. Draw different conic sections based on given situation.<br>2c. Draw involute and cycloidal curves based on given data.<br>2d. Draw helix and spiral curves from given data.<br>2e. Plot Loci of points from given data. | 2.1 Concept of focus, directrix, vertex and eccentricity. Conic sections.<br>2.2 Methods to draw an ellipse by Arcs of circle method and Concentric circles method<br>2.3 Methods to draw a parabola by Directrix-Focus method and Rectangle method<br>2.4 Methods to draw a hyperbola by Directrix-Focus method.<br>2.5 Methods to draw involutes: circle and pentagon.<br>2.6 Methods to draw Cycloidal curve: cycloid, epicycloid and hypocycloid<br>2.7 Methods to draw Helix and Archimedean spiral.<br>2.8 Loci of points on Single slider crank mechanism with given specifications. |
| Unit– III Orthographic projections | 3a. Explain methods of Orthographic Projections.<br>3b. Draw orthographic views of given simple 2D entities containing lines, circles and arcs only.<br>3c. Draw the orthographic views from given pictorial views. | 3.1 Projections-orthographic, perspective, isometric and oblique: concept and applications (No question to be asked in examination)<br>3.2 Orthographic projection, First angle and Third angle method, their symbols<br>3.3 Conversion of pictorial views into Orthographic Views – object containing plane surfaces, slanting surfaces, slots, and cylindrical surfaces (use First Angle Projection Method Only). |
| Unit– IV Isometric projections | 4a. Prepare isometric scale.<br>4b. Draw isometric views of given simple 2D entities containing lines, | 4.1 Isometric projection<br>4.2 Isometric scale and Natural Scale<br>4.3 Isometric view and isometric projection.<br>4.4 Illustrative problems related to simple |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | circles and arcs only<br>4c. Interpret the given orthographic views<br>4d. Draw Isometric views from given orthographic views | objects having: plain, slanting, cylindrical surfaces and slots on slanting surfaces.<br>2.4 Convert given orthographic views into isometric views/projection |
| Unit– V Free Hand Sketches of engineering elements | 5a. Sketch proportionate freehand sketches of given machine elements<br>5b. Select proper fasteners and locking arrangement for given situation | 5.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, locking arrangements (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching) |

*Note: To attain the UOs and competency above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER (INTERNAL) DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Principles of Drawing | 04 | - | 02 | 04 | 06 |
| II | Engineering curves and Loci of Points | 06 | - | 02 | 04 | 06 |
| III | Orthographic projections | 06 | - | 02 | 08 | 10 |
| IV | Isometric projections | 08 | 02 | 07 | 07 | 16 |
| V | Free Hand Sketches of mce elements | 08 | 02 | 02 | 08 | 12 |
| Total | | 32 | 4 | 15 | 31 | 50 |

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

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

*This specification table also provides a general guideline for teachers to frame internal and semester practical/theory exam paper which students have to undertake on the drawing sheet.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Student should maintain a separate A3 size sketch book which will be the part of term work and submitted along with drawing sheets. Following assignment should be drawn in the sketch book:
   i. Single stroke vertical Letters and Numbers.
   ii. Type of lines.
   iii. Redraw the figures given in text.
   iv. Engineering Curves: One problem for each type of curve.
   v. Orthographic projections: Minimum 2 problems.
   vi. Isometric Projections/Views: Minimum 2 problems.
   vii. Free hand sketches: All types of machine elements mentioned in Unit-V.
   viii. Note: Problems on sheet and in the sketch book should be different.
b. Students should collect Maps, Production drawings, Industrial Drawings, Layouts, Power point presentations/CDs from local industries/workshops/institutes and try to list:
   i. Types of lines used
   ii. Lettering styles used
   iii. Dimension styles used
   iv. IS code referred
c. List the shapes and curves you are observing around you in real life with name of place/industry. (For ex. ellipse, parabola, hyperbola, cycloid, spiral, helix, hypocycloid, involute, sphere, helix)
d. Take one circular shape. Assume one point on circular periphery and mark it. Roll that shape on flat and circular surface. Observe the path of the point and co-relate with the theory taught in the class.
e. Take circular and pentagonal shape and wrap a thread over the periphery. Now unwrap the thread and observe the locus of the end of the thread and try to correlate with the theory taught in the class.
f. Each student should explain at least one problem for construction and method of drawing on sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each student batch.
g. Each student will assess at least one sheet of other students (may be a group of such students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes if any.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. *'L' in section No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.*
c. *About 15-20% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs through classroom presentations (see implementation guideline for details).*
d. With respect to item No. 10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide students for undertaking micro projects.
f. Guide students in proper selection of sheet and proper utilization of drawing board.
g. Show video/animation films to explain orthographic and Isometric projections.
h. Demonstrate first and third angle method using model.
i. Use charts and industrial drawing sheets developed by experienced faculty to teach standard symbols and current industrial working practices.

## 12. SUGGESTED MICRO PROJECTS

Only one *micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry relevant COs. Each micro-project should encompass two or more COs which are, in fact, an integration of PrOs, UOs, and ADOs. The micro-project could be industry application based, internet based, workshop-based, laboratory-based or field-based. Each student will have to maintain a dated work diary containing all individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (Sixteen) student engagement hours* during the course.

In the first two semesters, the micro-project could be group based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty

a. **Helical springs:** Each batch will collect 5 open coil and closed coil helical springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding hors curve in his sketch book.
b. **Flat coil or spiral springs:** Each batch will collect 10 spiral springs of various sizes. Each student will measure the significant parameters of one spring and draw corresponding hors curve in his sketch book.
c. **Isometric views:** Each student of the batch will try to collect at least one production drawings/ construction drawings/plumbing drawings from local workshops/builders /electrical and mechanical contractors and try to get the isometric views from the orthographic views given in the drawings.
d. **Isometric views:** Each student of a batch will select a household/industrial machine and will draw its isometric view in the sketch book.
e. **Isometric and orthographic views:** Each batch will collect a single point cutting tool from workshop and draw its isometric and orthographic views with at ten times enlarged scale. In carpentry shop each batch will go to make wooden model from these views.
f. **Isometric views:** The teacher will keep ready one set of orthographic projections and ask the student to develop 3D thermocol models of the same.
g. **Involute curves:** Each batch will try to develop cardboard/thermocol working models which can generate involute curve of any regular geometrical shape.
h. **Cycloidal curves:** Each batch will collect 5 different sizes bicycle tyres and compare the locus of tube air valve by rolling them on flat road.
i. **Conic curves:** Each batch will go to institute's play ground and one student standing on the boundary throws a ball to the wicket keeper who is 30 meter away from the thrower and the ball has reached a maximum height of 20 meters from the ground, draw the path of the ball and identify the type of conic curve it has traced out.
j. **Involute and Cycloidal curves:** Each batch will collect one involute and one cycloidal tooth profile spur gear and fine out the involute function.

## 13. SUGGESTED LEARNING RESOURCES

| S No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1. | Engineering Drawing Practice for Schools and Colleges IS: SP 46 | Bureau of Indian Standards. | BIS Publications (I) India, Third Reprint, December 1998 ISBN 81-7061-061-2 |





| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 2. | Engineering Drawing | Bhatt, N.D. | Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-17-6 |
| 3. | Machine Drawing | Bhatt, N.D., Panchal, V.M. | Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-17-6 |
| 4. | Engineering Drawing | Jolhe, D.A. | Tata McGraw Hill. Edu. New Delhi, 2010, ISBN: 978-0-07-064537-1 |
| 5. | Engineering Drawing | Dhawan, R.K. | S. Chand and Company New Delhi ISBN 81-219-1431-0 |
| 6. | Engineering Drawing | Shah, P.J. | S. Chand and Company, New Delh. 2008, ISBN: 81-219-2964-4 |

## 14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=TMjOjC3-WCw
b. https://www.youtube.com/watch?v=dme6_n7Sgcg
c. https://www.youtube.com/watch?v=_MQSenLXL0M
d. https://www.youtube.com/watch?v=3WXPunCpfLI
e. https://www.youtube.com/watch?v=Erik7PIsAco
f. http://www.mcuma.edu/courses/me201/handouts/engg%20graphics.pdf
g. https://www.machinedesignonline.com

Program Name : Mechanical/ Civil/ Chemical & Plastic Program Group
Program Code : CE/ME/CH/PS/MC/ME/CH/PT/AE/GM/DP/DQT
Semester : First
Course Title : Workshop Practice
Course Code : 22083

## 1. RATIONALE

Workshop Practice is a basic practical oriented course. The knowledge of basic workshops such as wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tools, equipment and machines of various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides hands-on training to the students in the laboratory/workshop.

## 2. COMPETENCY

The course should be carried out and implemented with the aim to achieve the course outcomes (COs) so that student demonstrates the following competency specified by the industry.

- Prepare simple jobs on the shop floor of the engineering workshop

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and imparted, so that the student can acquire the following *(industry oriented)* COs associated with the above mentioned competency:

a. Select tools and machinery as per requirement of job.
b. Use hand tools in different shops for performing different operations.
c. Operate equipment and machinery in different shops.
d. Prepare job according to drawing.
e. Maintain workshop related tools, equipment and machinery.

## 4 TEACHING AND EVALUATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| -- | -- | 4 | 4 | -- | -- | -- | -- | -- | -- | -- | 50@ | 20 | 50# | 20 | 100 | 40 |

*(@ For Online Examination, it is ONLY Practical examination for 50 Marks and PA is not applicable under practical head. Online examination of practical exam is to be held in the laboratory of COE in Polytechnic. Duration of examination is 2 hours. Weightage of 40% to the Performance Test and 60% to the Viva-voce. Performance test is to be conducted in the laboratory of the student. Viva-voce is to be conducted in the laboratory of COE. Individual student per batch of 10 students.)*

*Legends: L-Lecture, T - Tutorial/Teacher Guided Theory Practice, P- Practical, C- Credits, ESE - End Semester Examination, PA - Progressive Assessment*





## 5. COURSE MAP with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry employer identified competency depicted at the centre of this map.

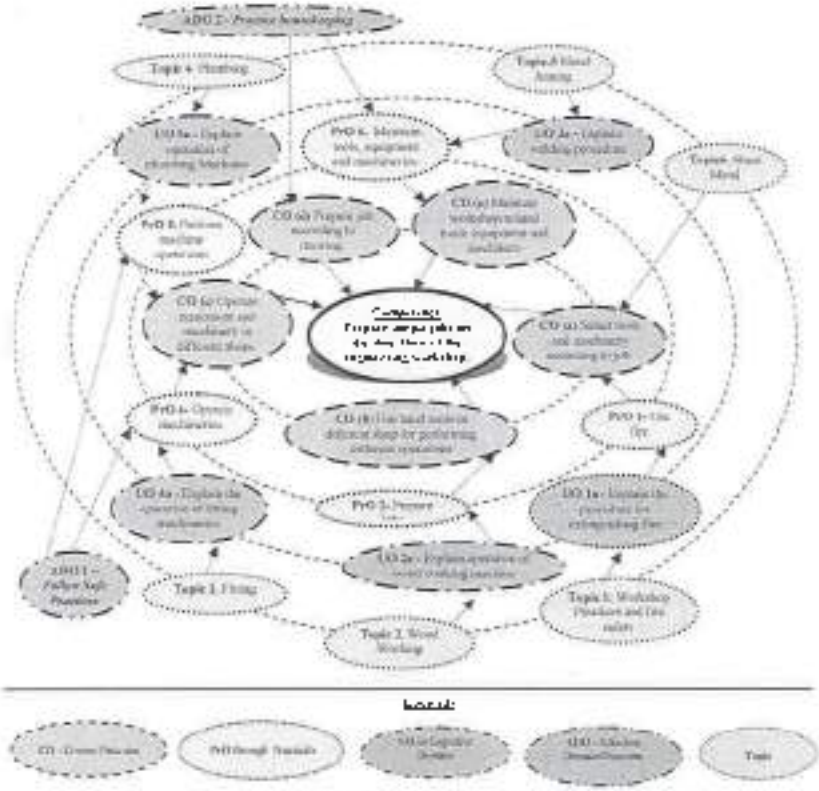


Figure 1 - Course Map

## 6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 1 | Perform mock drill session in group of minimum 10 students for extinguishing fire – Part I | 1 | 2* |
| 2 | Perform mock drill session in group of minimum 10 students for extinguishing fire – Part II | 1 | 2 |

| S. No. | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 3 | Prepare job with following operations: – Part I<br>a Marking operation as per drawing<br>b punching operation as per drawing<br>c filing operation as per drawing<br>d chamfering operation as per drawing<br>e. sawing operation as per drawing<br>f drilling operation as per drawing<br>g. tapping operation as per drawing | II | 2* |
| 4 | Prepare job with following operations: – Part II<br>a Marking operation as per drawing<br>b punching operation as per drawing<br>c filing operation as per drawing<br>d chamfering operation as per drawing<br>e sawing operation as per drawing<br>f drilling operation as per drawing<br>g. tapping operation as per drawing | II | 2 |
| 5 | Prepare job with following operations: – Part III<br>a. Marking operation as per drawing<br>b punching operation as per drawing<br>c. filing operation as per drawing<br>d chamfering operation as per drawing<br>e. sawing operation as per drawing<br>f drilling operation as per drawing<br>g. tapping operation as per drawing | II | 2 |
| 6 | Prepare job with following operations: – Part IV<br>a Marking operation as per drawing<br>b. punching operation as per drawing<br>c filing operation as per drawing<br>d. chamfering operation as per drawing<br>e sawing operation as per drawing<br>f drilling operation as per drawing<br>g. tapping operation as per drawing | II | 2 |
| 7 | Prepare job with following operations: – Part V<br>a. Marking operation as per drawing<br>b punching operation as per drawing<br>c. filing operation as per drawing<br>d chamfering operation as per drawing<br>e sawing operation as per drawing<br>f. drilling operation as per drawing<br>g. tapping operation as per drawing | II | 2 |
| 8 | Prepare job with following operations: – Part VI<br>a Marking operation as per drawing<br>b. punching operation as per drawing<br>c filing operation as per drawing<br>d. chamfering operation as per drawing<br>e. sawing operation as per drawing<br>f drilling operation as per drawing | I | 2 |





| S. No. | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | g. tapping operation as per drawing | | |
| 9 | Prepare job with following operations: – Part VII<br>a Marking operation as per drawing<br>b. punching operation as per drawing<br>c filing operation as per drawing<br>d. chamfering operation as per drawing<br>e. sawing operation as per drawing<br>f drilling operation as per drawing<br>g. tapping operation as per drawing | I. | 2 |
| 10 | Prepare T joint pipe fitting job as per given drawing (individually) | IV | 2* |
| 11 | Prepare elbow joint pipe fitting job as per given drawing | IV | 2* |
| 12 | Prepare bill of material for given pipe line layout – Part I | IV | 2* |
| 13 | Prepare bill of material for given pipeline layout – Part II | IV | 2 |
| 14 | Prepare lap joint using gas welding as per given drawing – Part I | IV | 2* |
| 15 | Prepare lap joint using gas welding as per given drawing – Part II | IV | 2 |
| 16 | Prepare butt joint using gas welding as per given drawing – Part I | IV | 2 |
| 17 | Prepare butt joint using gas welding as per given drawing – Part II | IV | 2* |
| 18 | Prepare utility job, like stool, benches, tables or similar jobs involving arc welding and artificial wood as per given drawing in group of 4 to 5 students. – Part I<br>a Fabrication operation involve measuring, marking, cutting, edge preparation welding<br>b Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | IV V | 2* |
| 19 | Prepare utility job like stool benches tables or similar jobs involving arc welding and artificial wood as per given drawing in group of 4 to 5 students – Part II<br>a Fabrication operation involve measuring, marking cutting edge preparation, welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part | IV, V | 2 |
| 20 | Prepare utility job like stool, benches, tables or similar jobs involving arc welding and artificial wood as per given drawing in group of 4 to 5 students – Part III<br>a Fabrication operation involve measuring, marking, cutting, edge preparation welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part | IV V | 2* |
| 21 | Prepare utility job like stool, benches, tables or similar jobs, involving arc welding and artificial wood as per given drawing in group of 4 to 5 students – Part IV<br>a Fabrication operation involve measuring, marking, cutting, edge preparation welding<br>b Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | V, V | 2 |
| | Prepare utility job like stool, benches, tables or similar jobs | IV | 2 |



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| S. No | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part V<br>a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | V | |
| 23 | Prepare utility job like stool, benches, tables or similar jobs involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VI<br>a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | IV, V | 2* |
| 24 | Prepare utility job like stool, benches, tables or similar jobs involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VII<br>a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | IV, V | 2 |
| 25 | Prepare utility job like stool, benches, tables or similar jobs involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VIII<br>a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding<br>b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part. | IV, V | 2 |
| 26 | Prepare sheet metal utility job using following operations – Part I:<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2* |
| 27 | Prepare sheet metal utility job using following operations – Part II<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2 |
| 28 | Prepare sheet metal utility job using following operations – Part III<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering | VI | 2 |





| S. No. | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | f. Riveting | | |
| 29 | Prepare sheet metal utility job using following operations – Part IV<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2 |
| 30 | Prepare sheet metal utility job using following operations – Part V<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2 |
| 31 | Prepare sheet metal utility job using following operations – Part VI.<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2 |
| 32 | Prepare sheet metal utility job using following operations – Part VI<br>a. Cutting and Bending<br>b. Edging<br>c. End Curling<br>d. Lancing<br>e. Soldering<br>f. Riveting | VI | 2 |
| | Total | | 64 |

*Note*

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which the practicals marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Setting of experimental set up | 20 |
| 2 | Operate equipment skillfully | 40 |
| 3 | Follow Safety measures | 10 |
| 4 | Work in team | 10 |
| 5 | Record Observations | 10 |
| 6 | Interpret Results to conclude | 10 |

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 7 | Answer to sample questions | 5 |
| 8 | Submit report in time | 5 |
| | Total | 100 |

The above PrOs also comprise of the following social skill/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments as well as aid to procure equipment by authorities concerned.

| S. No. | Equipment Name with Broad Specifications | Exp. S.No. |
|---|---|---|
| 1 | Fire buckets of standard size | I, II, III, IV, V, VI |
| 2 | Fire extinguisher A, B and C types | I, II, III, IV, V, VI |
| 3 | Wood Turning Lathe Machine, Height of Centre 200mm, Distance between Centres 1200mm, Spindle Bore 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive, with all accessories | I |
| 4 | Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size 450 x 450 mm, Table Tilting 45° | II |
| 5 | Wood working tools- marking and measuring tools: saws, claw hammer, mallet, chisels, plane, squares | II |
| 6 | Carpentry Vice 200 mm | II |
| 7 | Work Benches- size:1800 x 600 x 750 mm | III |
| 8 | Bench Drilling machine (upto 16 mm drill capacity) with ½ H.P. Motor 1350 rpm, Height | III |
| 9 | Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories | III |
| 10 | Bench Grinder 200 mm Grinding Disc diameter 200 mm with 25 mm bore 32 mm with ½ HP/1 HP Motor | III |
| 11 | Vernier height Gauge 450 mm | III |





| S. No | Equipment Name with Broad Specifications | Exp. S.No. |
|---|---|---|
| 12 | Surface Plate with 300 mm Grade I | III |
| 13 | Angle Plate 450 x 450 mm | I |
| 14 | Welding machine 3.0 kVA 400A welding current 50Hz at 50 Hz 230, 250 230 with std. Accessories and Welding Cable 40 sq mm, ISI with holder | IV |
| 15 | Oxygen and acetylene gas welding and cutting kit with cylinders and regulators | IV |
| 16 | Pipe Bending Machine | IV |
| 17 | Pipe Vice – Tilting | IV |
| 18 | Pipe Cutter- 50 mm | V |
| 19 | Bench Vice 100 mm | III, IV, V, VI |
| 20 | Portable Hammer Drill Machine 0-13 mm A.C. 220 V, 2.5 Amp. Metal cutting having different types of bits | II, III, IV, V, VI |
| 21 | Sheet Bending Machine | VI |
| 22 | Sheet Cutting Machine | VI |
| 23 | Brazing Equipment | VI |
| 24 | Fitting tools- hammers, chisels, files, hacksaw, surface plate, punch, V block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, dies set, | III |
| 25 | Plumbing tools- pipe vice, pipe bending equipment, pipe wrenches, dies | IV |
| 26 | Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter | V |
| 27 | Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush | V |
| 28 | Sheet metal hand tools- tin snips, sheet gauge, straight edge, L square, scriber, divider, hammer, punches, pliers, stakes, grooves, dies set | VI |

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics are to be taught and assessed in order to develop LOCs for achieving the PrOs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I General Workshop Practice | 1a. Describe the procedure for extinguishing the given type of fire<br>1b. Describe the procedure to use the given Fire fighting equipment<br>1c. Locate the specified equipment in workshop<br>1d. Describe the ways to maintain good housekeeping in the given situation | 1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols<br>1.2 First Aid<br>1.3 Fire: Causes of Fire, Basic ways of extinguishing the fire, Classification of fire (Class A, B, C, D), Fire fighting equipment, fire extinguishers and their types<br>1.4 Workshop Layout<br>1.5 Introduction to system of tools, equipment and consumables |
| Unit– II | 2a. Explain operation of the given | 2.1 Name hand tools, their parts, |

| | | |
|---|---|---|
| Fitting | fitting shop machines<br>3h. Describe the procedure to use the given fitting tools<br>3c. Describe the operation of the given machinery<br>3d. Describe the procedure to perform fitting operations<br>3e. Describe the procedure to maintain the equipment and machinery | hammers, chisels, files, hacksaw, surface plate, angle plate, V-block, marking block, steel rule, twist drills, reamers, tap set, die set and their Specifications<br>3.2 Operation of fitting shops machineries - Drilling machine, Pedestal wheel grinder their specifications and maintenance<br>3.3 Basic process: chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, die-ing, reaming |
| Unit– III Plumbing | 3a. Explain operation of fitting shop machines<br>3b. Describe the procedure to use the given plumbing tools<br>3c. Describe the procedure to operate the given type of plumbing machines<br>3d. Describe the procedure to maintain the given type of plumbing tools, equipment and machinery | 3.1 Plumbing hand tools: pipe vise, pipe bending equipment, pipe wrenches, dies and their Specifications<br>3.2 Pipe fittings: bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications<br>3.3 Operation of machineries in plumbing shops: pipe bending machine their specifications and maintenance<br>3.4 Basic process: cutting, threading |
| Unit– IV Metal Joining | 4a. Describe the procedure to identify the given metal joining tools<br>4b. Explain the given type of welding procedure<br>4c. Describe the procedure to use the given metal joining tools<br>4d. Describe the procedure to perform the given type of joining metals | 4.1 Gas welding hand tools: welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter and their specifications<br>4.2 Arc welding hand tools: electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their Specifications<br>4.3 Operation of machineries in welding shops: arc welding transformer their specifications and maintenance<br>4.4 Welding Electrode, filler rod, fluxes and solders<br>4.5 Basic process: welding, brazing and soldering |
| Unit– V Furniture Making | 5a. Select wood working tools as per job requirement with justification<br>5b. Explain operation of wood working machines<br>5c. Describe the procedure to use the given furniture making tools<br>5d. Describe the procedure to | 5.1 Types of particle boards such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications<br>5.2 Wood working hand tools: carpenter's vice, marking and measuring tools, saws, chisels, hammer, mallet, chisels, planes, squares, and their specifications<br>5.3 Operation of wood working |





| | | |
|---|---|---|
| | operate the given wood working machinery<br>5e. Describe the procedure to maintain given wood working tools, equipment and machines | machineries - Wood turning lathe, Circular saw, their specifications and maintenance<br>5.4 Basic process: marking, sawing, planning, chiseling, turning, grooving, boring |
| Unit– VI Sheet Metal | 6a. Identify sheet metal tools.<br>6b. Explain operation of sheet metal machineries<br>6c. Use sheet metal tools<br>6d. Describe the procedure to operate the sheet metal machinery.<br>6e. Describe the procedure to perform the given bending operations<br>6f. Describe the procedure to maintain the given sheet metal tools, equipment and machinery | 6.1 Sheet metal hand tools: snip, shears, sheet gauge, straight edge, L-square, scriber, divider, trammel, punches, punch, stakes, grooves, tinsmith set and their Specifications<br>6.2 Operation of machineries in sheet metal shops: sheet cutting and bending machine their specifications and maintenance<br>6.3 Basic process: marking, bending, folding, edging, seaming, staking, riveting |

*Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's Cognitive Domain Taxonomy.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable.

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *cocurricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Prepare work diary based on practical performed in workshop. Work diary should consist of job drawing, operations to be performed, required raw materials, tools, equipments, date of performance with teacher signature.

b. Prepare journals consist of free hand sketches of tools and equipments in each shop, detail specification and precautions to be observed while using tools and equipment.

c. Prepare/Download specifications of following:
   a) Various tools and equipment in various shops
   b) Precision equipment in workshop
   c) Various machineries in workshop

d. Undertake a market survey of local dealers for procurement of workshop tools, equipment, machineries and raw material.

e. Visit any fabrication/wood working/sheet metal workshop and prepare a report.

## 11. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.

b. 'Lecture' Method does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).

d With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

e. Guide students in undertaking micro-projects.

f Arrange visit to nearby industries and workshops for understanding various manufacturing process.

g Show video/animation films to explain functioning of various processes like shaping, lapping, honing, turning, milling, knurling etc.

h. Prepare maintenance charts various workshop machineries.

## 12 SUGGESTED TITLES OF MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (Sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a utility job using various wood working shop operations as per given drawing.

b. Prepare a utility job using various plumbing operations as per given drawing.

c. Prepare a utility job using various sheet metal operations as per given drawing.

*Note:*

i *Utility job will be assigned by the teacher.*

ii *Utility job will be completed in a group of 4 to 5 students and students have to maintain work diary consist of job drawing, operations details, required raw materials, tools, equipments, their role, performance record.*

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Workshop Practice | Bawa, H.S. | McGraw Hill Education, Noida; ISBN: 978-0070671195 |
| 2 | A Textbook of Manufacturing Process (Workshop Tech.) | Gupta, J.K., Kumar, R.S. | S Chand and Co. New Delhi ISBN:81-219-3092-8 |
| 4. | Introduction to Basic Manufacturing Process & Workshop Technology | Singh, Rajender | New Age International, New Delhi 2014, ISBN: 978 81-224-3078-7 |





## 14. SOFTWARE/LEARNING WEBSITES

a http://www.asrtu.com.au

b http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tips.pdf

c http://www.weldingtechnology.org

d http://www.newagepublishers.com/samplechapter/001169.pdf

e http://www.youtube.com/watch?v=-TcBXbckKEM

f http://www.youtube.com/watch?v=QHFDNHqtbs&feature=related

g http://www.youtube.com/watch?v=NoTeOCA38&feature=relmfu

h http://www.pebindia.com

i http://sourcing.indiamart.com/engineering_articles/materials-used-hand-tools

j https://www.youtube.com/watch?v=W_cnvsAbqLM

Program Name : All Branches of Diploma in Engineering and Technology

Program Code : [illegible]

Semester : Third

Course Title : English

Course Code : 22101

## 1. RATIONALE

English language skills have become inevitable in the era of globalization. The skills of English language contribute substantially to the needs of engineering profession, where almost all the service manuals, installation and commissioning manuals of the various equipment are in English. Technologies has to interpret them correctly. Competency in English is need of the hour not only for Indian industry, but also worldwide, where diploma engineers have the employable opportunity. Therefore the basic English skills- listening, speaking, reading and writing have become almost mandatory for employability. This course is therefore designed to help the students to communicate in English effectively.

## 2. COMPETENCY

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

- Communicate in English (spoken and written) form effectively.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a. Form simple grammatically correct sentences.
b. Summarize comprehension passages.
c. Compose dialogues and paragraphs for different situations.
d. Use relevant words as per the context.
e. Deliver prepared speeches to express ideas, thoughts and opinions.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Max | Min | Max | Min | Max | Min |
| 4 | -- | -- | 4 | 3 | 70 | 28 | 30* | 12 | 100 | -- | -- | 25 | 10 | 25 | 10 |

(*): Under the theory PA, Internal Assessment will be based on average of two tests to be taken during the semester. For the progressive assessment of the laboratory skills, 10 marks will be added during the examination of the CO.

*Legends: L (Lecture); T (Tutorial/Teacher Guided Theory Practice); P (Practical); C (Credit); ESE (End Semester Examination); PA (Progressive Assessment).*

## 5. COURSE MAP (mind map showing COs, PrOs and topics)





This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course in all domains of learning in terms of the industry employer identified competency depicted at the centre of the map.

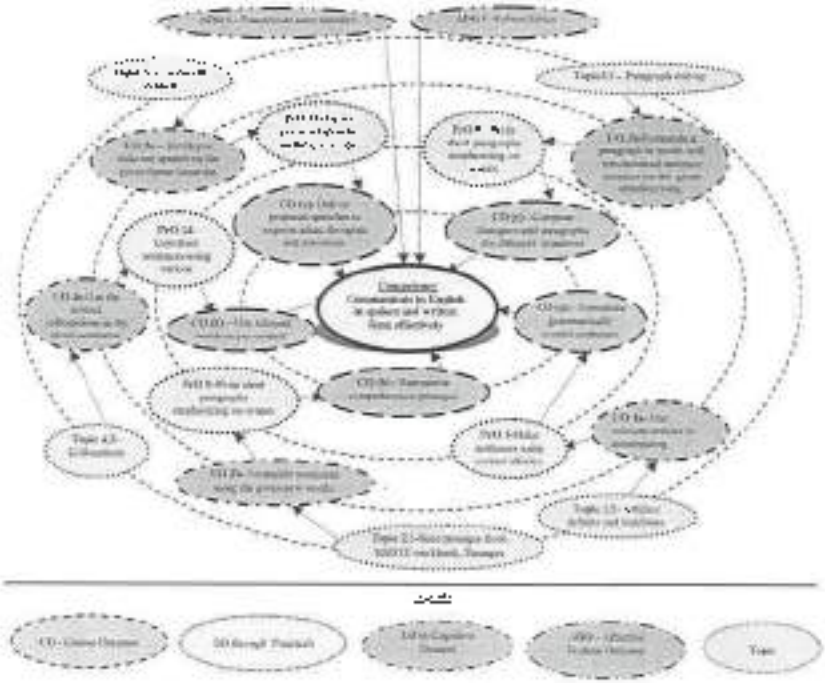


Figure 1 - Course Map

## 6. SUGGESTED PRACTICAL/EXPERIENCES

The practicals in this section are PrOs i.e. sub-components of the CO to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | Use 'Language laboratory' for different practical tasks | | |
| 1 | Make sentences using correct articles. | I | 2 |
| 2 | Construct sentences using correct prepositions. | I | 2* |
| 3 | Formulate sentences using correct conjunctions (coordinate). | I | 2 |
| 4 | Rearrange sentences using relevant forms of verbs. | I | 2* |
| 5 | Change the voice from active to passive and vice-versa. | I | 1* |
| 6 | Change the narration (direct to indirect and vice-versa). | I | 2* |
| 7 | Repeat words on Language Lab software after listening to them. | I | 2* |
| 8 | Deliver oral presentations using correct grammar. | I | 2* |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 9 | Write short paragraphs emphasizing on verbs | II | 2* |
| 10 | Compose dialogues on various situations | III | 2 |
| 11 | Enact a role play | III | 2* |
| 12 | Construct sentences using idioms. | IV | 2* |
| 13 | Narrate anecdotes of various situations | IV | 2 |
| 14 | Construct sentences using various collocations. | IV | 2 |
| 15 | Answer questions based on the given passage | IV | 2 |
| 16 | Use correct pronunciations and voice modulation while reading articles from different sources | IV | 2* |
| 17 | Deliver prepared speeches on the given topic | V | 2* |
| 18 | Repeat dialogues on Language Lab software after listening to them | V | 2* |
| | **Total** | | **36** |

*Note*

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical needs to be performed out of which the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be developed according to a suggested sample given below.*

| S.No. | Performance Indicators | Weightage in % |
|---|---|---|
| a. | Setting up of Language laboratory | 10 |
| b. | Using the language laboratory skillfully | 30 |
| c. | Follow Safety measures | 10 |
| d. | Work in teams | 20 |
| e. | Responded to given questions | 10 |
| f. | Self-learning | 20 |
| | **Total** | **100** |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices
b. Maintain Cleanliness
c. Demonstrate working as a leader/a team member
d. Follow ethics.

Acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year





## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The following topics/subtopics is to be taught and assessed in order to develop LOs for achieving the COs to attain the identified competency.

| S. No | Equipment Name with Broad Specifications | Exp. S.No. |
|---|---|---|
| 1 | Language Lab with relevant software and Computer system with all necessary components like Motherboard, Random Access Memory (RAM), Read-Only Memory (ROM), Graphics cards, Sound Cards, Internal Hard Disk Drives, DVD drive, Network Interface Card | All |
| 2 | LCD Projector with document reader | A.1 |
| 3 | Smart Board with networking | A.1 |

## 8 UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) in cognitive domain | | Topics and Sub-topics |
|---|---|---|---|
| | Writing Skills | Speaking Skills | |
| Unit – I Applied Grammar | 1a. Use relevant articles in constructing sentences<br>1b. Apply prepositions to construct meaningful sentences<br>1c. Identify conjunctions to connect phrases and clauses in the specified sentences<br>1e. Use correct forms of tenses in given situation<br>1d. Change the active and passive voice from the specified passage list<br>1f. Change the narration for the given situation. | 1g. Formulate grammatically correct sentences for the specified situation<br>1h. Use relevant Prepositions for the situation mentioned<br>1i. Apply relevant conjunctions to use idiomatic language for the given situation<br>1j. Apply the relevant tenses in formal communication for the given passage<br>1k. Use relevant narrations for the given situation | 1.1 Articles: Definite and Indefinite<br>1.2 Prepositions: Usage<br>1.3 Conjunctions: Coordinating and Subordinating<br>1.4 Types of Sentences: Assertive, Imperative, Exclamatory, Interrogative<br>1.5 Tenses - Present Tense (Simple, Continuous, Perfect) - Past Tense (Simple, Continuous, Perfect) - Future Tense (Simple)<br>1.6 Active and Passive Voice<br>1.7 Direct and Indirect Speech |
| Unit– II Comprehension | 2a. Answer the given questions on the specified passage<br>2b. Formulate sentences using the given new words | 2e. Pronounce the words correctly in the given passage<br>2f. Give oral instructions with correct pronunciation and | 2.1 Seen Passages from Model Work Books<br>2.2 Importance of Comprehension<br>2.3 Unseen Passages<br>2.4 Interpretation of |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | | Topics and Sub-topics |
|---|---|---|---|
| | Writing Skills | Speaking Skills | |
| | 2c. Use correct syntax to construct meaningful sentences for the given situation<br>2d. Answer the questions on the given unseen passage | intonation for the given situation<br>2g. Answer the questions orally on the given unseen passage with correct pronunciation | Passages in Written And Spoken Form |
| Unit- III Paragraph and Dialogue Writing | 3a. Differentiate the given types of paragraphs with justification<br>3b. Formulate a paragraph in words with synchronized sentence structure on the given Technical Topic<br>3c. Explain the theme in given paragraph precisely | 3d. Summarise the given paragraph with correct pronunciation and intonation<br>3e. Take part in debates with correct pronunciation, intonation and using verbal and non-verbal gestures on the given themes | 3.1 Types of Paragraph<br>i. Technical<br>ii. Descriptive<br>iii. Narrative<br>iv. Compare and Contrast<br>3.2 Dialogue Writing<br>i. Greetings<br>ii. Development of Dialogue<br>iii. Closing Sentences |
| Unit - IV Vocabulary Building | 4a. Remove the spelling errors in the given sentences/ paragraph<br>4b. Use relevant words in correct form to express for the given themes/ situation<br>4c. Use the collocations correctly<br>4d. Construct sentences using given idioms | 4e. Speak in specified formal / informal situations with correct pronunciation<br>4f. Speak in specified informal situations with correct pronunciation<br>4g. Speak sentences using relevant collocations | 4.1. Rules of Spelling<br>4.2. Words Often Confused<br>4.3. Collocations<br>4.4. Idioms |
| Unit-V Speeches | 5a. Develop a welcome speech for the given theme/ situation<br>5b. Develop a farewell speech for the given theme/ situation<br>5c. Formulate a speech for introducing a guest in the given situation<br>5d. Develop a vote of thanks for the given | 5e. Introduce oneself with correct pronunciation, intonation and using verbal and non-verbal gestures<br>5f. Give extempore talks with correct pronunciation, intonation and using verbal and non-verbal gestures for the given theme/ situation | 5.1. Importance of Public Speaking<br>5.2. Characteristics of Good Speech<br>5.3. Welcome Speech<br>5.4. Farewell Speech<br>5.5. Introducing a Guest<br>5.6. Vote of Thanks |





| Unit | Unit Outcomes (UOs) (in cognitive domain) | | Topics and Sub-topics |
|---|---|---|---|
| | Writing Skills | Speaking Skills | |
| | situation | | |

*Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Applied Grammar | 12 | 02 | 04 | 08 | 14 |
| II | Comprehension | 20 | 04 | 06 | 14 | 24 |
| III | Paragraph and Dialogue Writing | 16 | 02 | 04 | 06 | 12 |
| IV | Vocabulary Building | 06 | 02 | 04 | 06 | 12 |
| V | Speeches | 04 | 02 | 02 | 04 | 08 |
| Total | | 48 | 12 | 20 | 38 | 70 |

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
*Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect good articles from newspapers and find and write the meanings of words
b. Listen to TV news
c. Read articles from magazines/ newspapers
d. Undertake micro-projects

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub topics
b. 'L' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No 10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Arrange various language games and activities using functional grammar.
f. Show video/animation films to develop listening skills and enhance vocabulary.
g. Use real life situations for explanation.

d. Prepare and give oral presentations.
e. Circle micro-projects in groups as well as individually.

## 12. SUGGESTED TITLES OF MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or 'field-based'. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (Sixteen) student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Develop language games, activities, crossword puzzles enhancing word power to be used in English language.
b. Prepare advertisement for five technical projects using contextual vocabulary.
c. After studying standard English newspapers, prepare a booklet identifying various grammatical aspects of sentences.
d. Prepare a booklet of the interviewing any successful person in your locality in context with his life journey, inspiration, social contribution, role model and keys to success.
e. Prepare a booklet of the contribution of eminent Indian scientists and develop well organized paragraphs.
f. Summarise the contents of a famous book/books [fiction/non-fiction].
g. Prepare a collage using different idioms with their origins and their contextual usage.

## 13. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | English Workbook | MSBTE | MSBTE, Mumbai, 2017 |
| 2 | Effective English with CD | Kumar, E. Suresh, Sreehari, P, Savithri, J | Pearson Education, Noida, New Delhi, 2008, ISBN 978-81-317-1005-0 |
| 3 | English Grammar at Glance | Sinclair, M. | S. Chand and Co. New Delhi, 2011, ISBN 9788121929042 |
| 4 | Essential English Grammar | Murphy, Raymond | Cambridge University Press, New Delhi, Third edition, 2011, ISBN 9780-0-521-67580-9 |
| 5 | Living English Structure | Allen, W.S. | Pearson Education, New Delhi, Fifth edition, 2009, ISBN-10:8131729898,97 |

## 14. SOFTWARE/LEARNING WEBSITES

a. https://www.britishcouncil.in/english/learn-online
b. http://learnenglish.britishcouncil.org/en/content





c. http://www.talkenglish.com
d. http://englishlanguageguide.com/
e. www.worldwidewords.org

Course Name : All Branches of Diploma in Engineering and Technology.

Course Code : [illegible]

Semester : First

Subject Title : Basic Science (Physics & Chemistry)

Subject Code : 1210

## 1. RATIONALE

Diploma engineers need to use suitable technologies/tools to deal with various materials and machines. This course is designed with some fundamental information to help the technologists apply the basic concepts and principles of physics and chemistry to solve simple field based engineering problems. The study of basic principles of science and the concepts related to various materials such as metals & alloys, inorganic salts, polymers, lubricants, purposes, composites, adhesives, fuels, refractories, magnetism, optics, semiconductors and others will help in understanding the technology courses where emphasis is on the applications of these and Diploma Technologists should.

## 2. COMPETENCY

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

- **Solve broad-based engineering problems applying principles of physics and chemistry.**

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *Industry Oriented* COs associated with the above mentioned competency:

a. Take measurements in the measurement of physical quantities.
b. Apply the principles of electricity and magnetism to solve engineering problems.
c. Use the basic principles of heat and optics in related engineering applications.
d. Apply the suitable process in industries.
e. Use corrosion preventive measures in workshop.
f. Use relevant engineering materials in industry.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Open Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 2 | – | 2 | 4 | 2 | 70 | 28 | 30 | 12 | 100 | 40 | 50 | 20 | 50 | 20 | 100 | 40 |
| 2 | – | 2 | 4 | | | | | | | | 50 | 20 | 50 | 20 | 100 | 40 |

*Open Hours: One hour is for 50 minutes. Normally, one practical session is of two hours duration. Hence, if there are 4 hours of practicals in a week, then 2 hours are considered as Open Hours. Open hours are for the purpose of engaging students in self-learning activities such as assignments, tutorials, etc. as per the requirement of the curriculum. Open hours are not considered for the examination scheme.*

*Legends: L - Lecture, T - Tutorial/Teacher Guided Theory Practice, P - Practical, C - Credit, ESE - End Semester Examination, PA - Progressive Assessment.*





## 5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

The course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry employer identified competency depicted in the centre of the map.

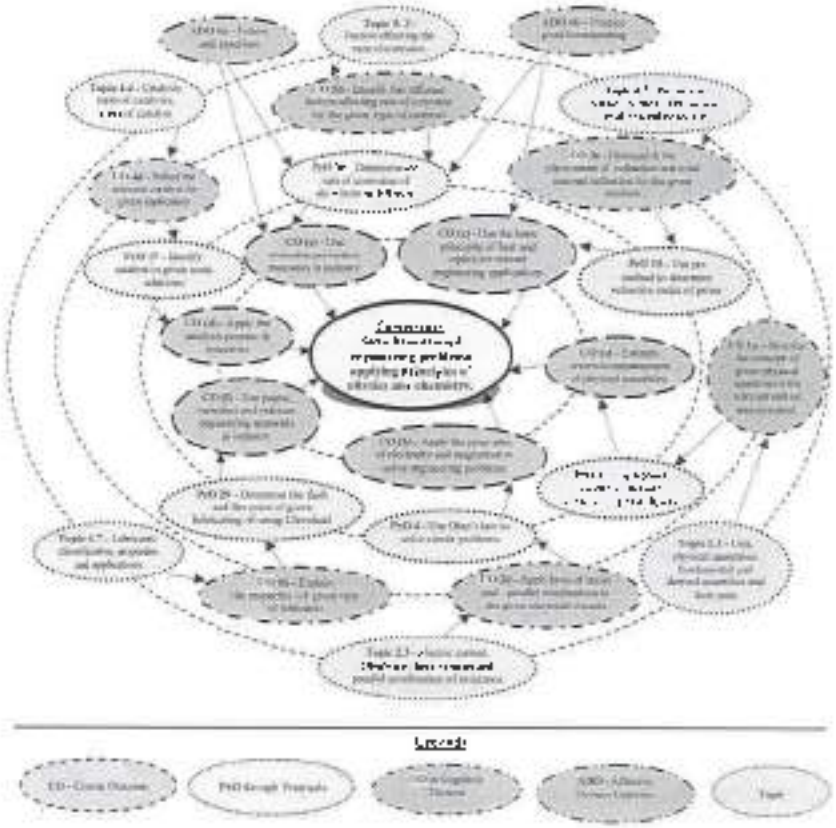


*Figure 1 - Course Map*

## 6. SUGGESTED PRACTICALS/EXERCISES

The practicals in this section are PrOs i.e. sub-components of the COs to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | **Physics** | | |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 1 | Use Vernier caliper to :<br>(i) Measure dimensions of given objects<br>(ii) Measure the dimensions of objects of known dimensions<br>(iii) Estimate the errors in measurement | I | 02* |
| 2 | Use Screw gauge to:<br>(i) Measure dimensions of given objects.<br>(ii) Measure the dimensions of objects of known dimensions<br>(iii) Estimate the errors in measurement. | I | 02* |
| 3 | Use Spherometer to measure radius of curvature of any curved surface | I | 02 |
| 4 | Use Ohm's law to solve circuit problems. | II | 02* |
| 5 | Determine the specific resistance of given wire | II | 02* |
| 6 | Use the principle of series resistance in solving electrical engineering problems | II | 02 |
| 7 | Use the principle of parallel resistance in solving electrical engineering problems | II | 02 |
| 8 | Use magnetic compass to draw the magnetic lines of forces of magnet of different shapes | II | 02* |
| 9 | Use magnetic compass to determine the neutral points when<br>(a) North pole of bar magnets points towards the north pole of earth<br>(b) South pole of bar magnets points towards the north pole of earth | II | 02 |
| 10 | Use p-n junction diode to draw forward bias and reverse bias I-V characteristics. | II | 02* |
| 11 | Determine forbidden energy band gap in semiconductors. | II | 02 |
| 12 | Determine the pressure-volume relation using Boyle's law. | III | 02 |
| 13 | Use Joule's calorimeter to determine Joule's mechanical-electrical equivalent of heat | III | 02* |
| 14 | Use Searle's thermal conductivity apparatus to find coefficient of thermal conductivity of a given material | III | 02* |
| 15 | Use pin method to determine refractive index of prism | III | 02* |
| 16 | Determine the refractive index of glass slab using TIR phenomenon | III | 02 |
| | **Chemistry** | | |
| 17 | Identify cation in given ionic solutions | IV | 02* |
| 18 | Identify anion in given ionic solutions. | IV | 02 |
| 19 | Determine the percentage of iron in the given sample using redox titration. | IV, V | 04* |
| 20 | Prepare the corrosive medium for Aluminium at different temperature. | V | 02 |
| 21 | Determine the rate of corrosion on different temperatures for Aluminium | V | 02* |
| 22 | Determine the electrode potential of Copper metal | V | 02 |
| 23 | Determine the electrode potential of Iron metal | V | 02* |
| 24 | Determine the voltage generated from chemical reaction using | V | 02 |





| S. No | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | Daniel Cell | | |
| 25 | Determine the pH value of given solution using pH meter and universal indicator. | V | 02* |
| 26 | Determine electrochemical equivalent of Cu metal using Faraday's first law | V | 02 |
| 27 | Determine equivalent weight of metal using Faraday's second law | V | 02 |
| 28 | Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer-I | VI | 02* |
| 29 | Determine the steam emulsification number of given lubricating oil | VI | 02 |
| 30 | Determine the flash and fire point of given Lubricating oil using Pensky-Martens closed open cup apparatus | VI | 02* |
| 31 | Determine the flash point of given lubricating oil using Abel's closed cup apparatus | VI | 02* |
| 32 | Determine dropping point of grease | VI | 02* |
| | Total | | 64 |

**Note**

1. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 experiments/practicals in Physics and Chemistry out of which at least 5 should be performed from each group. Practicals marked as * are compulsory so that the student reaches the 'Precision Level' of Dave's Psychomotor Domain Taxonomy' as generally required in the industry.*
2. *The 'Process and Product' related skills (generalized skills) associated with each PrO are to be assessed as per the suggested sample given below.*

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Preparation of experimental set up | 20 |
| 2 | Setting and operation | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 10 |
| 5 | Interpretation of result and Conclusion | 20 |
| 6 | Answer to sample questions | 10 |
| 7 | Submission of report in time | 10 |
| | Total | 1000 |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follows safety practices.
b. Practices good housekeeping.
c. Demonstrates working as a leader/a team member.
d. Follows ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- Valuing Level in 1st year
- Organising Level in 2nd year and
- Characterising Level in 3rd year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The list of equipment with broad specification mentioned here will usher in uniformity in conduct of PRACs as well as aid in procurement of equipment by polytechnics concerned.

| Sl. No. | Equipment Name with Broad Specifications | Exp. S.No. |
|---|---|---|
| 1 | Vernier Calipers: Range: 0-15cm, Resolution: 0.1mm | 1 |
| 2 | Micrometer screw gauge: Range: 0-25mm, Resolution: 0.01mm, Accuracy: ±0.02mm or better | 2 |
| 3 | Spherometer: range: 0-1cm, Pitch: 1mm, LC = 0.01mm | 3 |
| 4 | Digital multimeter: 3½ digit display, 9999 counts, digital multimeter measures: $V_{dc}$: 0 to 1000V max; $A_{dc}$: 0 to 10 amps max; Ext. Resistance: 0-10MΩ; Capacitance and Temperature | 4, 5 & 7, 21, 22, 23 |
| 6 | Resistance Box: 4 decade range from 1 ohm to 1KΩ, accuracy: 0.1% ± 1 Ω | 4,5,6,7 |
| 7 | Battery eliminator: 0-12V, 2A | 6, 7, 25, 26 |
| 8 | Boyle's apparatus: U tube manometer, digital barometer | 12 |
| 9 | Joule's calorimeter: set, insulated mechanical-Electrical equivalent of heat apparatus in wooden box, digital analog thermometer | 13 |
| 10 | Thermistor: energy band gap set up: Oven: temperature range up to 100°C, thermometer, probe, voltmeter, connecting leads | 14 |
| 11 | pH meter: reading: up to pH 14, solution temp: -40 to 200 °C, pH: 1/0.1 resolution, 13 b1 | 24 |
| 12 | Electronic balance: with the table range of 0.01g to 500gm, max = 200 gm, readability: 0.01gm, response time: 3-5 sec, power requirement: 90-250 V, 10 watt | 17, 18, 19, 20, 21, 31 |
| 13 | Digital resistance: range: 0-1MΩ, 0.1MΩ, 1MΩ, temperature range: 10°C to 25°C with the accuracy of 4°C | 31 |
| 14 | Ammeter: 0-2 amp | 23,26 |
| 15 | Rheostat: (wire wound) | 27 |
| 16 | Cleveland open cup apparatus | 29 |
| 17 | Abel's closed cup apparatus | 30 |

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and understood in order to develop PCOs for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| **Physics** | | |



| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| **Unit – I Units and Measurements** | 1a Describe the given measurement device and its application.<br>1b. Describe with justification the device required to measure the value of the given object.<br>1c State with justification the error in the given measurement quantity.<br>1d. Describe the procedure to determine the dimensions of the given physical quantities. | 1.1 Unit: physical quantities: fundamental and derived quantities and their units<br>1.2 Systems of unit: FPS, MKS, CGS and SI<br>1.3 Dimensions: dimensional formula<br>1.4 Errors: types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures |
| **Unit- II Electricity, Magnetism and Semiconductors** | 2a Calculate electric field, potential and potential difference of the given static charge.<br>2b Describe the concept of given magnetic intensity and flux with relevant units.<br>2c Explain the heating effect of the given electric current.<br>2d. Apply laws of series and parallel combination in the given electric circuits. | 2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference<br>2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux<br>2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effect of electric current |
| | 2e Distinguish the given conductors, semiconductors and insulators on the basis of energy bands.<br>2f Explain the I-V characteristics and applications of the given p-n junction diodes. | 2.4 Conductors, insulators and semiconductors: energy bands, intrinsic and extrinsic semiconductors<br>2.5 p-n junction diode, I-V characteristics of p-n junction, applications of p-n junction diode |
| **Unit- III Heat and Optics** | 3a. Convert the given temperature in different temperature scales.<br>3b. Describe the properties of the given good and bad conductors of heat.<br>3c Relate the characteristics of the three gas laws.<br>3d. Determine the relation between specific heats for the given materials. | 3.1 Heat, temperature, temperature scales<br>3.2 Modes of transfer of heat, good and bad conductors of heat, law of thermal conductivity<br>3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas equation<br>3.4 Specific heat of gas at constant pressure and volume ($C_p$ and $C_v$), ratio of specific heats |
| | 3e. Distinguish the phenomena of total internal reflection for | 3.5 Reflection, refraction, laws of refraction, total internal reflection |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | the given medium.<br>3f. Describe light propagation in the given type of optical fiber | 3.6 Optical fiber: Principle, construction and path of light through optical fiber, applications of optical fibers |
| | **Chemistry** | |
| Unit-IV Chemical bonding and Catalysis | 4a. Explain the properties of given material based on the bond formation.<br>4b. Describe the molecular structure of given solid, liquid and gases.<br>4c. Describe the crystal structure of the given solids.<br>4d. Select the relevant catalyst for given application. | 4.1 Electronic theory of valency: chemical bonds, types and characteristics, electrovalent bond, covalent bond, coordinate bond, hydrogen bond, metallic bond, metallic properties, intermolecular force of attraction.<br>4.2 Molecular arrangement in solid, liquid and gases.<br>4.3 Structure of solids: crystalline and amorphous solid, properties of metallic solids, unit cell of simple cubic, body centre cubic, face centre cubic, hexagonal close pack, crystals.<br>4.4 Catalysis: Types of catalysis, Catalyst, Types of Catalyst: Positive catalyst, Negative Catalyst, Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial Application of Catalyst |
| Unit-V Metal Corrosion, its prevention and Electrochemistry | 5a. Describe the phenomenon of the given type of corrosion and its prevention.<br>5b. Identify the different factors affecting rate of corrosion for the given type of material.<br>5c. Select the protective measures to prevent the corrosion in the given corrosive medium. | 5.1 Corrosion: Types of corrosion- Dry corrosion, Wet corrosion, Oxidation corrosion, Atmospheric corrosion due to oxygen gas, mechanism, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium).<br>5.2 Concentration cell corrosion, oxygen absorption mechanism in neutral or alkaline medium, Pitting corrosion, Waterline corrosion, Crevice corrosion.<br>5.3 Factors affecting the rate of corrosion control: Modification of environment, Use of protective coatings: coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing), Anodic and cathodic protection, Choice of material: using pure metal and using metal alloys. |
| | 5d. Differentiate the salient features of the given electrolytic cell and electrochemical cell.<br>5e. Distinguish the given | 5.4 Electrolyte: strong and weak, Non-Electrolyte, Electrolytic cell, Electrochemical cell, Cathode, Anode, Electrode potential, oxidation and reduction, Construction and working of |





| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | primary and secondary electrolytic cells.<br>5f. Describe the process of electrolysis for the given electrolyte.<br>5g. Describe the process of electroplating of the given material. | Daniel cell: Description and its electrodes.<br>5.5 Faraday's first and second law.<br>5.6 Primary cell and secondary cell, Electrolysis: Mechanism, Electroplating and electro refining of copper. |
| Unit-VI Paints, Varnishes, Insulators, Polymer, Adhesives and Lubricants | 6a. Identify the ingredients of the given paints.<br>6b. Differentiate various properties of the given paint and varnish.<br>6c. Describe the properties of insulating material for the given application. | 6.1 Paints: Purpose of applying paint, Characteristics of paints, Ingredients of paints, Function and Example of each ingredients.<br>6.2 Varnish: Types, Difference between paint and varnishes.<br>6.3 Insulators: Characteristics, Classification: Inorganic and Organic, Application of Glass wool, Thermocol, Mica. |
| | 6d. Differentiate the given types of structural polymers.<br>6e. Describe the polymerization process of the given polymers.<br>6f. Explain the properties and uses of the given polymer, elastomer and adhesive.<br>6g. Describe the application of the lubricant and adhesive as required for the given material.<br>6h. Explain the properties of given type of lubricants. | 6.4 Polymer: Monomer, Classification on the basis of structure, on the basis of monomers (homo polymer and copolymer), on the basis of Thermal behaviour (Thermoplastics and Thermosetting).<br>6.5 Types Polymerization Reaction: Addition Polymerization, Condensation Polymerization, Properties and applications of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin.<br>6.6 Adhesives: Characteristics, Classification and Examples.<br>6.7 Lubricants: Classification, properties and applications. |

*Note: To attain the COs and competency above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.*

## 9 SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| | **Physics** | | | | | |
| I | Units and Measurements | 09 | 02 | 07 | - | 15 |
| II | Electricity, Magnetism and Semiconductors | 14 | 03 | 07 | 06 | 16 |

Program Name : All Branches of Diploma in Engineering and Technology

Program Code : C E E C R I S C H P S T M X O E F W D E E N E Q U I V A L E N T T O P O L Y T E C H N I C

Semester : Four

Course Title : Mathematics

Course Code : 22070

## 1. RATIONALE

Within the realm of the core course to develop the competencies of diploma technology students in the field of Mathematics is being introduced as a foundation which will help in developing the 'Power' and the required 'Course Outcomes' of each of the following technology programmes in order to fulfil the needs of the industries and thereby enhance the employability. This course is an attempt to introduce the basic concepts and logical thinking and reasoning capabilities. It will help in apply the principles of basic mathematics to solve related technology problems. Hence the course provides the ability to analyze engineering problems scientifically by using logarithms, determinants, matrices, trigonometry, coordinate geometry, measurement of solid etc.

## 2. COMPETENCY

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

- Solve broad-based technology problems using the principles of basic mathematics

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a. Apply the concepts of algebra to solve engineering related problems.
b. Utilize basic concepts of trigonometry to solve elementary engineering problems.
c. Solve various engineering problems under given conditions of straight lines.
d. Solve the problems based on measurement of regular closed figures and regular solids.
e. Use basic concepts of statistics to solve engineering related problems.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| L | T | P | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 4 | 2 | -- | 6 | 3 | 70 | 28 | 30* | 12 | 100 | 40 | -- | -- | -- | -- | -- | -- |

(*) Based on average of best of two tests to be taken in each of the two semesters, one test in each semester. (#) Internal Assessment (IA) will be of 20 marks in the theory of 3 hours duration. The remaining 10 marks are for assessment of the regular practical COs required for the attainment of the COs.

*Legends: L (Lecture), T (Tutorial/Teacher Guided Theory Practice), P (Practical), C (Credits), ESE (End Semester Examination), PA (Progressive Assessment).*



## 5. COURSE MAP (with sample COs, Unit Outcomes i.e. UOs and topics)

The course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry employer identified competency depicted at the centre of the map.

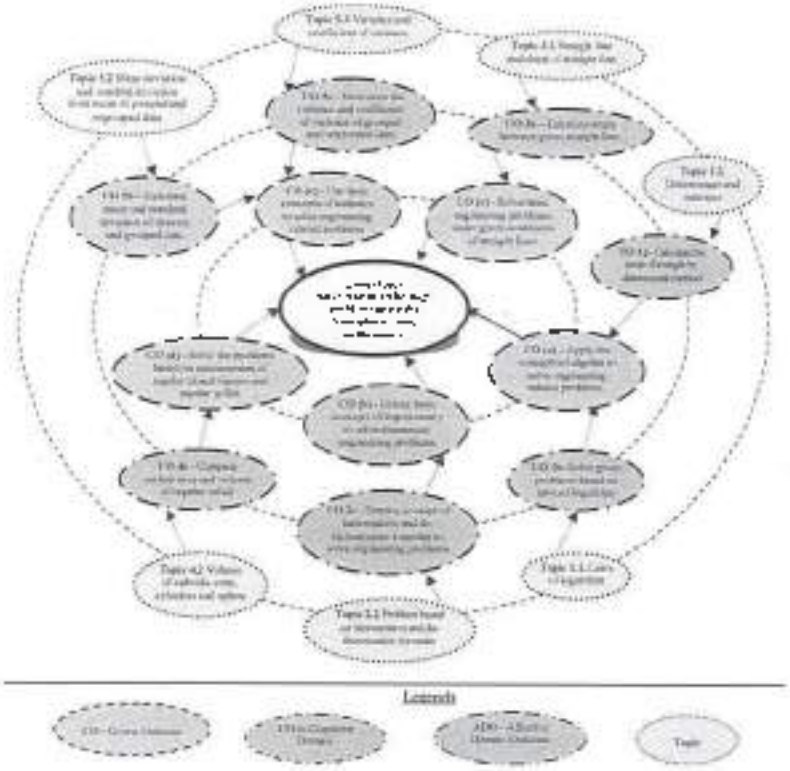


**Figure 1 - Course Map**

## 6. SUGGESTED PRACTICALS/ EXERCISES

The laboratory experiences in this section are UOs i.e. sub-components of the COs to be developed and assessed in the student to lead to the attainment of the competency.

| S. No. | Tutorials | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 1 | Solve simple problems of Logarithms based on definition and laws. | I | 2 |
| 2 | Solve problems on determinant to find area of triangle, and solution of simultaneous equation by Cramer's Rule. | II | 2 |
| 3 | Solve elementary problems on Algebra of matrices. | II | 2 |

| S. No. | Tutorials | Unit No. | Approx Hrs. Required |
|---|---|---|---|
| 4 | Solve solutions of Simultaneous Equation using inversion method | I | 2 |
| 5 | Resolve into partial fraction using linear non repeated, repeated, and irreducible factors | I | 2 |
| 6 | Solve problems on Compound, Allied, multiple and sub multiple angles | II | 2 |
| 7 | Practice problems on factorization and de factorization. | II | 2 |
| 8 | Solve problems on inverse circular trigonometric ratios | II | 2 |
| 9 | Practice problems on equation of straight lines using different forms. | III | 2 |
| 10 | Solve problems on perpendicular distance, distance between two parallel lines, and angle between two lines | III | 2 |
| 11 | Solve problems on Area, such as rectangle, triangle and circle | IV | 2 |
| 12 | Solve problems on surface and volume sphere, cylinder and cone. | IV | 2 |
| 13 | Solve practice problems on the surface area, volumes and its applications. | V | 2 |
| 14 | Solve problems on finding range, coefficient of range and mean deviation | V | 2 |
| 15 | Solve problems on standard deviation. | V | 2 |
| 16 | Solve problems on coefficient of variation and comparison of two sets | V | 2 |
| | Total | | 32 |

*Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.*

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

## 8 UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the CO to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Algebra | 1a Solve the given simple problem based on laws of logarithm<br>1b Calculate the area of the given triangle by determinant method<br>1c Solve given system of linear equations using matrix inversion method and by Cramer's rule<br>1d. Obtain the proper and improper partial fraction for the given simple rational function | 1.1 Logarithm: Concept and laws of logarithm<br>1.2 Determinant and matrices<br>a Value of determinant of order 2x3<br>b Solutions of simultaneous equations in three unknowns by Cramer's rule.<br>c Matrices, algebra of matrices, transpose, adjoint and inverse of matrices. Solution of simultaneous equations by matrix inversion method<br>d Types of partial fraction based on nature of factors and related |



| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | | problems |
| Unit– II Trigonometry | 2a Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s).<br>2b Apply the concept of Sub- multiple angle to solve the given simple engineering related problem(s).<br>2c Employ concept of factorization and defactorization formulae to solve the given simple engineering problem(s).<br>2d Investigate given simple problems involving inverse trigonometric ratios. | 2.1 Trigonometric ratios of Compound, allied, multiple and sub-multiple angles (without proofs)<br>2.2 Factorization and defactorization formulae (without proofs)<br>2.3 Inverse trigonometric ratios and related problems.<br>2.4 Principle values and relation between trigonometric and inverse trigonometric ratio |
| Unit– III Coordinate Geometry | 3a Calculate angle between given two straight lines.<br>3b Formulate equation of straight lines related to given engineering problems.<br>3c Identify perpendicular distance from the given point to the line.<br>3d Calculate perpendicular distance between the given two parallel lines. | 3.1 Straight Line: rad slope of straight line<br>a Angle between two lines<br>b Condition of parallel and perpendicular lines<br>3.2 Various forms of straight lines<br>a Slope point form, two point form<br>b Two points intercept form<br>c General form<br>d Perpendicular distance from a point to the line<br>e Perpendicular distance between two parallel lines |
| Unit–IV Mensuration | 4a Calculate the area of given triangle and circle.<br>4b Determine the area of the given square, parallelogram, rhombus and trapezium.<br>4c Compute surface area of given cuboids, sphere, cone and cylinder.<br>4d Determine volume of given cuboids, sphere, cone and cylinder. | 4.1 Area of regular closed figures: Area of triangle, square, parallelogram, rhombus, trapezium and circle<br>4.2 Volume of cuboids, cone, cylinder and sphere |
| Unit –V Statistics | 5a Obtain the range and coefficient of range of the given grouped and ungrouped data<br>5b Calculate mean and standard deviation of discrete and grouped data related to the given simple engineering problem<br>5c Determine the variance and coefficient of variance of given grouped and ungrouped data | 5.1 Range, coefficient of range of discrete and grouped data<br>5.2 Mean deviation and standard deviation from mean of grouped and ungrouped data, weighted mean<br>5.3 Variance and coefficient of variance<br>5.4 Comparison of two sets of observation |

| Unit | Unit Outcomes (UOs) (at cognitive level) | Topics and Sub-topics |
|---|---|---|
| | U1: Identify the consistency of given equations of data | |

*Note: To attain the COs and competency, above listed Unit Outcomes (UOs) need to be undertaken to achieve the 'Application level' and above of Bloom's Cognitive Domain Taxonomy.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Algebra | 20 | 02 | 08 | 10 | 20 |
| II | Trigonometry | 18 | 02 | 08 | 10 | 20 |
| III | Coordinate Geometry | 08 | 02 | 02 | 04 | 08 |
| IV | Mensuration | 06 | 02 | 02 | 04 | 08 |
| V | Statistics | 10 | 02 | 05 | 07 | 14 |
| Total | | 64 | 10 | 25 | 35 | 70 |

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised Taxonomy)*

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

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve with the use of free software's available on the internet
b. Use graphical softwares EXCEL, UFLOW and GRAPH for related topics
c. Use MathCAD as Mathematical Tools and solve the problems of Calculus
d. Identify problems based on applications of matrix and use MAT LAB to solve these problems
e. Prepare models to explain different concepts
f. Prepare a seminar on any relevant topic

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub topics
b. *'C' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. *About 15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the UOs/COs through classroom presentations (see implementation guideline for details).
d. With respect to item No. 10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide student(s) in undertaking micro-projects.
f. Apply the mathematical concepts learnt in this course to branch specific problems

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact an integration of PrOs, UOs and ASOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

a. Prepare charts using determinants to find area of regular shapes
b. Prepare models using matrices to solve simple problems based on cryptography
c. Prepare models using matrices to solve simple network problems
d. Prepare charts displaying regular solids.
e. Prepare charts displaying regular closed figures.
f. Prepare charts for grouped and ungrouped data

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Higher Engineering Mathematics | Grewal, B.S | Khanna publications New Delhi 2015 ISBN 81NO91933 |
| 2 | Advanced Engineering Mathematics | Kreyig, Erwin | Wiley Publications, New Delhi, 2014 ISBN 978-81-265-45836-8 |
| 3 | Engineering Mathematics (third edition). | Croft, Anthony | Pearson Education, New Delhi, 2014 ISBN 978-81-317-2605-1 |
| 4 | Getting Started with MATLAB 7 | Pratap, Rudra | Oxford University Press, New Delhi, 2014, ISBN 0199731241 |
| 5 | Advanced Engineering Mathematics | Das, H K | S Chand & Co; New Delhi, 2008, ISBN-9788121903455 |

## 14. SOFTWARE/LEARNING WEBSITES

a. www.scilab.org/ - SCI Lab
b. www.mathworks.com/products/matlab/ - MATLAB
c. www.gnuplot.info/ - GNUplot
d. www.ai.mit.edu/ - MathCAD
e. www.wolfram.com/mathematica/ - Mathematica
f. https://www.khanacademy.org/math?gclid=CNqIuaoCysICFdOlaAodcHoPig

3. www.easycalculation.com
4. www.math-magic.com

**Maharashtra State Board of Technical Education, Mumbai**

**Teaching and Examination Scheme for Post S.S.C. Diploma Courses**

**Program Name : Civil Engineering Groups**

**Program Code : CE/CR/ CS** — **With Effect From Academic Year: 2017 - 18**

**Duration of Program : 6 Semesters** — **Duration : 16 Weeks**

**Semester : Second** — **Scheme - I**

| S. N. | Course Title | Course Abbreviation | Course Code | Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | | | | | Practical | | | | | |
| | | | | | | | | Exam Duration in Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | L | T | P | | | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | |
| 1 | Applied Mathematics | AMS | 22201 | 3 | 1 | - | 4 | 3 | 70 | 28 | 30* | 00 | 100 | 40 | -- | -- | -- | -- | -- | -- | 100 |
| 2 | Applied Science: Physics | ASM | 22202 | 2 | - | 4 | 8 | 90 Min | 70# | 28 | 15* | 00 | 100 | 40 | 25@ | 10 | 25 | 10 | 50 | 20 | 200 |
| | Applied Science: Chemistry | | | 2 | - | | | | | | 15* | 00 | | | 25@ | 10 | 25 | 10 | 50 | 20 | |
| 3 | Applied Mechanics | AME | 22203 | 3 | 1 | 2 | 6 | 3 | 70 | 28 | 30* | 00 | 100 | 40 | 25@ | 10 | 25 | 10 | 50 | 20 | 150 |
| 4 | Construction Materials | CMA | 22204 | 3 | - | 2 | 5 | 3 | 70 | 28 | 30* | 00 | 100 | 40 | 25@ | 10 | 25 | 10 | 50 | 20 | 150 |
| 5 | Basic Surveying | BSU | 22205 | 3 | - | 4 | 7 | 3 | 70 | 28 | 30* | 00 | 100 | 40 | 50@ | 20 | 50 | 20 | 100 | 40 | 200 |
| 6 | Civil Engineering Workshop and Practice | CEW | 22008 | - | - | 4 | 2 | -- | -- | -- | -- | -- | -- | -- | 50@ | 20 | 50- | 20 | 100 | 40 | 00 |
| 7 | Business Communication Using Computers | BCC | 22009 | - | - | 2 | 2 | -- | -- | -- | -- | -- | -- | -- | 35@$ | 14 | 15- | 06 | 50 | 20 | 50 |
| | | Total | | 16 | 2 | 18 | 36 | -- | 350 | -- | 150 | -- | 500 | -- | 235 | -- | 215 | -- | 450 | -- | 950 |

Student Contact Hours Per Week **36 Hrs.** Medium of Instruction: **English**

**Theory and practical periods of 60 minutes each.** Total Marks : 950

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L. - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *@ On Line Examination, $ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (15 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

- For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **It is mandatory for the candidate to appear for practical (ESE) of both the part of Applied Science (Physics & Chemistry). Candidate remaining absent in exam of any one part, will be considered as absent for the head ESE (PR) of Applied Science.**
- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

| | |
|---|---|
| Program Name | : Civil Engineering Program Group |
| Program Code | : CE/CR/CS |
| Semester | : Second |
| Course Title | : Applied Mathematics |
| Course Code | : 22201 |

## 1. RATIONALE

This course is an extension of Basic Mathematics of first semester namely Applied Mathematics which is designed for the application in engineering and technology to get the techniques of calculus, differentiation, integration, differential equations and in particular numerical integration. Several uses are needed to find slope of the curve, maxima and minima of the function, radius of curvature, area of curve, this helps to finding the area. Differentiation equation is used to find out the curve and its related applications for various engineering models. Numerical integration is used to find the area of the functions especially whose integration cannot be evaluated easily with prescribed rules. This course further develops the skills and understanding of mathematical concepts which underpin the various technologies used in engineering.

## 2. COMPETENCY

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

- Solve civil engineering related broad-based problems using the principles of applied mathematics.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Calculate the equation of tangent, normal, minimum radius of curvature by differentiation.
b. Solve the given problems of integration using suitable methods.
c. Apply the concept of integration to find area and volume.
d. Solve the ordinary differential equations of first order and first degree using suitable methods.
e. Apply the concept of numerical integration to investigate the area.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper | ESE | | CA | | Total | | ESE | | PA | | Total | |
| C | T | P | | Hrs. | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | 1 | – | 4 | 3 | 70 | 28 | 30 | 12 | 100 | 40 | – | – | – | – | – | – |

*(**): Under the theory CA, One of the tests or Online tests are to be conducted for the assessment of COs and the remaining 20 marks is the average of two tests or two online tests. The procedure for the assessment of the remaining 10 marks is explained in the implementation of COs.*



*Legends: L (Lecture), T (Tutorial/Teacher Guided Theory Practice), P (Practical), C (Credit), ESE (End Semester Examination), PA (Progressive Assessment)*

## 5. COURSE MAP (with sample COs, Learning Outcomes and UOs and topics)

This course map gives an overview of the COs and the stages of the topics that will lead to the attainment of the competency as specified by the COs mentioned in the above section. The course map also gives the flow of the topics to be taught to develop the various cognitive levels (Bloom's taxonomy) of the UOs and the sequence in which the topics are to be taught. The arrangement of the topics in the course map is in the hierarchical order to show the linkages among the topics.

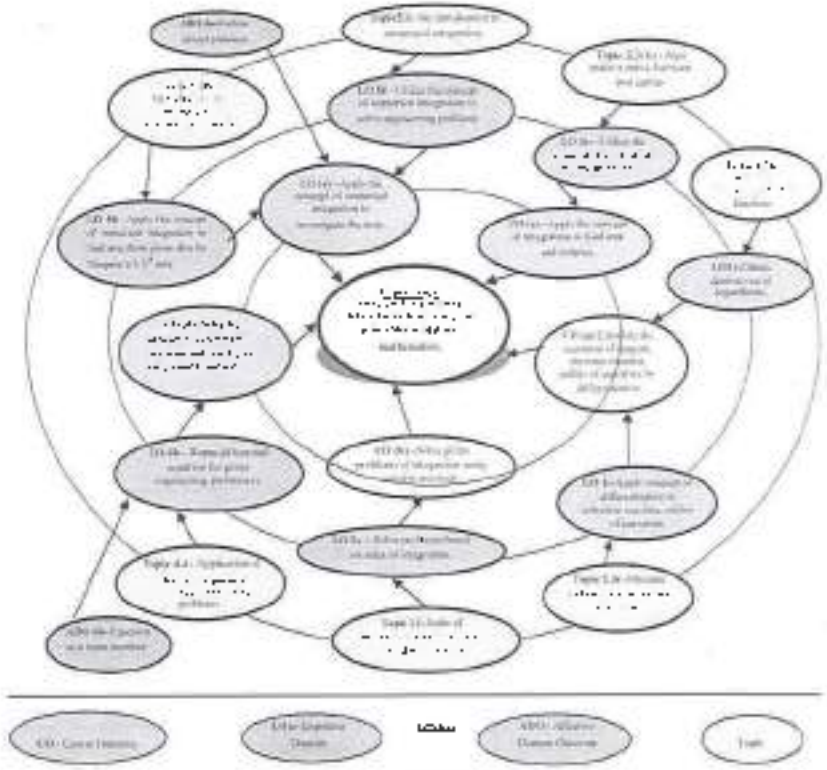

Figure 1 - Course Map

## 6. SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are UOs or the sub-components of the COs to be developed and assigned to the student to help in the attainment of the competency.

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

| S. No. | Tutorials | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 1 | Solve problems based on finding value of the function at different points | I | 1 |
| 2 | Solve problems on finding derivatives of algebraic functions and parametric functions | I | 1 |
| 3 | Solve problems to find derivative of logarithmic and exponential functions | I | 1 |
| 4 | Solve problems based on finding equation of tangent and normal | I | |
| 5 | Solve problems based on finding maxima, minima of function and radius of curvature at a given point | I | |
| 6 | Solve the problems based on standard formulae of integration | II | 1 |
| 7 | Solve problems based on methods of integration substitution, partial fractions | II | 1 |
| 8 | Solve problems based on integration by parts | II | 1 |
| 9 | Solve practice problems based on properties of definite integration. | II | 1 |
| 10 | Solve simple problems based on finding area under curve, area between two curves and volume of revolutions | III | 1 |
| 11 | Solve the problems based on formation, order and degree of differential equations | V | 1 |
| 12 | Develop a model using variable separable method to related engineering problem | V | |
| 13 | Develop a model using the concept of linear differential equation to related engineering problem | V | |
| 14 | Solve problems based on Trapezoidal rule | V | 1 |
| 15 | Solve problems based on Simpson's [illegible] rule | V | 1 |
| 16 | Make use of concept of numerical integration to solve related civil engineering problems | V | 1 |
| Total | | | 15 |

*Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice*

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED:
- Not applicable -

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop Unit Cognitive Domain for achieving the CO to obtain the identified competency

| Unit | Major Cognitive Domain Learning Outcomes | Topics and Sub-topics |
|---|---|---|
| Unit – I Differential Calculus | a. Solve the given simple problems based on functions<br>b. Solve the given simple problems based on rules of differentiation | 1.1 Functions and Limits :<br>a) Concept of function and simple examples<br>b) Concept of limits without |



| Unit | Major Cognitive Domain Learning Outcomes | Topics and Sub-topics |
|---|---|---|
| | c. Obtain the derivatives of algebraic, exponential functions<br>d. Apply the concept of differentiation to find eqn. equation of tangent and normal<br>e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for given function. | examples<br>1.2 Derivatives<br>a) Rules of derivatives (without proofs), product of functions<br>b) Derivatives of composite functions (chain rule), implicit and parametric functions<br>c) Derivatives of inverse, logarithmic and exponential functions<br>1.3 Application of derivative<br>a) Second order derivatives (without examples)<br>b) Equations of tangent and normal<br>c) Maxima and minima<br>d) Radius of curvature |
| Unit– II Integral Calculus | 2a. Solve the given simple problems based on rules of integration.<br>2b. Obtain the given simple integrals using substitution method<br>2c. Integrate given simple functions using the integration by parts<br>2d. Evaluate the given simple integral by partial fractions | 2. Simple Integration: Rules of integration and integration of standard functions<br>2.1 Methods of Integration.<br>a) Integration by substitution<br>b) Integration by parts<br>c) Integration by partial fractions |
| Unit– III Applications of Definite Integration | 3a. Solve given simple problems based on properties of definite integration<br>3b. Apply the concept of definite integration to find the area under the given curves<br>3c. Utilize the concept of definite integration to find area between given two curves<br>3d. Demonstrate the concept of definite integration to find the volume of revolution of given surface | 3. Definite Integration<br>a) Simple examples<br>b) Properties of definite integral (without proof) and simple examples<br>3.1 Applications of Integration :<br>a) Area under the curve<br>b) Area between two curves<br>c) Volume of revolution |
| Unit-IV First Order First Degree Differential Equations | 4a. Find the order and degree of given differential equations<br>4b. Form simple differential equations for given simple engineering problems.<br>4c. Solve given differential equations using the method of variable separable<br>4d. Solve the given simple problems | 4.1 Concept of differential equation<br>4.2 Order, degree and formation of differential equation<br>4.3 Solution of differential equation<br>a) Variable separable form<br>b) Linear differential equation<br>4.4 Application of differential equations and related engineering problems |

| Unit | Major Cognitive Domain Learning Outcomes | Topics and Sub-topics |
|---|---|---|
| | based on linear differential equations. | |
| Unit–V Numerical Integration | 5a. Apply the concept of numerical integration to find area from given data by Trapezoidal rule.<br>5b. Apply the concept of numerical integration to find area from given data by Simpson's $1/3^{rd}$ rule.<br>5c. Apply the concept of numerical integration to find area from given data by Simpson's $3/8^{th}$ rule.<br>5d. Utilize the concept of numerical integration to solve related engineering problems. | 5.1 Need and significance of numerical integration<br>5.2 Trapezoidal rule<br>5.3 Simpson's $1/3^{rd}$ rule<br>5.4 Simpson's $3/8^{th}$ rule. |

*Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application' level of Bloom's Cognitive Domain Taxonomy.*

## 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Differential calculus | 14 | 04 | 04 | 12 | 24 |
| II | Integral calculus | 12 | 03 | 04 | 08 | 15 |
| III | Applications of Definite Integration | 08 | 02 | 02 | 04 | 08 |
| IV | First Order First Degree Differential Equations | 10 | 02 | 02 | 06 | 08 |
| V | Numerical Integration | 04 | 01 | 01 | 07 | 09 |
| Total | | 48 | 12 | 13 | 37 | 64 |

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

*Note: This specification table provides general guidelines to assist teachers for their planning and to provide a fair and across student work pertaining to attainment of COs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

## 9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world situations and solve with the use of technology available on the internet.
b. Use graphical software's: EXCEL, POLOT and GRAPH for related topics.
c. Use Mathcad as Mathematical Tools and solve the problems of Calculus.
d. Identify problems based on applications of differential equations and solve these problems.
e. Prepare models to explain different concepts of applied mathematics.
f. Prepare a seminar on any relevant topic based on applications of numerical integration or related engineering problems.

## 10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. '*Chalk and talk*' method may not only be traditional lecture method but different types of teaching methods and media that are to be employed to develop the outcomes.
c. *About 15-20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (role of teacher as facilitator).
d. With respect to item No. 11, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide student(s) in undertaking micro-projects.

## 11. SUGGESTED MICRO PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should preferably focus on more than one COs which are in fact an integration of practical's, cognitive domain and affective domain LOs. The micro-project could be industry application based, internship based, workshop based, laboratory based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen)* student engagement hours during the term.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes in the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare models using the concept of tangent and normal to bending of roads, case of sliding of a vehicle.
b. Prepare models using the concept of radius of curvature to bending of railway track.
c. Prepare charts displaying the area of irregular shapes using the concept of integration.
d. Prepare charts displaying volume of irregular shapes using concept of integration.
e. Prepare models using the concept of differential equations for mixing problem.
f. Prepare models using the concept of differential equations for radio carbon dating.
g. Prepare models using the concept of differential equations for population growth.
h. Prepare models using the concept of differential equations for thermal cooling.
i. Prepare charts displaying the area of irregular shapes using the concept of Simpson's $1/3^{rd}$ rule.
j. Prepare charts displaying the area of irregular shapes using the concept of Simpson's $3/8^{th}$ rule.

## 12. SUGGESTED LEARNING RESOURCES

| S No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Higher Engineering Mathematics | Grewal, B.S | Khanna publications, New Delhi, 2012 ISBN- 8174091955 |
| 2 | A Text Book of Engineering Mathematics | Dutta, D. | New Age International Publications, New Delhi 2006. ISBN 978-81-224-1689-3 |
| 3 | Advanced Engineering Mathematics | Kreyig, Erwin | Wiley Publications, New Delhi, 2016 ISBN 978-81-265-5423-2 |
| 4 | Advanced Engineering Mathematics | Das, H.K | S. Chand Publications, New Delhi, 2008, ISBN 9788121903455 |
| 5 | Engineering Mathematics Volume I (4th edition) | Sastry, S.S | PHI learning, New Delhi, 2014 ISBN-978-81-203-3616-2. |
| 6 | Comprehensive Basic Mathematics, Volume-2 | Verma, G.R. | New Age International Publications, New Delhi, 2005 ISBN:978 81-224-1689-6 |
| 7 | Getting Started with MATLAB-7 | Pratap, Rudra | Oxford University Press, New Delhi, 2009 ISBN 0199731241 |
| 8 | Engineering Mathematics (3rd edition) | Croft, Anthony | Pearson Education, New Delhi,2013 ISBN: 978-81-317-2605-1 |

## 13. SOFTWARE/LEARNING WEBSITES

a. www.scilab.org - SCI Lab
b. www.mathworks.in/products/matlab/ - MATLAB
c. Spreadsheet applications
d. www.dplot.com - DPlot
e. www.ilmathcad.com/ - MathCAD
f. www.wolfram.com/mathematica - Mathematica
g. http://desmos.com
h. https://www.khanacademy.org/math?gclid=CNqHuabCvs4CFdOUaAodaHoFig
i. www.easycalculation.com
j. www.math-magic.com

| | |
|---|---|
| Program Name | : Mechanical and Civil Engineering Programs Group |
| Program Code | : ME/CE/CH/CHT/PT/PG |
| Semester | : Second |
| Course Title | : Applied Science (Physics & Chemistry) |
| Course Code | : 22202 |

## 1. RATIONALE

Diploma engineers have to deal with various materials and machines. The study of concepts and principles of science like elasticity, viscosity, surface tension, modulus, thermal coefficients, LASERs, X-Rays, metals, alloys, cement, lime, refractory materials, water treatment and analysis of fuel and combustion will help the student to select and use relevant principle and methods which will be economical and eco-friendly.

## 2. COMPETENCY

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

- Solve broad-based engineering problems using principles of advanced physics and chemistry.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *outcome oriented* COs associated with the above mentioned competency:

a. Select relevant material in industry by analysing its physical properties.
b. Apply laws of diffraction in various applications.
c. Use LASER, X-Rays and photoelectric sensors.
d. Select the relevant metallurgical process related to industrial applications.
e. Use relevant water treatment process to solve industrial problems.
f. Use relevant fuel in relevant applications.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | 2 | - | 5 | 2 Hrs | 70 | 28 | 30 | 12 | 100 | 40 | 50 | 20 | 50 | 20 | 100 | 40 |
| 3 | 2 | - | | 2 Hrs | 70 | 28 | 30 | 12 | | | 50 | 20 | 50 | 20 | | |

*(L) - Lecture, (T) - Tutorial, (P) - Practical, (C) - Credits, ESE - End Semester Examination, PA - Progressive Assessment*

*Note: Practical of Chemistry and Physics will be conducted on alternate weeks for each batch.*





## 5. COURSE MAP with sample CO- PrOs, UOs, ADOs or Theory

This course map illustrates an overview of the flow and linkage of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry employer identified competency depicted at the centre of this map.

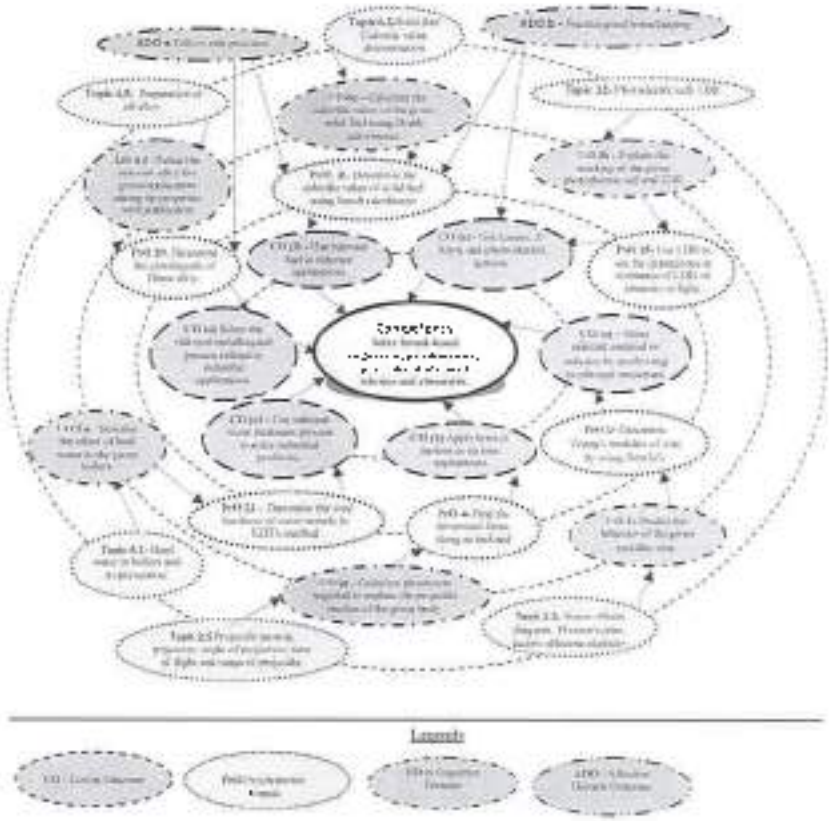


Figure 1 - Course Map

## 6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | Physics | | |
| 1 | Use Searle's method to determine the Young's modulus of given | 1 | 2 |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | ance | | |
| 2 | Apply Archimedes principle to determine the viscous force or coefficient of viscosity of a liquid | I | 02 |
| 3 | Determine the coefficient of viscosity of given liquid by Stoke's method | I | 02 |
| 4 | Find the downward force along inclined plane acting on a roller due to gravity and its relationship with the angle of inclination | I | 02 |
| 5 | Check the range of the projectile from the initial speed and angle | II | 02* |
| 6 | a. Find the dependence of the stopping potential on the frequency of light source in photo electric effect experiment.<br>b. Find the dependence of the stopping potential on the intensity of light source in photo electric effect experiment. | II | 02 |
| 7 | Determine the I-V characteristics of photoelectric cell and LDR | III | 02* |
| 8 | Determine the divergence of laser beam | III | 02 |
| | Chemistry | | |
| 9 | Standardization of $KMnO_4$ solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by $KMnO_4$ solution. | IV | 02* |
| 10 | Determine the percentage of Copper in given Copper ore | IV | 02 |
| 11 | Determine total hardness, temporary hardness and permanent hardness of water sample by EDTA method. | V | 02* |
| 12 | Determine the alkalinity of given water sample. | V | 02 |
| 13 | Determine the turbidity of given water sample by Nephelometric method. | V | 02 |
| 14 | Determine the moisture and ash content in given coal sample using proximate analysis. | VI | 02* |
| 15 | Determine the calorific value of given solid fuel using Bomb calorimeter. | VI | 02* |
| 16 | Determine the percentage of Sulphur in given coal sample by ultimate analysis (only internal analysis) | VI | 02 |
| | | Total | 32 |

Note

*a. A minimum five (5) PrOs are to be performed out of the above PrOs. More such PrOs can be added to attain the 'Dreyfus' competency level of proficiency (2) in the given skill needed to be performed out of which the PrOs marked as (*) are considered as 'Must do' PrOs and are to be performed to attain the 'Proficiency Level' of Course Outcomes/Program Outcomes as given in the curriculum developed by the industry.*

*b. The 'Practical' and 'Practical related skills' mentioned in the table for the PrO's are to be considered as indicative only suggested in a single group/batch.*

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Preparation of experimental set up | 20 |
| 2 | Setting and operation | 20 |
| 3 | Safety practices | 10 |
| 4 | Observations and Recording | 10 |
| 5 | Interpretation of Result and Conclusion | 20 |
| 6 | Answer to sample questions | 10 |
| 7 | Submission of report in time | 10 |
| | Total | 100 |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safe practices.
b. Practice good housekeeping
c. Practice energy conservation
d. Demonstrate working as a leader/a team member.
e. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of the ADOs takes place gradually in the student when he undergoes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

## 7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will serve as a guideline for procurement of equipment by the institutions.

| S. No. | Equipment Name with Broad Specifications | Exp. No. |
|---|---|---|
| 1 | Stoke's apparatus with slotted mass of 0.5 kg each | 1 |
| 2 | Liquid sample | 2 |
| 3 | Solid body (sphere) : size and material | 3,4 |
| 4 | Stoke's apparatus (glass tube, viscous liquid, spherical balls of varying size) | 3 |
| 5 | Stop watch | 2,3 |
| 6 | Plain protractor | 4 |
| 7 | Ruler | 4 |
| 8 | Projectile motion Apparatus | 5 |
| 9 | Photo electric effect apparatus | 6 |
| 10 | Experimental setup for characteristics of photoelectric cell | 7 |
| 11 | Experimental setup for characteristics of LDR | 7 |
| 12 | Laser Source (He-Ne, diode laser) | 8 |
| 13 | Electronic balance with the wide range of 0.00 gm to 500g, minimum 10 Hz sampling response time 2-5 sec, power requirement 90-250 V AC, 50 Hz | All |
| 14 | Electric oven internal size 16" x 18" x 18", temperature range 70 to 250° C with the capacity of 40 lit. | 14 - 16 |
| 15 | Bomb calorimeter | 17 |

| S. No. | Equipment Name with Broad Specifications | Exp. No. |
|---|---|---|
| 20 | Muffle furnace: Temperature up to 900°C digital temperature controller with an accuracy of +/- 5°C | 14,16 |
| 21 | Nephelometer: Auto-ranging from 20 to 200 NTU, +/- 2% of reading plus 0.... NTU, power 230 Volts +/- 10% at 50 Hz | 11 |

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | **Physics** | |
| Unit – I Properties of matter and Non-Destructive Testing | 1a. Explain the concept of elasticity and plasticity for the given material.<br>1b. Establish relation between given types of modulus of elasticity.<br>1c. Predict the behaviour of the given metallic wire. | 1.1 Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity<br>1.2 Stress and Strain and their types, Hooke's law, types of modulus of elasticity<br>1.3 Stress- Strain diagram, Poisson's ratio, factors affecting elasticity |
| | 1d. Explain pressure-depth relation for the given liquid.<br>1e. Explain Newton's law of viscosity for the given liquid.<br>1f. Explain Stokes' law for the free fall of the body through the given viscous medium. | 1.4 Fluid Pressure, pressure, pressure-depth relation, Pascal's law, Archimedes' principle<br>1.5 Viscosity, velocity gradient, Newton's law of viscosity<br>1.6 Free fall of spherical body through viscous medium and Stokes' law, derivation of coefficient of viscosity $\eta$ by Stokes' method, effect of temperature and adulteration on viscosity of liquids |
| | 1g. Describe the salient features of the given NDT method. | 1.7 Non-destructive testing (NDT), Various NDT methods used, Criteria for the selection of NDT method, merits and demerits of NDT |
| Unit– II Types of Motion | 2a. Explain the equations of motion for the given body moving in the given type of path.<br>2b. Calculate the angular velocity of the given body.<br>2c. Explain the relevant Newton's laws of motion for the given moving object.<br>2d. Calculate the work, power, energy for the given situation.<br>2e. Calculate the given | 2.1 Displacement, velocity, acceleration and retardation, equations of motion, equations of motion under gravity<br>2.2 Angular displacement, angular velocity, angular acceleration, three equations of angular motion<br>2.3 Momentum, impulse, impulsive force, Newton's laws of motion and their Applications<br>2.4 Work, power and energy, potential energy, kinetic energy, work-energy principle. |





| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | parameters for the given projectile motion. | 2.5 Projectile motion, trajectory, angle of projection, time of flight and range of projectile with formulae. |
| Unit– III Photoelectricity, X-Rays and LASERs | 3a. Explain the concept of the given parameters of the given material.<br>3b. Explain the working of the given photoelectric device. | 3.1 Planck's hypothesis, photoelectric effect, photons, Photoelectric effect, threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation<br>3.2 Photoelectric cell and LDR, principle, working and applications |
| | 3c. Explain the production of X-Rays of the given material with properties and applications. | 3.3 Production of X-rays by modern Coolidge tube, properties and applications |
| | 3d. Differentiate between LASER and given source of light.<br>3e. Explain the given terms with examples. | 3.4 Laser properties, absorption, spontaneous and stimulated emission, applications of Laser<br>3.5 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser |
| | **Chemistry** | |
| Unit-IV Metals, alloys, Cement, and Refractory materials | 4a. Describe the construction and working of the given type of furnace.<br>4b. Describe the extraction process of the given ore with chemical reaction.<br>4c. Explain purposes and preparation methods of making the given alloy.<br>4d. Select the relevant alloy for the given application stating the properties with justification.<br>4e. Describe the constituents, hardening and setting process of the given type of cement.<br>4f. Select the relevant refractory for given application stating the properties with justification. | 4.1 Metallurgy, Minerals, ore, gangue, flux, slag<br>4.2 Types of furnace, Muffle furnace, Blast furnace<br>4.3 Extraction processes of Haematite, copper pyrites ores, Crushing, concentration, reduction, refining<br>4.4 Properties of iron and copper, Hardness, tensile strength, toughness, malleability, ductility, refractoriness, fatigue, creep, strength, specific gravity, specific heat, brazing, castability, stiffness<br>4.5 Preparation of alloys, Fusion and compression methods<br>4.6 Ferrous alloys, Classification, wrought iron, carbon, high carbon steels<br>4.7 Non-ferrous alloys, Brass, Bronze, Duralumin, Fusible solder, Woods metal<br>4.8 Cement, Types, Roman cement and Portland cement, constituents, setting and hardening, applications<br>4.9 Lime, classification, constituents, setting and hardening, applications |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | | 4.0 Refractory material: Types, properties |
| Unit –V Water treatment | 5a. Describe the given quality parameters related to hard water and their effects<br>5b. Describe the given process for softening of the given water sample<br>5c. Draw by neat sketches the parts/features of the given type of boiler<br>5d. Describe the given type of waste water treatment | 5.0 Hardness: Classification<br>5.2 Hard water in boilers and prevention, Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges<br>5.3 Water softening: Lime soda process (cold lime soda and hot lime soda process), zeolite process, ion exchange process (cation exchange and anion exchange)<br>5.5 Potable water treatment: Sedimentation, coagulation, filtration and sterilization<br>5.5 Waste water treatment: Sewage treatment: BOD and COD of sewage water, Reverse Osmosis: recycling of waste water |
| Unit-VI Fuels and Combustion | 6a. Describe salient properties of the given type of fuel<br>6b. Explain the given type of analysis of the given type of coal<br>6c. Calculate the calorific value of the given solid fuel using Bomb calorimeter.<br>6d. Describe composition, properties of given gaseous fuel with their applications<br>6e. Calculate the mass and volume of air required for complete combustion of the given fuel | 6.1 Fuel, Calorific value and ignition temperature, classification<br>6.2 Solid fuels: Coal, Classification and composition, proximate analysis, Ultimate analysis, Bomb calorimeter, Carbonization of coke by Otto Hoffmann's oven.<br>6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, properties, Knocking, cracking, octane number and cetane number<br>6.4 Gaseous fools: Biogas, LPG and CNG, Combustion equation of gaseous fuels, mass and volume of air required for complete combustion |

*Note: Indication for UOs and competency, above listed UOs need to be undertaken to achieve the Appreciation Level and above of Bloom's Cognitive Domain Taxonomy.*

## 9 SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| | Physics | | | | | |
| I | Properties of matter and NDT | 12 | 03 | 05 | 06 | 14 |
| II | Types of Motion | 04 | 02 | 02 | 06 | 10 |
| III | Photoelectricity, X-Ray and LASER. | 09 | 03 | 02 | 04 | 11 |
| | Chemistry | | | | | |



| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| IV | Metallic alloys, cement, refractory and lubricants | 12 | 03 | 04 | 05 | 12 |
| V | Water treatment | 11 | 02 | 03 | 06 | 11 |
| VI | Fuels and combustion | 11 | 03 | 04 | 05 | 12 |
| | Total | 61 | 15 | 22 | 33 | 70 |

*Legends: R=Remember, U= Understand, A= Apply and above (Bloom's Revised Taxonomy)*

*Note: The above table is only a guideline to help the teachers to design a question paper which may vary from time to time and paper to paper.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Seminar on any relevant topic.
b. Library survey regarding engineering material used in different industries.
c. Prepare power point presentation on application for showing applications of lasers.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub-topics.
b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guidelines for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide students in undertaking micro-projects.

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to complete it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of POs, COs and CRSOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary containing record of his/her contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (Sixteen) student engagement hours* during the course.

In the first four semesters the micro-project could be group-based. However, in higher semesters it should be individually undertaken to build up the skill and confidence in every

student to become problem solver so that s/he contributes to the projects of the industry. A suggested list is given here. Similar more projects could be added by the concerned faculty.

a. **Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
b. **Viscosity:** Collect 2 to 3 liquids and prepare a working model to different the Liquids on the basis of viscosity and demonstrate their applications.
c. **Motion:** Prepare model of ball rolling down on inclined plane to demonstrate the conservation of energy and motion of an object on inclined plane.
d. **Photo Sensors:** Prepare simple photo sensor using LDR.
e. **Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
f. **Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
g. **Water treatment:** Collect 2 to 3 water samples to find the dosage of bleaching powder required for sterilization.
h. **Water analysis:** Prepare model to find the soap foaming capacity of hard water on addition of soda ash.
i. **Fuels:** Prepare chart showing different types of liquid fuels showing their calorific values and uses.
j. **Cement:** Collect different samples of cement and find their initial and final setting time.
k. **Refractory materials:** Prepare chart showing properties of refractory materials.
l. **Metal properties:** Prepare chart showing different industrial application of metal and related to the required properties or properties using internet.
m. **Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Cu on properties of steel. Prepare chart showing percentage composition, properties and industrial applications of different types of steel based on above alloying elements using internet.

## 13 SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Physics Textbook Part I and Part – Class XI | Narlikar, J.V., Joshi, A. W., Mathur Anuradha, et al | National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505085 |
| 2 | Physics Textbook Part I and Part II - Class XII | Narlikar, J.V., Joshi, A. W., Ghatak A.K., et al | National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174505314 |
| 3 | Engineering Physics | Bhattacharya, D. K., Tandon Poonam | Oxford Publishing, New Delhi, ISBN 0199458284 |
| 4 | Principles of Engineering Physics-1 | Md. Nazeer Khan and Sinanchala Panigrahi | Cambridge university press, New Delhi, 2016, ISBN : 9781316636442 |
| 5 | Engineering Physics | Pillai, S. O. | SCITECH Publications, Chennai, ISBN : 9788183711912 |
| 6 | Principles of Physics | Walker, J., Halliday, D., Resnick, R. | Wiley Publications, New Delhi, 10th edition, ISBN: 9788126552665 |
| 7 | Textbook of Engineering Physics | Avadhanulu, M. N., Kshirsagar, P. G. | S. Chand and Co., New Delhi, 2015, ISBN : 9788121908771 |
| 8 | Engineering Chemistry | Agarwal, Sonika | Cambridge university press, New Delhi, 2015, ISBN : 9781107437417 |





| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 9 | Engineering Chemistry | Dara, S. S., Umare S.S. | S Chand and Co. Publication, New Delhi, 2013, ISBN: 8121997558 |
| 10 | Engineering Chemistry | Jain & Jain | Dhanpat Rai and sons, New Delhi, 2014, ISBN : 9352160062 |
| 11 | Engineering Chemistry | Vairam, S. | Wiley India Pvt. Ltd., New Delhi, 2015, ISBN: 9788126535347 |
| 12 | Chemistry for engineers | Agnihotri, Rajesh | Wiley India Pvt. Ltd., New Delhi, 2014, ISBN: 9788126510784 |

## 14 SOFTWARE/LEARNING WEBSITES

a. http://spiel.ac.in/course.php?disciplineId=115
b. http://spiel.ac.in/course.php?disciplineId=116
c. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
d. www.physics.ssscentre.com
e. www.learnphysics.com
f. www.physics.iyengar.edu.in/physics.html
g. www.sciencehowstuffworks.com
h. https://plot.ly/create/
i. www.chemistryteaching.com
j. www.virtuallearning.com
k. www.chem1.com
l. www.onlinelibrary.wiley.com
m. www.rsc.org
n. www.chemistryforlife.org
o. www.acs.org
p. www.em-ea.org

| | |
|---|---|
| **Program Name** | : Mechanical, Civil & hemical and Fabrication Technology and Erection Engineering Program Group |
| **Program Code** | : AE/CE/CH/FG/FT/PT/PG |
| **Semester** | : Second |
| **Course Title** | : Applied Mechanics |
| **Course Code** | : 22205 |

## 1. RATIONALE

In day-to-day course p ve s ral t es different types of structures created for different purposes and functions. While designing the structures, analysis of forces is important and necessary step. Correct analysis is possible only when one knows the types and effects of forces acting on the structures. This course provides the basis to understand, fundamental concepts of forces in mechanics and their applications to different engineering problems. This course is designed to provide basic understanding about the different types of forces, moments and their effects on material elements which will analysing different structural systems.

## 2. COMPETENCY

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

- **Use principles of applied mechanics to solve broad-based engineering related problems.**

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a. Identify the force systems for given conditions by applying the basics of mechanics.
b. Select the relevant simple lifting machines for given purposes.
c. Determine the mechanical factors of different engineering systems.
d. Check the stability of various force systems.
e. Apply the principles of friction in various conditions for useful purposes.
f. Find the centroid and centre of gravity of various components in engineering systems.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| L | T | P | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | 1 | 2 | 6 | 3 | 70 | 28 | 30* | 12 | 100 | 40 | 50 | 20 | 25 | 10 | 75 | 30 |

*(*) Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to be done in group for each batch of 20 students and the remaining 20 marks is for average of two tests to be taken during the assessment for the assessment of the cognitive domain UOs required for the attainment of the COs.*



*Legends: L=Lecture, T=Tutorial/Teacher Guided Theory Practice, P=Practical, C=Credits, ESE=End Semester Examination, PA=Progressive Assessment.*

## 5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

The course map in figure 1 gives an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student, by the end of the course, in all domains of learning in terms of the industry employer identified competencies depicted at the centre of this map.

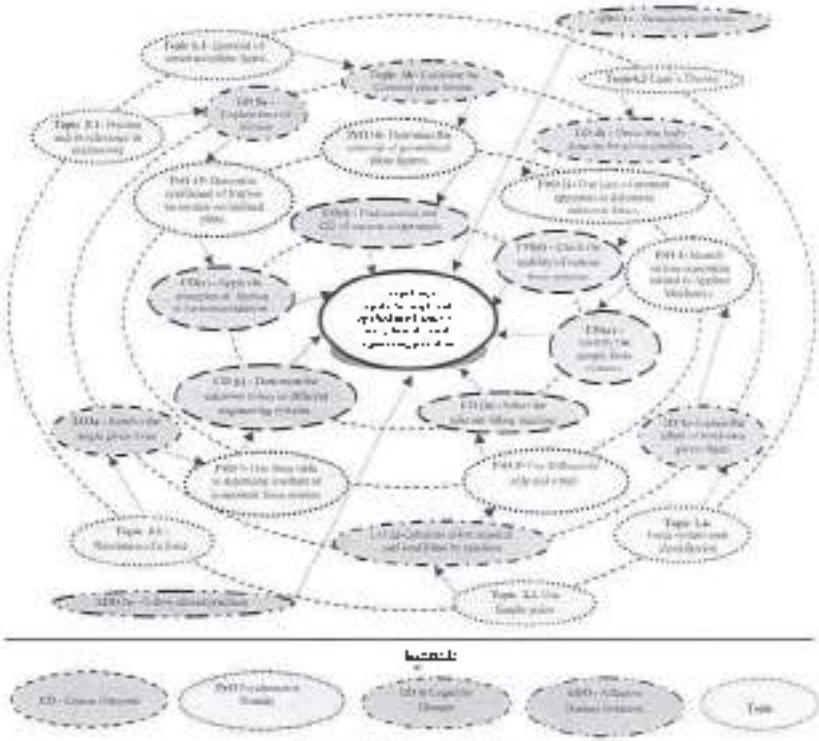

**Figure 1 - Course Map**

## 6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components) of the COs to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx Hrs. required |
|---|---|---|---|
| 1 | Identify various equipment related to Applied Mechanics. | Unit-I | 02* |
| 2 | Use 2 differential axle and wheel. | II | 02* |

| S No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 7 | Use Single screw jack | II | 02 |
| 8 | Use worm and worm wheel | II | 02 |
| 9 | Use single or double purchase crab | II | 02 |
| 10 | Use Weston's Differential or wormed geared pulley block | II | 02 |
| 11 | Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-I) | III | 02* |
| 12 | Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-II) | III | 02* |
| 13 | Graphically determine resultant of concurrent force system | III | 02 |
| 14 | Graphically determine resultant of parallel force system. | III | 02 |
| 15 | Use Law of moments apparatus to determine unknown forces | IV | 02* |
| 16 | Apply Lami's Theorem to determine unknown force. | IV | 02 |
| 17 | Determine support reactions for simple supported beam. | IV | 02 |
| 18 | Determine coefficient of friction for motion on horizontal plane. | V | 02* |
| 19 | Determine coefficient of friction for motion on inclined plane | V | 02 |
| 20 | Determine centroid of geometrical plane figures. | VI | 02 |
| | Total | | 32 |

*Note*

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which the practicals marked as * are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain' Taxonomy' as specially required by the industry.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

| S.No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Preparation of experimental set up | 20 |
| 2 | Setting and operation | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 10 |
| 5 | Interpretation of result and Conclusion | 20 |
| 6 | Answer to sample questions | 10 |
| 7 | Submission of report in time | 10 |
| | **Total** | 100 |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.





The ADOs are not specific to any one PrO. But are embedded in many PrOs. Hence the inculcation of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organizing Level' in 2nd year.
- 'Characterizing Level' in 3rd year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specifications mentioned here will help the student in performing the experiments as well as help the institute in procuring the equipment by the administrators.

| S. No. | Equipment Name with Broad Specifications | Exp. No. |
|---|---|---|
| 1 | Differential axle and wheel (wall mounted unit with the wheel of 30 cm diameter and axles are inches or 20 cm dia. 10 cm reducing diameter | 4 |
| 2 | Simple screw Jack (Table mounted metal made body, screw with a pitch of 5 mm carrying a double flanged turn table of 20 cm diameter) | 3 |
| 3 | Worm and worm wheel (wall mounted unit with threaded spindle, load drum effort wheel, with necessary slotted weights, hanger and thread) | 4 |
| 4 | Single Purchase Crab winch (Table mounted heavy cast iron body. The effort wheel is of C.I. material of 25 cm diameter mounted on axle/shaft of about 40mm dia. On the same shaft a geared wheel of 15 cm dia. | 5 |
| 5 | Double Purchase Crab winch (Having assembly same as above but with double set of gearing arrangement) | 5 |
| 6 | Weston's Differential pulley block (consisting of two pulleys, one bigger and other smaller. | 6 |
| 7 | Weston's Differential worm geared pulley block (Consists of a metallic (preferably steel) rugged wheel of about 20 cm along with a protruded load drum of 10 cm dia to suspend the weights of 10 kg, 20 kg+2 weights and a 50 kg hook gauge) | 6 |
| 8 | Universal Force Table (Consists of a circular 40 cm dia. Aluminum disc graduated into 360 degrees.) with all accessories. | 7, 8 |
| 9 | Law of moments apparatus (consisting of a stainless steel graduated beam 12.5 mm square in section, 1m long, pivoted at centre | 9 |
| 10 | Beam Reaction apparatus (The apparatus is with two circular dia. type 10 kg | 11 |
| 11 | Friction apparatus for motion along horizontal and inclined plane base on which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees pan. Two weight boxes each of 5 gm, 10 gm, 2×20 gm, 2×50 gm, 2×100 gm weights | 12 |
| 12 | Models of geometrical figures | 15 |

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop COs in cognitive domain for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Mechanics and force system | 1a. Explain the concepts of the given terms.<br>1b. Use the relevant units of various quantities in the given situations.<br>1c. Explain effects of a force on the given object.<br>1d. Identify the force system for the given situation. | 1.1 Significance and relevance: Mechanics, applied mechanics, statics, dynamics.<br>1.2 Space, time, mass, particle, body, rigid body.<br>1.3 Scalar and vector quantity, Units of measurement (SI units)- Fundamental units and derived units.<br>1.4 Force – its unit, representation as a vector and its characteristics, effects of a force, Principle of transmissibility of force, Force system and its classification. |
| Unit – II Simple lifting machine | 2a. Draw/ label the components of the given lifting machine.<br>2b. Differentiate the working principle of the given two types of simple lifting machines.<br>2c. Determine velocity ratio, efficiency and law of the given simple lifting machine.<br>2d. Calculate effort required and load lifted by the given simple lifting machine.<br>2e. Interpret the graphs after drawing them with the given data.<br>2f. Select the relevant simple lifting machine required for the given purpose with justification. | 2.1 Simple lifting machine, load, effort, mechanical advantage, applications and advantages, Velocity ratio, efficiency of machine, law of machine.<br>2.2 Ideal machine, friction in machine, reasons and Mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility.<br>2.3 Velocity ratio of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley blocks, geared pulley block.<br>2.4 Graphs of Load verses Effort, Load verses Efficiency, Load verses Friction, Load verses M.A., Load verses Efficiency. |
| Unit- III Resolution and composition | 3a. Resolve the given single force.<br>3b. Compute the resultant of the given force system analytically.<br>3c. Determine graphically the resultant of the given force system.<br>3d. Find the resultant of the given forces acting [illegible] | 3.1 Resolution of a force - Orthogonal and Non Orthogonal components of a force, moment of a force, Varignon's Theorem.<br>3.2 Composition of forces – Resultant, analytical method of determination of resultant for concurrent, non-concurrent and parallel co-planar force systems, Law of triangle, parallelogram and polygon of forces.<br>3.3 Graphical statics, graphical representation |





| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | law of triangle and law of parallelogram. | of force, Space diagram, force diagram, polar diagram and funicular polygon, Graphical method of determination of resultant for concurrent and parallel co-planar force systems. |
| Unit– IV Equilibrium | 4a. Draw the free body diagram for the given condition.<br>4b. Determine unknown forces in the given situation using Lami's theorem.<br>4c. Identify the types of beams supported for the given situation.<br>4d. Determine reactions in the given type of beam analytically and graphically. | 4.1 Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical conditions of equilibrium.<br>4.2 Equilibrium of force systems analytically.<br>4.3 Lami's Theorem.<br>4.4 Types of beam- supports (simple, hinged or pin and roller), types of load- point load, uniformly distributed load, uniformly varying load, couple, span of beam.<br>4.5 Beam reaction for cantilever, simply supported beam with or without overhang subjected to combination of Point load and UD load or Vertical Point load and couple.<br>4.6 Beam reaction graphically for simply supported beam subjected to vertical loads only. |
| Unit– V Friction | 5a. Determine force of friction and coefficient of friction for the given condition.<br>5b. Describe the conditions for friction for the give situation.<br>5c. Determine friction force in the given situation.<br>5d. Identify the various forces acting on a ladder for the given conditions using free body diagram. | 5.1 Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, coefficient of friction, angle of friction, angle of repose, relation between coefficient of friction and angle of friction.<br>5.2 Equilibrium of bodies on level surface subjected to force parallel and inclined to plane.<br>5.3 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.<br>5.4 Effect of ladder on friction. |
| Unit - VI Centroid and centre of gravity | 6a. Determine the centroid of geometrical plane figures and centre of gravity of the given simple solid.<br>6b. Calculate centroid of the given composite plane forms.<br>6c. Determine centre of gravity of the given solids.<br>6d. Determine centre of gravity of the given composite solid. | 6.1 Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle).<br>6.2 Centroid of composite figures composed of not more than three geometrical figures.<br>6.3 Centre of Gravity of simple solids (cube, cuboid, cone, cylinder, sphere, hemisphere).<br>6.4 Centre of Gravity of composite solids composed of not more than two simple solids. |

*Note: To inform the COs and competencies above listed it is expected to be undertaken to achieve the target across Level and above of Bloom's Cognitive Domain Taxonomy.*

9. **SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN**

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Mechanics and Force System | 04 | 02 | 02 | 02 | 05 |
| II | Simple Lifting Machines | 08 | 02 | 04 | 06 | 12 |
| III | Resolution and Composition | 10 | 02 | 04 | 08 | 14 |
| IV | Equilibrium | 10 | 02 | 02 | 10 | 14 |
| V | Friction | 06 | 02 | 04 | 06 | 12 |
| VI | Centroid and Centre of Gravity | 08 | 02 | 02 | 08 | 12 |
| Total | | 48 | 12 | 18 | 40 | 70 |

*Legends: R: Remember; U: Understand; A: Apply and above (Bloom's Revised Taxonomy)*

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

10. **SUGGESTED STUDENT ACTIVITIES**

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect/ Get different photographs indicating concurrent, parallel, general force system in equilibrium.
b. Prepare a table of type of machine and relevant industrial application.
c. Collect five different situations where law of moment plays an important role.
d. Prepare models representing various types of supports (hinged, roller and fixed).
e. Illustrate situations where friction is essential and not essential.
f. Prepare models in the form of geometrical figures and solids and locate centroid and centre of gravity of them.

11. **SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (If any)**

These are sample strategies which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guidelines for details).
d. With respect to item No. 10, teachers need to ensure to create opportunities and provisions for *co-curricular* activities.
e. Guide student(s) in undertaking *micro-projects*.

12. **SUGGESTED MICRO-PROJECTS**

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which, in fact, are integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Types of Forces**: Prepare chart showing real-life examples indicating various types of forces.
b. **Lifting Machine**: Collect photographs of operative simple lifting machine and relate these machines with the machines being studied and prepare models of simple lifting machines using products like MECHANO and MECHANIX.
c. **Types of supports**: Prepare chart showing actual and corresponding schematic diagram of various type of support.
d. **Beams**: Prepare models of beam subjected to point loads, uniformly distributed loads, simply supported, overhang and cantilever type beam.
e. **Friction**: Prepare chart regarding type of friction in various field conditions and collect data regarding coefficient of friction by referring books. Determine coefficient of friction for three different types of surfaces.
f. **Centre of Gravity**: Prepare a chart of situations wherein concept of Centre of Gravity is vital.

13. **SUGGESTED LEARNING RESOURCES**

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Applied Mechanics | Khurmi, R.S. | S Chand & Co. New Delhi 2014 ISBN: 9788121916417 |
| 2 | Engineering Mechanics | Ramamrutham, S. | S Chand & Co. New Delhi 2008 ISBN 9788187433514 |
| 3 | Foundations and Applications of Applied Mechanics | Ram, H. D., Chauhan, A. K. | Cambridge University Press Thomson Press India Ltd., New Delhi, 2015. ISBN: 9781107606586 |
| 4 | Engineering Mechanics-Statics Vol. I | Meriam, J. L., Kraige, L. G. | Wiley Publication, New Delhi ISBN 978-81-265-1396 |

14. **SOFTWARE/LEARNING WEBSITES**

a. http://www.asmeonline.com.au
b. www.4mechanics.com for videos regarding machines and applications, friction
c. www.nptel.ac.in
d. www.discoverboatengineers.com

| | |
|---|---|
| Program Name | : Civil Engineering Program Group |
| Program Code | : CE-CRCS |
| Semester | : Second |
| Course Title | : Construction Materials |
| Course Code | : 22304 |

## 1. RATIONALE

Construction material is the key element in the construction project. A diploma civil engineer also called technologist has to undertake the selection of materials for various engineering projects of constructions such as residential / commercial buildings, roads, minor irrigations, bridges, dams, tunnels, and flyovers. The development of advance technology generates the necessity of new engineering materials. It is a challenging job for the civil engineer to select relevant material which is durable, economical and eco-friendly. New materials are introduced every day in the market. Modern techniques are developed to handle and use materials for economic and safer designs of engineering structures. At diploma level students are expected to study about these aspects so as to develop their understanding, performance oriented abilities in order to apply their knowledge in construction industry.

## 2. COMPETENCY

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

- Select relevant building materials to fulfill construction requirements.

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student can demonstrate the following *industry oriented* COs associated with the above mentioned competency:

a. Test the relevant construction materials.
b. Test the relevant natural construction materials.
c. Select relevant artificial construction materials.
d. Select relevant special purpose construction materials.
e. Select relevant finishing materials for given situation.
f. Identify proper use of construction materials.

## 4. TEACHING AND EVALUATION SCHEME

| Teaching Scheme | | | Credits (L + T + P) | Examination scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| L | T | P | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | - | 2 | 5 | 3 | 70 | 28 | 30 | 12 | 100 | 40 | 50 | 20 | 25 | 10 | 75 | 30 |

*Legend: L – Lecture; T – Tutorial/Teacher Guided Theory Practice; P – Practical; C – Credits; ESE – End Semester Examination; PA – Progressive Assessment.*

## 5. COURSE MAP (with sample COs, PrOs, UAs, ASUOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competencies depicted at the centre of this map.

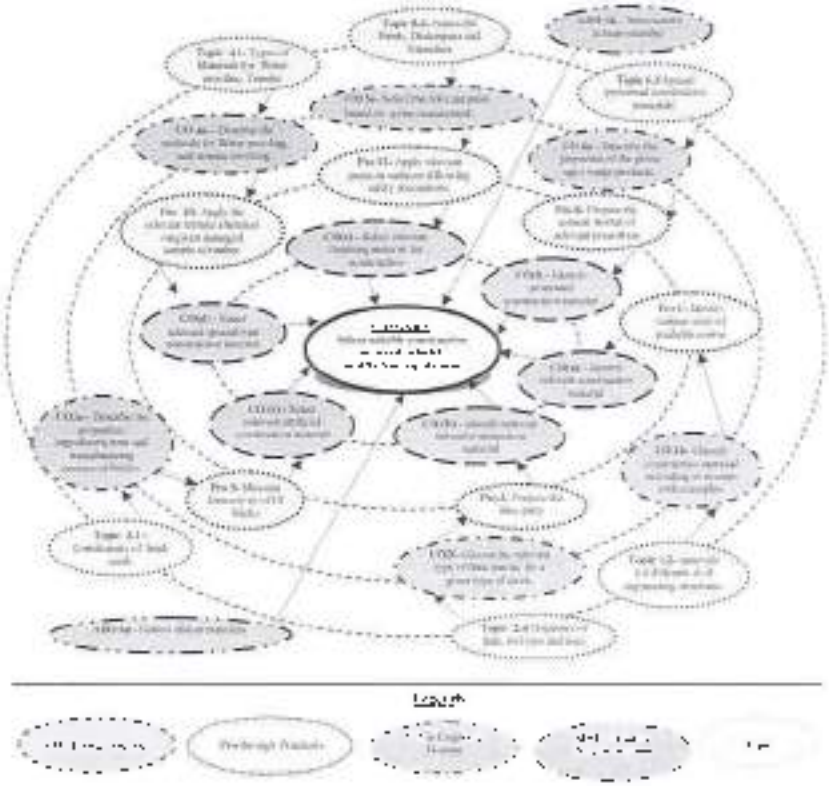

Figure 1 - Course Map

## 6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs that are components of the COs to be developed and assessed in the student for the attainment of the competency.

| Sr. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 1 | Identify the various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report. (80, dry 2, 0.10- | 1 | 02* |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | mon) | | |
| 2 | Identify the available construction materials in the laboratory on the basis of their sources | I | 02 |
| 3 | Identify the grain distribution pattern in given sample of teak wood in the laboratory and draw the various patterns (along and perpendicular to the grains) | II | 02* |
| 4 | Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and prepare report on the slaking of lime | II | 02 |
| 5 | Identify various layers and types of soil in formation pit by visiting at least 2 construction sites in different locations of city and prepare report consisting photographs and samples. Part I | II | 02 |
| 6 | Identify various layers and types of soil in formation pit by visiting at least 2 construction sites in different locations of city and prepare report consisting photographs and samples. Part I | II | 02 |
| 7 | Select first class, second class and third class bricks from the stake of bricks and prepare report on the basis of its properties | III | 02* |
| 8 | Measured dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained. | III | 02* |
| 9 | Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained | III | 02 |
| 10 | Identify different types of flooring tiles such as vitrified tiles ceramic tiles glazed tiles mosaic tiles marble tiles chequered tiles paving blocks and prepare report about the specifications. Part I | III | 02* |
| 11 | Identify different types of flooring tiles such as vitrified tiles ceramic tiles glazed tiles mosaic tiles, marble tiles chequered tiles paving blocks and prepare report about the specifications. Part I | III | 02 |
| 12 | Apply the relevant first aid treatment given damaged sample of timber. Part I | IV | 02* |
| 13 | Apply the relevant first aid treatment given damaged sample of timber. Part I | IV | 02 |
| 14 | Prepare the finished piece of glass of given dimension from broken and damaged pieces of glass and asbestos using standard cutting and fitting tools with safe practices. Part I | IV | 02 |
| 15 | Prepare the finished piece of glass of given dimension from broken and damaged pieces of glass and asbestos using standard cutting and fitting tools with safe practices. Part II | IV | 02 |
| 16 | Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 10 sq. m using suitable brush rollers adopting safe practices. Part I | V | 02* |
| 17 | Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 10 sq. m using suitable brush rollers adopting safe practices. Part II | V | 02 |





| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 18 | Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 10 sq. m using suitable brush rollers adopting safe practices. Part I | V | 02 |
| 19 | Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 10 sq. m using suitable brush rollers adopting safe practices. Part II | V | 02 |
| 20 | Prepare the cement mortar of proportion 1:3 or 1:6 using artificial sand as a special processed construction material | VI | 02* |
| 21 | Prepare mortar using cement and fly ash or Granite marble polishing waste in the proportion 1:3 or 1:6 | VI | 02 |
| | Total | | 72 |

Note

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A polytechnic may add or delete few PrOs depending upon the need and the availability of resources but the number of PrOs should not be increased to the extent that the student spends more time in performing PrOs rather than in learning the theoretical considerations. The PrOs should be arranged in a proper sequence.*
- *Hence, the Process and Product related skills associated with each PrO in the laboratory workshop should only be mentioned and not the theoretical aspects given before.*

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Preparation of experimental set up | 20 |
| 2 | Setting up of operation | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 10 |
| 5 | Interpretation of result and Conclusion | 20 |
| 6 | Answer to sample questions | 10 |
| 7 | Submission of report in time | 10 |
| | Total | 100 |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as pointed below.

- Valuing Level in 1st Year
- Organising Level in 2nd Year
- Characterising Level in 3rd Year

## 7 MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in conformity in conduct of experiments as well as in procurement by authorities concerned.

| S. No. | Equipment Name with Broad Specifications | Exp No. |
|---|---|---|
| 1 | Weighing balance | 2 to 5 |
| 2 | Pan balance | 2 to 5 |
| 3 | Steel Tape | 5 to 8 |
| 4 | Saw of different types, Hip saw having 4 to 6 mm pitch cross cut saw with teeth made 2 to 3 mm, panel saw | 7 |
| 5 | Painting brushes of different size for oil, acrylic painting and rollers of different size for smooth finish on work | 11 |
| 6 | Manual Glass cutter with diamond tip at end | 13 |
| 7 | Trowel, Brick, Pointing, Trowel, triangular, range up to size up to about 11 inches (279.40 mm) long and from 191.6 mm to 305.2 mm wide i.e. 7½ to 8 inches wide) | 1,3,7,8 12 |
| 8 | Portable Hammer, Spade, Pans (Chemplay Thermometer | 1,3,4,7 8,12 |
| 9 | Square, T-bevel and straightedge 28.57 mm to 38.10 mm and the middle portion of the straightedge from 152.40 mm to 254 mm wide | 3,5, 2 |
| 10 | Ordinary Portland Cement | 8 |
| 11 | Bricks of standard size (20 cm x 10 cm x 10 cm) | 4,5 |
| 12 | Sheet for Granite marble polishing work | 12 |
| 13 | Paints (OBD acrylic plastic emulsion) | 11 |
| 14 | Silicon grease or Glass | 3 |





## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub topics should be taught and assessed in order to develop COs for cognitive domain for achieving the CO to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Overview of Construction Materials | 1a Describe the civil engineering applications in the given field of civil engineering<br>1b Classify the given construction material according to sources with examples<br>1c Describe the criteria to select the construction materials for the given situation<br>1d Suggest the construction material in the given situation with justification | 1.1 Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (Applications only)<br>1.2 Selection of materials for different civil engineering structures on the basis of strength, durability, Eco-friendly and economy<br>1.3 Broad classification of material, Sources of materials, Natural, Artificial, special, Finishing and recycled |
| Unit – II Natural Construction Materials | 2a Describe the properties and structure of the given natural construction material<br>2b Explain the given type of defect(s) in timber<br>2c Explain the procedure of preservation of timber in the given situation<br>2d Select the natural construction material for the given situation with justification<br>2e Choose the relevant type of lime mortar for the given type of construction work with justification | 2.1 Requirements of good building stone, general characteristics of good building and dressing methods and tools for stone<br>2.2 Structure of timber, general properties of good timber, seasoning, preservation and defects in timber and uses, use of Plywood in construction<br>2.3 Abobe, bamboo and its uses in construction, properties and uses<br>2.4 Properties of lime, its types and uses<br>2.5 Types of sand and its suitability for construction<br>2.6 Properties of sand and uses<br>2.7 Classification of coarse aggregate according to sizes and its uses |
| Unit- III Artificial Construction Materials | 3a Describe the properties ingredients, uses and manufacturing process of the given type of brick<br>3b Classify the given artificial construction materials. Classify different structural construction material<br>3c Select relevant type of artificial | 3.1 Constituents of Brick earth, Conventional Traditional bricks, Modular and standard bricks, Characteristics of good brick, Classification of burnt clay bricks and their suitability, special bricks, Common Build tests on Bricks, Manufacturing process of burnt clay brick |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | material for the given type of construction work with justification.<br>3c Select the type of precast concrete products for the given civil structure with justification.<br>3d Select relevant type of ferrous metal for the given type of construction work with justification.<br>3e Select relevant type of non-ferrous metal for the given type of construction work with justification. | 3.2 Thatching fibre – Types, uses<br>3.3 Manufacturing process of Cement – clinker and cement only (flow chart), types of cement and its uses<br>3.4 Precast concrete blocks for low cost construction: Hollow blocks, solid blocks and their uses<br>3.5 Plywood, particle board, Veneer laminated board and their uses<br>3.6 Types of glass: soda lime glass, lead glass and borosilicate glass and their uses<br>3.7 Ferrous and non-ferrous metals and their uses |
| Unit- IV Special Construction Materials | 4a Describe the method used for water proofing, termite proofing, thermal and sound insulation in the given situation.<br>4b Select the relevant material required for the given operations with justification.<br>4c Describe the fibres required for the given construction material.<br>4d Select features of the given fiber which can be used in construction material with justification.<br>4e Describe the features of the given type of geosynthetic element. | 4.1 Types of material and suitability in construction works of following materials: Water proofing, Termite proofing, Thermal and sound insulating materials<br>4.2 Fibers – Types –Jute, Glass, Plastic, Asbestos & Sisal – only uses<br>4.3 Geosynthetics and its – Geotextile, geomembrane, geocomposite, properties, uses and applications |
| Unit- V Finishing Materials | 5a Choose the relevant proportion (identified on site) for the given type of construction work with justification.<br>5b Select the relevant type of POP based for the given type of work with justification.<br>5c Describe the properties of the given type of paint.<br>5d Select the relevant type of paint to be used for the given situation with justification.<br>5e Choose the relevant type of finishing material for the given situation with justification. | 5.1 Lime Mortar, Cement Mortar, Special Mortars and their uses in plastering materials<br>5.2 Constituents and uses of POP (Plaster of Paris), POP finishing boards, uses and types<br>5.3 Paints-Oil Paints, Distempers and Varnishes with their uses (Situations where used) |
| Unit- VI Processed | 6 Describe the properties of the given industrial waste/agro waste | 6.1 Industrial waste materials – Fly ash, Blast furnace slag, Gypsum and |



| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Construction Materials | products used for the given type of work.<br>5b Describe the salient properties of the given natural construction material.<br>5c Describe the salient properties of the given type of construction material.<br>5d Select the relevant processed construction material for the given situation with justification. | marble, polishing waste and their uses.<br>6.2 Agro waste materials – Rice husk, Bagasse, coir fibre, sisal fibre, jute.<br>6.3 Special processed construction materials: Glass reinforced Ferrocrete, Artificial timber, Artificial sand and their uses |

*Note: To achieve the UOs and competency, more stress is to be given to the practical aspects, hence the teacher should ensure adequate provision of laboratory experiments.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Overview of Construction Materials | 04 | 04 | 04 | — | 08 |
| II | Natural Construction Materials | 12 | 06 | 08 | 04 | 18 |
| III | Artificial Construction Materials | 14 | 06 | 08 | 04 | 18 |
| IV | Special Construction Materials | 08 | 06 | 04 | 04 | 14 |
| V | Finishing Materials | 06 | 02 | 04 | 04 | 10 |
| VI | Processed Construction Materials | 04 | 02 | 04 | 04 | 10 |
| | Total | 48 | 18 | 32 | 20 | 70 |

*Legends: R – Remember, U – Understand, A – Apply and above (Bloom's Taxonomy)*

Note: *The assignments in the previous question guideline are to be given to the students by the teacher to make sure that they have achieved the required competency. The teacher has the option of using different assignments each time the question paper is set from the list.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Undertake a market survey of different construction materials and compile the following points:
   i. Structure
   ii. Properties
   iii. Applications
b. Prepare journals containing of sketches of construction materials.
c. Undertake a market survey from local dealers for procurement of civil engineering material.
d. Inspect the various activities as listed in Construction material at selected different civil structures.
e. Teacher guided self-learning activities

i. Course libraries, internet based micro-projects.
ii. Literature survey in available or institute library regarding construction material used for different purposes and situations.
iii. Develop Power point presentation or animation for demonstrating laying and fixing the construction materials.
iv. Seminar on any relevant topic related to construction materials.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are simple strategies, which the teacher can use to accelerate the attainment of the various outcomes of this course.

a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
b. *'Chalk and talk'* Method may not mean only the traditional lecture method but different types of teaching methods and models are to be employed to develop the competencies.
c. *About 15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations. Give implementation guidelines for doing so.
d. While respecting the Govt. Norms, efforts need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide students in undertaking micro-projects.
f. Prepare charts/models/specimens required for practical exercises.
g. Arrange visit to nearby industries and workshops for understanding various construction materials.
h. Use video/animation films to explain various processes like Manufacturing of construction materials, Concrete mixing and Base preparation for painting, exterior laying and pointing work, Wire pulling.
i. Use different instructional strategies for effective teaching.
j. Demonstrate different samples of various construction materials like Stone aggregate and Different sizes, Bricks, Tiles, Varieties of cement, Mixed concrete products, Water proofing material, Termite proofing material, Thermal insulating materials, plaster of Paris, paints, distempers and varnishes.
k. Display various technical brochures of recent building materials.

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADAs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain a dated work diary containing details of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (fifteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individual's undertaking to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Collect the market rates for following construction materials from various dealers, applicable for local market for different brands:
   i. Bricks
   ii. Stone aggregate (20 mm, 40 mm and 80 mm)
   iii. Glass wool
   iv. Flooring tiles
   v. Ordinary Portland Cement
   vi. Oil paint
   vii. Cement Paint
   viii. Plaster of Paris
   ix. Plastic paints
   x. Recent types of paint.
b. Download the IS 456 and IS 800 and attach the printout for following materials:
   i. Steel section (Section and ISA)
   ii. Mortar of proportion 1:3 and 1:4
   iii. Cement concrete mix of 1:1:2:4, 1:1.5:3 and 1:2:4.
c. Collect the technical brochures of following construction materials:
   i. Ordinary Portland Cement
   ii. Vitrified flooring tiles
   iii. Particle boards used in furniture
   iv. Paints.
d. Undertake a market survey for the cost and technical specification of different brands of following construction Materials and prepare comparison chart:
   i. Cement
   ii. Paints
   iii. Glass
   iv. Bricks.

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Construction Materials | Ghose, D. N. | Tata McGraw Hill, New Delhi, 2014 ISBN: 9780070151758 |
| 2 | Building Materials | Varghese, P.C. | PHI Learning, New Delhi, 2014 ISBN: 8120345485 |
| 3 | Engineering Materials | Rangwala, S.C. | Charotar publishing house, Gujarat, 2015, ISBN: 9789385039072 |
| 4 | Civil Engineering Materials | Somayaji, Shan | Pearson education, New Delhi, 2015 ISBN: 9788131764831 |
| 5 | Engineering Materials | Rajput, R.K. | S. Chand and Co., New Delhi, 2015 ISBN: 8121919606 |
| 6 | Engineering Materials | Sharma | PHI Learning, New Delhi, 2015 ISBN: 8120324862 |
| 7 | Building Materials | Duggal, S.K. | New International, New Delhi, 2014 ISBN: 8131914124 |

## 14. SOFTWARE/LEARNING WEBSITES

a. https://www.quora.com/Which-is-greatest-civil
b. http://apis-cor.com/en/about/blog/geocement-new-generation-hightech-material
c. http://www.nbmcw.com/concrete/10827-geopolymer-concrete-a-new-eco-friendly-material-for-construction.html

2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

| | |
|---|---|
| Program Name | : Civil Engineering Program Group |
| Program Code | : CE/AE/CS |
| Semester | : Second |
| Course Title | : Basic Surveying |
| Course Code | : 22205 |

## 1. RATIONALE

Data operation and planning practices for any civil engineering project needs survey of that region to obtain digital and contour/spot levels maps are to be prepared. These maps and drawings are used for taking various decisions regarding the planning, designing, estimation, execution and construction process. The diploma passed civil technician should therefore know the various methods and instruments required for surveying. They should also have the skill and alternation to handle and operate the needed survey instruments. This course is therefore one of the core courses required for civil, irrigation, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey related works.

## 2. COMPETENCY

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

- **Undertake civil engineering surveys.**

## 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Select the type of survey required for given situation.
b. Compute area of open field using chain, tape and cross staff.
c. Conduct traversing with the help of prismatic compass.
d. Use leveling instruments to determine reduced level of ground points.
e. Draw and interpret contours and plan collecting field data.
f. Use digital planimeter to calculate the areas.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credits (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| | | | | Paper Hrs | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | -- | 2 | 5 | 3 | 70 | 28 | 30* | 12 | 100 | 40 | 50 | 20 | 50 | 20 | 100 | 40 |

*(*) Out of 30 marks, 10 marks are for micro project assessment to evaluate attainment of COs and for collecting 20 marks is the average of 2 tests to be taken during the session for the assessment of the cognitive domain COs required for the attainment of the UOs.*

*Legends: L=Lecture; T – Tutorial/Teacher Guided Theory Practice; P – Practical; C – Credits; ESE - End Semester Examination; PA - Progressive Assessment*

## 5. COURSE MAP (with sample COs, Learning Outcomes or UOs and topics)

The course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of Bloom's taxonomy, as depicted by the course map.

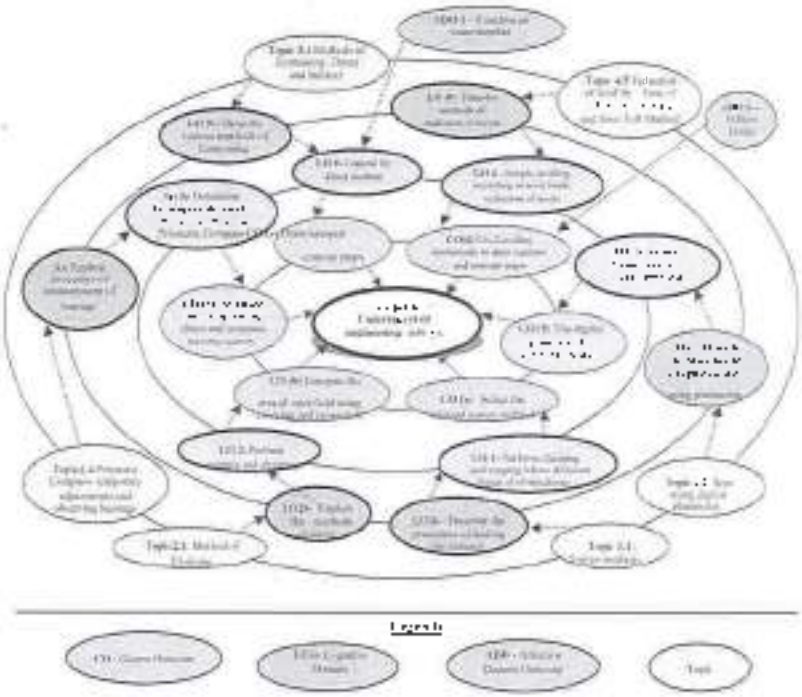


Figure 1 - Course Map

## 6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in the section are to be considered as the essential components of the COs, to be developed and assessed in the student to lead to the attainment of the competency.

| S. No. | Practical Exercises (Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| 1 | Study & use of Metric Chain, Tapes, Ranging rods, Arrows | I | 02 |
| 2 | Measure distance between two survey stations using chain, tape and ranging rods in open and narrow area – one hr. Part I | II | 02* |

| S. No | Practical Exercises<br>(Learning Outcomes in Psychomotor Domain) | Unit No. | Approx. Hrs Required |
|---|---|---|---|
| 3 | Undertake the practical using optical diastimeter the distance between two stations. Part I | II | 02* |
| 4 | Undertake the practical using optical diastimeter the distance between two stations. Part II | II | 02 |
| 5 | Determine the area of open field using chain and cross staff survey. Part I | II | 02* |
| 6 | Determine area of open field using chain and cross staff survey. Part II | I | 02 |
| 7 | Determine area of open field using chain and cross staff survey. Part III | I | 02 |
| 8 | Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part I | II | 02* |
| 9 | Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part II. | II | 02 |
| 10 | Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. Part III | III | 02 |
| 11 | Measure Fore Bearing and back bearing of a closed traverse of five or six sides and correct the bearings and included angles for the local attraction. Part I | III | 02* |
| 12 | Measure Fore Bearing and back bearing of a closed traverse of five or six sides and correct the bearings and included angles for the local attraction. Part II | III | 02 |
| 13 | Measure Fore Bearing and back bearing of a closed traverse of five or six sides and correct the bearings and included angles for the local attraction. Part III | III | 02 |
| 14 | Measure Fore Bearing and back bearing of a closed traverse of five or six sides and correct the bearings and included angles for the local attraction. Part IV | III | 02 |
| 15 | Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides ensuring bundrical(Compulsory) | III | 1* Full Day |
| 16 | Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No 15 . Part I | II | 02 |
| 17 | Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No 15 . Part II | II | 02 |
| 18 | Undertake simple leveling using dumpy level Auto level and levelling staff. Part I | IV | 02* |
| 19 | Undertake simple leveling using dumpy level Auto level and levelling staff. Part II | IV | 02 |
| 20 | Undertake Differential leveling and determine Reduced Levels by Height of Instrument method and Rise and fall method using Dumpy level Auto Level and level staff. Part I | IV | 02* |
| 21 | Undertake differential leveling and determine Reduced Levels by Height of Instrument method and Rise and Fall method using Dumpy level Auto Level and level staff. Part II | IV | 02 |
| 22 | Undertake differential leveling and determine Reduced Levels by Height of Instrument method and Rise and Fall method using | IV | 02 |





| S. No | Practical Exercises<br>(Learning Outcomes in Psychomotor Domain) | Unit No | Approx. Hrs Required |
|---|---|---|---|
| | Dumpy level Auto Level and levelling staff. Part III | | |
| 23 | Undertake fly levelling with double check using dumpy level Auto level and levelling staff. Part I | IV | 02 |
| 24 | Undertake fly levelling with double check using dumpy level Auto level and levelling staff. Part II | IV | 02 |
| 25 | Undertake Survey Project with Leveling and Contouring for Profile leveling and cross-sectioning for a road length of 1km with cross-section at 30 m interval. *(Compulsory)* | IV | 1 Full Day |
| 26 | Plot the L-section and minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned in practical No 25. Part I | V | 02* |
| 27 | Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned in practical No 25. Part II | V | 02 |
| 28 | Conduct block contouring for the area of 40m x 40m in dry ground using plane table. Part I | V | 02 |
| 29 | Conduct block contouring for the area of 40m x 40m to draw its contour plan. Part II | V | 02 |
| 30 | Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m. *(Compulsory)* | V | 1 Full Day |
| 31 | Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No 30. Part I | V | 02 |
| 32 | Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No 30. Part II | V | 02 |
| 33 | Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No 30. Part III | V | 02 |
| 34 | Measure area of irregular figure using Digital planimeter. Part I | VI | 02* |
| 35 | Measure area of irregular figure using Digital planimeter. Part II | VI | 02 |
| | Total | | 82 |

**Note**

1. *Suggested list of practical's in group in the above table more practical's can be added to cover the COs and competency. A practical unit of minimum 2 or more practical COs hours can be performed, out of which the practicals marked as '*' are compulsory so that the student teaches the 'Progressive stage of Dreyer's Psychomotor Domain Taxonomy' as mentioned in the curriculum.*
2. *Hence the 'Process and Product' related skills associated with each unit of the laboratory learning shall be assessed as mentioned in the suggested 'Assessment Scheme'.*

| S. No | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Proper use of experimental setup | 10 |
| 2 | Neatness and promptness | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 20 |
| 5 | Interpretation of result and Conclusion | 40 |

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 6 | Answer to simple questions | 20 |
| 7 | Submission of Report in time | 10 |
| | **Total** | **100** |

Additionally, the following attributes (Affective Domain Outcomes) such as Safety attitudes, care of equipment and punctuality may also be assessed for the development of the competency which can be best developed through the above mentioned laboratory based experiences:

a. Follows safety practices
b. Practices good housekeeping
c. Demonstrates working as a leader/a team member
d. Maintains tools and equipment
e. Follows ethical practices

The development of the above related Cognitive (Knowledge) and Affective Domain Taxonomy levels of achievement level may be

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year.

## 5. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

To acquire the required skills in the following specific equipment/instruments (Minimum specifications are indicated here. However, institutes may procure equipment/instruments with higher specifications to broaden the scope of experiments):

| S. No. | Equipment Name with Broad Specifications | Exp. S. No. |
|---|---|---|
| 1 | Metric Chain made from galvanized mild steel wires 4 mm in dia. brass handles with swivel and a brass tallies provided at every 5 m length of chain 20 m or 30 m. Metallic tape, Steel tape, Invar, Fiber glass tape satisfying IS 1269 (Part 1 and Part 2) – 1987 specifications | 1 to 6,11, 13 and 14 |
| 2 | Pegs of length 400 mm and cross area of 50 mm x 20 mm. Arrows 400 mm long and made up of good quality hardened and tempered steel wire of 4 mm in diameter. | 1 to 6,11, 13 and 14 |
| 3 | Ranging rods of 2 m length, circular or octagonal in cross section of 30 mm diameter, Lower third of 30 cm long painted in black, White and red strips of 200 mm each. | 1 to 6, 11,13 and 14 |
| 4 | Optical square conforming to IS 7999 – 1976 specifications and open cross staff consisting of 4 metal arms with vertical slits for sighting through. | 1 to 6, 11,13 and 14 |
| 5 | Prismatic compass conforming to IS 1957-1961 with stand, made in Gun metal material having diameter of 80-100 mm and the least count of 30 minutes. | 1, 5 and 6 |
| 6 | Dumpy level and automatic level conforming to IS 9640 – 1980 with stand and internal focusing telescope of standard make. | 8 to 11, 13 and 14 |
| 7 | Leveling staves 2 m and 4 m of triangular type conforming to IS 11196 – 1985 or folding type conforming to IS 7714 (Part 1) – 1975 (least count) | 8 to 11, 13 and 14 |
| 8 | Digital planimeter of standard make with NiCd batteries and AC adapter. | 12 |

## 8. UNDERPINNING THEORY COMPONENTS





The following topics/sub topics should be taught and assessed in order to develop LOs in order to achieve the CO to attain the identified competency.

| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Overview and Classification of Survey | 1a. Classify given type of survey based on purpose, instruments used and nature of field and place.<br>1b. Explain the given basic principles of surveying.<br>1c. Describe given type of scale.<br>1d. Select the type of survey for given situation.<br>1e. Select the type of scale for given situation. | 1.1 Survey: Purpose and Use, Principles of Survey.<br>1.2 Types of Survey: Primary and Secondary classification, Plane, Geodetic, Cadastral, Hydrographic, Photogrammetric, Aerial, Layout survey, Control and topographical survey, Route survey, Reconnaissance survey.<br>1.3 Scales: Engineer's scale, R.F. and Diagonal scale. |
| Unit– II Chain and cross staff Survey | 2a. Describe the procedure of locating the details between two given chainages/ stations and how it is represented in survey sketches.<br>2b. Explain the methods of ranging and measuring the length of the given survey line with examples.<br>2c. Explain the corrections in measurement of distance with chain in given situation.<br>2d. Compute the area of given field using principle of triangulation.<br>2e. Compute area of given open field by using chain and cross staff.<br>2f. Select type of chaining for given situation. | 2.1 Chain survey Instruments: Metric Chain, Tapes, Arrow, Ranging rod, Open cross staff, Optical square (No questions to be asked on these instruments)<br>2.2 Chain survey Stations, Base line, Check Line, Tie line, Offset, Ties, Types of obstacles in chaining, Types of errors, Precautions to be taken (No questions to be asked on these topics)<br>2.3 Ranging: Direct and Indirect Ranging (No questions to be asked on these topics)<br>2.4 Errors in chaining: Instrumental error, personal error, error due to natural cause, random error<br>2.5 Principle of triangulation<br>2.6 Locating Station by survey stations and running measurements of building<br>2.7 Conventional Signs, Recording of measurements in a field book.<br>2.8 Area Calculations (Numerical problems) |
| Unit– III Chain and Compass traverse<br><br>Survey | 3a. Carry out the traversing in given situation by using compass and chain.<br>3b. Convert given whole circle bearing to reduced bearing and vice versa in the stated angle with examples.<br>3c. Explain construction and functions of given parts of the given type of compass.<br>3d. Determine correct bearings from the given observed | 3.1 Compass Traversing: open, closed.<br>3.2 Technical Terms: Geographical Meridian, Magnetic and Arbitrary Meridians and Bearings, Meridional and Bearing, Whole Circle Bearing System, Azimuth and Reduced, Quadrantal Bearing system and examples on conversion of given bearing to another bearing from one system to another, Fore Bearing and Back Bearing, Calculation of included and external angles from bearings of a station, Dip of Magnetic needle, Magnetic Declination, Numerical problems. |

| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | bearings.<br>3e Explain the methods used to plot a traverse on the given situation<br>3f Adjust the closing error of the traverse for the given data. | 3.3 Components of Prismatic Compass and their Functions/Use sketch/Method of using Prismatic Compass/ Temporary adjustments and observing bearings.<br>3.4 Local attraction, Methods of correction of observed bearings-Correction at station and correction to included angles.<br>3.5 Methods of plotting a traverse and closing error, Graphical adjustment of closing error. |
| Unit– IV Levelling | 4a Explain the given terms related to leveling.<br>4b Describe construction and use of the given Leveling instrument.<br>4c Explain the given temporary adjustments of a typical Dumpy level.<br>4d Describe methods of reduction of levels by height of collimation and rise and fall method in the given situation.<br>4e Select type of leveling for the given work with principles and justification.<br>4f. Compute the missing readings from the given observed readings. | 4.1 Terminologies: Level surfaces, level line, Horizontal and vertical surfaces, Datum, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Rise, Fall, Line of collimation, Station, Back sight, Fore sight, Intermediate sight, Change point, Height of instrument.<br>4.2 Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its Fundamental axes, Temporary adjustments of Level.<br>4.3 Types of Leveling Staffs: Self-reading staff and Target staff.<br>4.4 Reduction of level by: Line of collimation method and Rise, Fall Method.<br>4.5 Methods of finding R.L of the B.M by H.I. method/Numerical problems.<br>4.6 To find R.L by Rise and Fall method with necessary checks. (Numerical problems)<br>4.7 Leveling Types: Simple, Differential, Fly, Profile and Reciprocal Leveling.<br>4.8 Computation of missing readings, Errors in Leveling. (Numerical problems)<br>4.9 Comparison of different methods. |
| Unit– V Contouring | 5a Describe the importance of contour maps for the given type of topography.<br>5b Explain the characteristics of contours for the given terrain.<br>5c Explain methods of plotting contours in the given situation.<br>5d Explain factors affecting the selection of the given contour interval.<br>5e Prepare contour maps from the given R.L of grid points with | 5.1 Contour, contour interval, horizontal equivalent.<br>5.2 Contour maps: Characteristics and uses of.<br>5.3 Methods of Contouring: Direct and indirect.<br>5.4 Methods of interpolation of contours approximate, arithmetic and graphical.<br>5.5 Toposheets: Study. |





| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit– VI Measurement of Area and Volume | 6a Explain the theory and use of digital planimeter on the given situation.<br>6b Describe procedure for measuring the given area using digital planimeter.<br>6c Compute the area from the given contour map.<br>6d Compute the volume of reservoir from the given contour map. | 6.1 Digital planimeter: Components and uses.<br>6.2 Measurement of area using digital planimeter (No problems to be asked for exam).<br>6.3 Measurement of volume of reservoir from contour map. (No problems to be asked for exam). |

*Note: To attain the COs and competency above mentioned Learning Outcomes (LOs) need to be undertaken to complete the 'Appropriate Level' of Bloom's Cognitive Domain Taxonomy.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Overview and Close Traverse Survey | 08 | 02 | 04 | – | 06 |
| II | Open and Closed Traverse Survey | 08 | 02 | – | 06 | 08 |
| III | Use of Prismatic Compass for Traverse Survey | 12 | 04 | 04 | 08 | 16 |
| IV | Leveling | 16 | 06 | 06 | 12 | 24 |
| V | Contouring | 08 | 02 | 04 | 04 | 10 |
| VI | Measurement of Area and Volume | 06 | 02 | 04 | – | 06 |
| Total | | 48 | 18 | 22 | 30 | 70 |

*Legends: R – Remember, U – Understand, A – Apply and above (Bloom's Revised Taxonomy)*

*Note: This specification table provides general guidelines to use at session for the teaching and to students to understand pattern of questions with respect to attainment of cos. The actual distribution of marks at different learning levels of R, U and A in the question paper may vary from one to other.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes:

a. Construct a plain scale 1 cm = 1 m to read up to a meter and represent 2.7 m on the scale.
b. Draw a neat labeled sketch of a 20in chain and show its salient features.
c. Explain one method each to measure the distance between points on either side of obstacles in case of following: River, Lake, Building.
d. Explain different obstacles encountered in chain survey.
e. Explain the relation between the whole circle bearing and reduced bearing with the help of neat sketches and convert the given set of five W.C to R.B and vice versa.
f. Measure the bearing of Sun at noon with Compass and then magnetic bearing of any line AB to find the true bearing of that line.



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g. Find the deflection angles at each vertex of a given traverse with internal angles.
h. Find the bearing of remaining lines using the bearing of any one line and the internal and deflection angles at respective stations using sketches.
i. Determine the reservoir capacity for a given contour map of reservoir.
j. Interpret the given contour maps (minimum five situations).
k. Draw the representative contour maps for the following: Ridge, Hill Slope, Valley, Pond, Lake, Gentle slope, Very Steep Slope, Plain Surface.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are some suggested strategies which teachers can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub-topics.
b. *'Chalk and Talk'* method may be used to teach theory topics but different types of teaching methods, aids, models etc. may be used to develop the skills.
c. About *15-20% of the topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of Cos through class room presentations (see implementation guidelines for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide students in undertaking micro-projects.
f. Arrange visit to nearby newly started site for understanding various surveying techniques.
g. Show video/animation Films to explain various practices like Leveling, Levelling, Surveying and Contouring.
h. Prepare Maintenance charts for various instruments/equipments in survey laboratory.

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain, and affective domain. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. each student will have to maintain a dated work diary containing of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen)* student engagement hours during the course.

In the first four semesters, the micro-project should be group-based. However in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the needs of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Collect the various types of survey instruments available in the market with specifications.
b. Carry out comparative study of following survey instruments in terms of features, uses and brands: Auto level, Digital Theodolite, Total station, Digital planimeter.
c. Calibrate the given chain with reference to standard gauge.
d. Collect the maps of various types and scales like the survey of India, Land use, Geological maps.
e. Determine the R.L of the existing structures like bridge, pipe, dam and beam.





f. Download spot heights for given campus, compute level and mark contours using Digital planimeter.
g. Perform reconnaissance survey for alignment of road.
h. Collect and interpret topographical maps of different formats available with various authorities.
i. Determine and measure given length using Diagonal scale from a given map.

## 13. SUGGESTED LEARNING RESOURCES

| Sr. No | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Surveying and Levelling Volume I | Kanetkar, T. P. Kulkarni, S. V. | Pune Vidyarthi Griha Prakashan, Pune, ISBN: 978-81-858-22[illegible] |
| 2 | Surveying and Levelling | Basak, N. N. | McGraw Hill Education, New Delhi, ISBN: 93-329[illegible] |
| 3 | Surveying | Saikia, M. Das, B.M., Das, M.M. | PHI Learning, New Delhi, ISBN: 978-81-203-3956-9 |
| 4 | Fundamentals of Surveying and Leveling | Subramanian, R. | Oxford University Press, New Delhi, ISBN: 0-19-[illegible]-[illegible] |
| 5 | Survey I | Duggal, S. K. | McGraw Hill Education, New Delhi, ISBN: 978-00-701-5123-6 |
| 6 | Textbook of Surveying | Rao, S. Venugopala, Seetha, Viswanadham | PHI Learning, New Delhi, ISBN: 978-81-203-4981-8 |
| 7 | Surveying I | Punmia, B.C. Jain, Ashok Kumar, Jain, Arun Kumar | Laxmi Publications, New Delhi, ISBN: 81-7[illegible]-[illegible]-4 |
| 8 | Surveying and Leveling, Volume I | Bhavikatti, S. S. | I. K. International, New Delhi, ISBN: 978-93-[illegible]-[illegible]-[illegible] |
| 9 | Textbook of Surveying | Venkatramaiah, C. | Universities Press, New Delhi, ISBN: 978 81 737 1021 6 |

## 14. SOFTWARE/LEARNING WEBSITES

a. www.asdm.com.au
b. www.engineeringcivil.com
c. www.ustudy.in/technology-undergrad
d. www.wlpsu.edu.in/academics/Degrees
e. www.hcidp.org/2493134.pdf#page=3
f. www.pstcc.edu/catalog/12_13.pdf
g. https://youtu.be/-yahR9NiO
h. https://youtu.be/Z4yYHHSRN3
i. https://youtu.be/2hU4wWLLNEs
j. https://youtu.be/ienur2vD3jQ
k. https://youtu.be/ubyc_H4eY
l. https://youtu.be/7_54TenpVYg
m. https://youtu.be/NeNzs-HBsc4
n. https://youtu.be/3dt-HeuHSts
o. https://youtu.be/N8cvbqfXLOs

| | |
|---|---|
| Program Name | : Civil Engineering Program Group |
| Program Code | : CE/CR/CS |
| Semester | : Second |
| Course Title | : Civil Engineering Workshop and Practice |
| Course Code | : 22008 |

## 1. RATIONALE

Student visit the various practices in basic engineering workshop. The knowledge of various civil Engineering material such like masonry, flooring, plastering, finishing works is essential for each diploma pass out in his/her duties in industries. Therefore, an opportunity is created through this course to develop basic skills in the safety aspects required for the same. Students will be able to supervise construction activities and use quality control techniques and material tests and components which are safety to staff, the workers and the constructed components at the building. Working in field develops the attitude of team working and safety awareness. This course provides the unique opportunity in hand work.

## 2. COMPETENCY

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

- Perform basic civil engineering jobs using relevant tools.

## 3. COURSE OUTCOMES (COs)

The various practical experiences and relevant soft skills associated with this course are to be integrated and implemented such that the student demonstrates the following *industry oriented* COs in accordance with the above mentioned competency:

a. Identify the various civil construction activities.
b. Perform masonry jobs.
c. Perform plumbing jobs.
d. Identify finishing jobs related to building construction.
e. Identify the various components of typical civil structures like road, culvert, bridge.

## 4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | Practical | | | | | |
| L | T | P | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| - | - | 4 | 4 | - | - | - | - | - | - | - | 50 | 25 | 50 | 25 | 100 | 50 |

*[1] For the practical only courses, the PA has two components under practical marks i.e. the assessment of practicals (each practical has a weightage of 60% i.e. 30 marks) and the project assessment (each student has a weightage of 40% i.e. 20 marks). For each assigned practical, the assessment of COs may be done.*

*Legends: L = Lecture, T = Tutorial/Teacher Guided Theory Practice, P = Practical, C = Credit, ESE = End Semester Examination, PA = Progressive Assessment.*



## 5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course in all domains of learning in terms of the industry oriented COs. Any one CO may be depicted at the centre in the form of a flower with the other outcomes as petals, or in any other form.

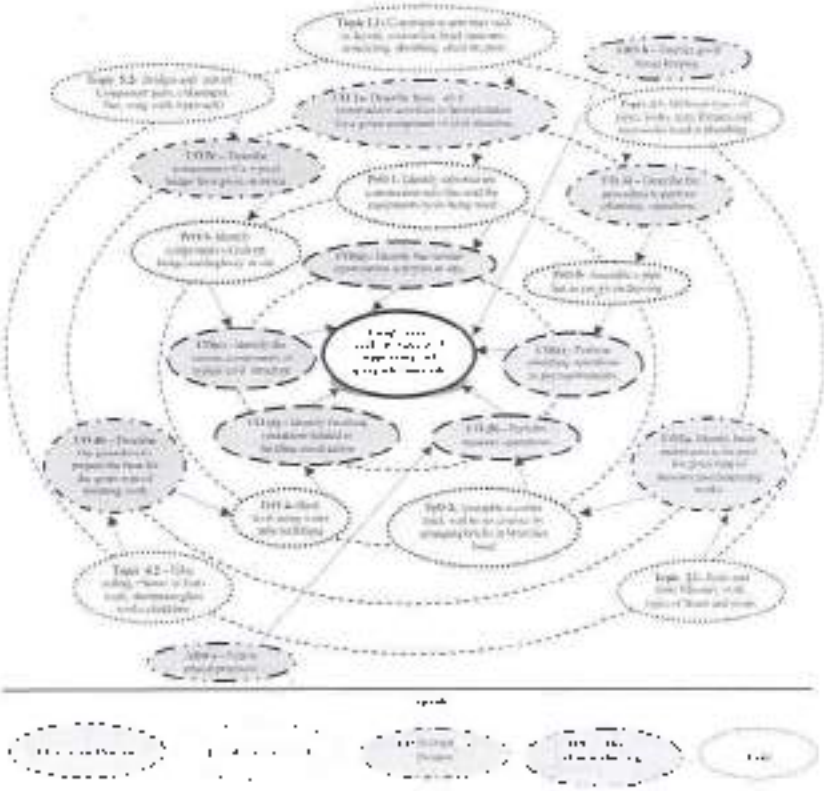


Figure 1 - Course Map

## 6. SUGGESTED PRACTICAL LEARNING OUTCOMES/ FORMULATION

The practicals in this section are PrOs i.e. sub-components of the COs. Each PrO is to be assigned a unique number. It is suggested that the students maximize the number of hands-on experiences possible to master the various skills identified in the competency and associated COs. Each PrO is to be mapped with the COs.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 1 | Identify the substructure construction activities and the components being used at site during the visit. Part I | 1 | 02 |
| 2 | Identify the substructure construction activities and the components being used at site during the visit. Part II | 1 | 02 |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 1 | Identify the substructure construction activities and the equipments/tools being used at site during the visit Part II | I, II | 02 |
| 1 | Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part IV | I, II | 02 |
| 2 | Assemble one per brick wall in six courses by arranging bricks in stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students) | II | 04* |
| 3 | Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part I | I | 02 |
| 4 | Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part II | II | 02 |
| 8 | Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part III | II | 02 |
| 9 | Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students) Part IV | II | 02 |
| 10 | Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part I | III, IV | 02* |
| 11 | Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part II | III, IV | 02 |
| 12 | Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part III | III, IV | 02 |
| 13 | Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part IV | III, IV | 02 |
| 14 | Mark level of given height from ground level at different locations in the specified location using water pipe technique Part I (Group of 10 students) | I, IV | 02* |
| 15 | Mark level of given height from ground level at different locations in the specified locations using water pipe technique Part II (Group of 10 students) | I, IV | 02 |
| 16 | Mark level of given height from ground level at different locations in the specified location using water pipe technique Part III (Group of 10 students) | I, IV | 02 |
| 17 | Mark level of given height from ground level at different locations in the specified location using water pipe technique Part IV (Group of 10 students) | II, IV | 02 |
| 18 | Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves, T, elbow and other to assemble this pipe line Part I | III | 02* |
| 19 | Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves, T, elbow and other to assemble this pipe | II, | 02 |





| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | line Part II | | |
| 20 | Assemble a pipe line as per given drawing using pipes of one inch diameter pipes of half inch diameter nipple, reducer, union, valves, T, elbow and other to assemble this pipe line Part III | III | 02 |
| 21 | Assemble a pipe line as per given drawing using pipes of one inch diameter pipes of half inch diameter nipple, reducer, union, valves, T, elbow and other to assemble this pipe line Part IV | II | 02 |
| 22 | Test the quality of cement on site/Laboratory Part I | IV | 02* |
| 23 | Test the quality of cement on site Laboratory Part II | IV | 02 |
| 24 | Test the quality of cement on site Laboratory Part III | IV | 02 |
| 25 | Identify types of bar bend up bar and stirrups etc during the field visit for the reinforcement for beams, column and slab Part I | IV | 02* |
| 26 | Identify types of bar bend up bar and stirrups etc during the field visit for the reinforcement for beams, column and slab Part II | IV | 02 |
| 27 | Carry out field test on bricks at site Part I | IV | 02* |
| 28 | Carry out field test on bricks at site Part II | IV | 02 |
| 29 | Carry out field test on bricks at site Part III | IV | 02 |
| 30 | Identify the various components of the culvert at site | V | 06* |
| 31 | Identify the various components of the bridge at site | V | 06 |
| 32 | Identify the various components of the flyover at site | V | 06 |
| | Total | | 64 |

*Note*

- *A suggested list of PrOs is given in the above table. More such PrOs can be added to cover the COs and competency. A student must perform minimum 10 or more PrOs to attain the competency. It is desirable that the student reaches the "Precision" level of Dave's taxonomy for most of the PrOs to acquire the competency.*
- *Hence, the Practical and Practical related skills associated with each unit of the laboratory covering field work are to be developed considering the suggested sample given below:*

| S. No | Performance Indicators | Weightage in % |
|---|---|---|
| 1 | Preparation of experimental set up | 20 |
| 2 | Setting and Operation | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 10 |
| 5 | Interpretation of result and Conclusion | 20 |
| 6 | Answers to sample questions | 10 |
| 7 | Submission of report in time | 10 |
| | Total | 100 |

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory field based experiences:

a) Follow safety practices
b) Practice good housekeeping
c) Demonstrate working as a leader/a team member
d) Maintain tools and equipment
e) Follow ethical practices

The ADOs are not specific to any one PrO, but are embedded in many PrOs. However, the attainment of the ADOs takes place gradually in the student when he undertakes a series of practical experiences over a period of time. However, the level of achievement of the ADOs according to stated in the Affective Domain Taxonomy should gradually increase as planned below

- Valuing Level in 1st year
- Organising Level in 2nd year
- Characterising Level in 3rd year.

## 7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will enable the craftsman to conduct the experiments as well as and to procure equipment by authorities concerned

| S. No. | Equipment Name with Broad Specifications | Exp. No. |
|---|---|---|
| | Any material such as Bricks of standard size 230 mm x 115 mm x 75 mm. | 2,8 |
| 2 | Trowels (Brick, Pointing, Pointing), Rectangular, ranging in size as follows: 11 inches (279.40 mm) long and from 1/16 inch to 3/16 inch (1.6 mm to 4.8 mm) thick and 4 to 8 inches wide). | 3 |
| 3 | Portable Instrument Spade, Pick, Shovel, Crowbar, Thread, Line | 5 |
| 4 | Set square (45 degree and 30 degree/60 degree 250 mm to 300 mm) of the smaller size of the triangle from 150 mm to 250 mm in length | 5 |
| 5 | Levels and Staves & Plate Staves | 5 |
| 6 | Steering Level, Square, Plumb bob, Right Angle | 1 |
| 7 | Plastering tools (Level to establish "plumb" and "level" lines) | 2 |
| 8 | Plumbing materials such as pipes and accessories for different sizes and materials, pipe wrench | 5 |
| 9 | Pipe Bending Machine | 1 |
| 10 | Pipe Vise – 100 mm | 5 |
| 11 | Pipe Cutter- 50 mm | 5 |
| 12 | Ordinary Portland Cement | 3 Kg |
| 13 | Iron Reinforcement bar 10 mm dia – Binding wire and Bending tool | - |
| 14 | Bricks of standard size 230 mm x 115 mm x 75 mm. | 2,8 |





## 8. UNDERPINNING THEORY COMPONENTS

The following broad subtopics should be taught and learned in order to develop the competency/sub-competency in the industry/real world.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| Unit – I Overview of Construction activities | 1a. Describe the basic construction activities to be undertaken for the given component of construction.<br>1b. Identify the construction activities at the given site.<br>1c. Identify the tools used for the given type of foundation work.<br>1d. Describe different safety precautions to be taken at the given construction site. | 1.1. Construction activities such as layout, excavation, brick masonry, concreting, plastering, electrification, interdependency of various activities<br>1.2. Workmanship etc. Safety precautions |
| Unit – II Masonry and Concreting | 2a. Identify the basic techniques to be used for the given type of masonry and concreting works with justification.<br>2b. Identify the relevant quality control measures to be adopted in operations related to the given type of masonry and concreting with justification.<br>2c. Describe the methods of plastering and pointing to be undertaken in the given situation.<br>2d. Describe the requirements of the formwork for the given type of building.<br>2e. Identify type of bonds for the given type of the plywood. | 2.1 Brick and stone Masonry works – types of bricks and stones, vertical and horizontal<br>2.2 Use of plumb bob, spirit level, angle and water level tube<br>2.3 Plastering, Pointing<br>2.4 Proper mixing of concrete – concrete laying<br>2.5 Use of concrete Mixtures and Vibrators, different types of Vibrators<br>2.6 Formwork, Scaffolding<br>2.7 Curing and Shuttering |
| Unit- III Plumbing Services | 3a. Identify the plumbing tools and fixtures in the given situation with justification.<br>3b. Select the pipe fittings, tools, tools and machines for the given type of work with justification.<br>3c. Select the type of plumbing items and accessories for the given situation with justification.<br>3d. Describe the procedure to perform plumbing operations for the given condition.<br>3e. Describe the safety precautions to be undertaken for the given site. | 3.1 Drinking water supply system, pipes, fittings and accessories and their joints<br>3.2 Components of pipes, valves, bends, water supply, sanitary, sewerage lines |
| Unit– IV Finishing Works | 4a. Describe the operations to be undertaken related to the given situation of false ceiling, aluminium partitions, plastering work.<br>4b. Describe the procedure to prepare the | 4.1 Flooring, skirting and dado<br>4.2 False ceiling, Plaster of Paris (POP) work, aluminium – glass works, cladding<br>4.3 Whitewash and painting |

| Unit | Unit Outcomes (UOs) (at cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | basic for the given type of finishing / painting work<br>4d. Choose the tools of any minimum section for the given type of work with justification<br>4e. Determine whitewashing and Painting procedure for the given type of wall surface (brick/wooden/steel) | Tools required, bench, rule or and scraper, painting preparation of surface for timber and steel members for painting |
| Unit–V Construction of Road, culverts, bridges | 5a. Identify roles of materials for the given type of road construction with justification<br>5b. Describe the types and components of road for the given situation<br>5c. Describe the components of typical bridge for the given situation<br>5d. Describe the components of a typical culvert for the given situation<br>5e. Identify relevant materials for construction of given type of bridge culvert | 5.1 Types of road, components of road, Drainage system, shoulder, camber, gradient<br>5.2 Bridge and Culvert, components parts, Abutment, Pier, Wing wall, Approach |

*Note: A course should be planned to attain the Course Outcomes (COs) to the extent specified in the Curriculum. Any additional outcomes may be planned by the course teacher depending on the time available and the importance of the outcomes.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

*(Not applicable)*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Undertake a market survey of local dealers for procurement of civil engineering materials, plumbing materials and finishing items
b. Organize a visit to Construction sites of different types such as simple residential buildings, malls, multistoried buildings, observe the current practices in the field
c. Interview (field visit) leaving teachers
d. Collect market rates of different materials
e. Develop Power point presentation on construction techniques seen during field visit

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics
b. *'Show me how'* (*Not* 'tell me how') does not mean only the traditional lecture method. Rather demonstrations of different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through *classroom presentations*. (see implementation guidelines for details).
d. Guide students in undertaking micro-projects.
e. Arrange visit to nearby construction sites for understanding various construction stages and practices followed in the industry.
f. Show video/animation films to explain functioning of various processes/equipment/machines/parts, demonstrate operations like painting, laying water supply and sewer pipeline etc.
g. Prepare models of components/charts for various types of engineering drawings.

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PRACTICAL and THEORY. The micro-project could be industry application based, market-based, workshop-based, laboratory-based or field based. Each student will have to maintain dated work diary consisting of individual contributions in the project work and give seminar presentations of the same in the institution. The total duration of the micro-project should be spread *16 (sixteen) student engagement hours* during the course.

In the first two semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he can undertake the projects in the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Bill Preparation (Group of 3-5 students) – Prepare all the materials for given superstructure
b. *Measure and estimating* – Each student will collect the information regarding the different provisions for the construction materials like cement, bricks, reinforcement and wood.
c. *Finishing Work* – Collect the information from local market regarding the types, thickness, specification, cost etc. of various boards and prepare sheet showing the enhanced application along with its specifications, also list the tools, tools and equipment.
d. *Plumbing* – Download the specifications on plumbing work such as bench vice, hammers, pipe wrench and pipe accessories.
e. *Measure and estimating* – Undertake a market survey of cement, aggregates and sand of various specifications and dealers. Collect various rates.
f. *Plumbing* – Collect the technical information for various plumbing accessories such as different pipes, bend, union, couplings of various dimensions and write a brief report and visit the site.
g. *Measure and estimating (personal activity)*
   i. Collect five samples of bricks from different suppliers and test them in lab to assess the qualities and write a report on it with reference to its construction and process of manufacturing.
   ii. Prepare a model of various types of bricks and apply proper mortar plaster (1:4) on it. Dry and observe the results after a few days.
   iii. Prepare a report on various types of aggregates (F.A. and C.A.) and prepare a sample block of 1:4 concrete to test its strength. Calculate its cost.

iv. Masonry and concreting –Collect the list of various hand tools used in flooring tiles with their IS specifications and make a report of it.

f. *Masonry and concreting* (Group of five students) – Undertake the local survey for various scattering material along with its specifications.

g. *Masonry and concreting* (Group of five students) – Assemble and dismantle the shuttering material for a beam of given dimension using appropriate material as directed by concern teacher.

h. Finishing Work (Individual activity) - Undertake the survey for different brands of paint, painting tools and prepare a report with reference to the following points.
   i. Constituents of paint material
   ii. Coverage area of finishing surface
   iii. Cost
   iv. Durability and aesthetic features

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | PWD- Standard Data Book for Building Work | PWD | PWD, Government of Maharashtra, Mumbai |
| 2 | CPWD Specifications (Vol-I and II) | CPWD | CPWD, Govt. of India, New Delhi. |
| 3 | The Practical design of Structural Elements in Timber | Doll, J.W. | Granada Press, London, 1989, ISBN: 9780586902884 |
| 4 | Basic Plumbing With Illustrations | Massey Howard C. | Craftsman Book Co, California. ISBN: 9780924004997 |
| 5 | Modern Plumbing | Baker, E.Keith Blanker | Goodheart-Willcox Co. ISBN: 978-1590703502 |
| 6 | District Schedule of Rates, (DSR) | PWD | PWD, Government of Maharashtra, Mumbai |
| 7 | A To Z Of Practical Building Construction & Its Management | Mantri Sandeep | Satya Prakashan, New Delhi, 2015, ISBN: 9788175882651 |

## 14. SOFTWARE/LEARNING WEBSITES

a. http://www.esnu.com.au
b. http://www.tomci-ilengineer.com/building-design.html
c. www.mahapwd.com/
d. cpwd.gov.in
e. https://pwd.maharashtra.gov.in/

Program Name : All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EM/EN/EQ/ET/EX/FD/MU/EU/

I/PE/IS/SU/AT/TO/MI/OP/GP/PT/TX/TT

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

## 1 RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to *Communicate effectively and skillfully at workplace*.

## 2 COMPETENCY

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

- **Communicate effectively and skillfully at workplace.**

## 3 COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Communicate effectively in simple business situations (oral and informal situations).

b. Communicate well (follow) using non-verbal methods of communication.

c. Give presentations by using audio-visual aids.

d. Write reports using correct guidelines.

e. Compose e-mail and letters (Business letters).

## 4 TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination scheme | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | | | Practical | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| — | — | 2 | 2 | — | — | — | — | — | — | — | 25 | 10 | 25 | 10 | 50 | 20 |

(*) For only practical courses, the PA (Theory) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e. 15 marks out of 25 marks) and assessment has a weightage of 40% (i.e. 10 marks). This is contained to facilitate attainment of COs holistically as there is no theory ESE.





*Legends: L=Lectures, T = Tutorial/ Practice/ Guided Project Practice, P = Practical, C = Credits, ESE = End Semester Examination, PA = Progressive Assessment.*

## 5 COURSE MAP (with sample COs, Units, Hours, Units wise COs and topics)

The course map displays an overview of the COs and linkages of the topics at various levels of taxonomies (details in subsequent sections) to be attained by the student by the end of the course in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

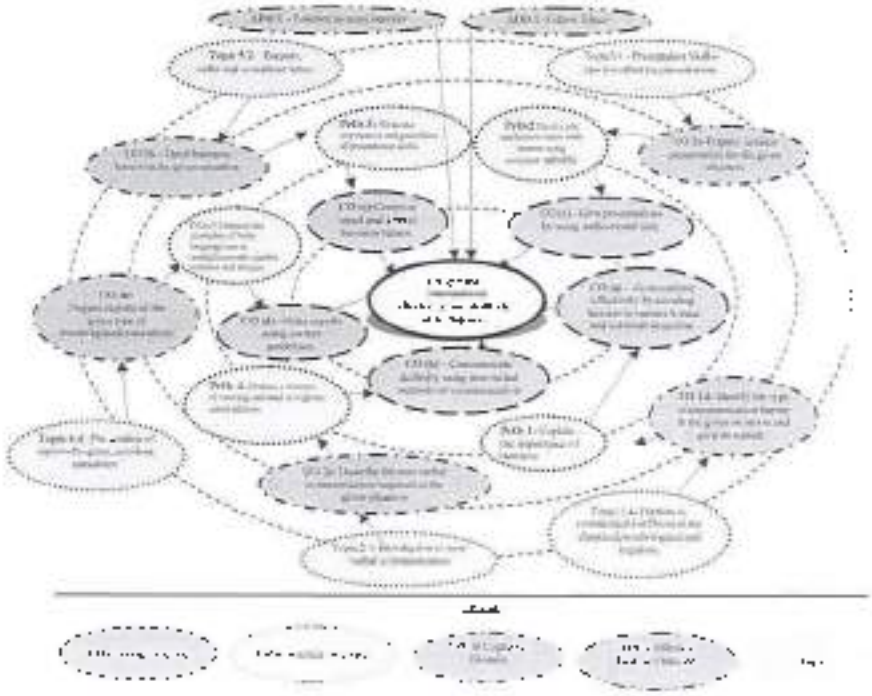


Figure 1 - Course Map

## 6 SUGGESTED PRACTICALS/ ACTIVITIES/ EXERCISES (Integrate the theory in the laboratory when conducting practical.)

The practical in this section are PrOs (i.e. sub-components) of the COs to be developed and assessed in the student for the attainment of the competency.

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| | | | |
| 1 | Explain the importance of business communication for an organization using case study. | I | 2* |

| S. No. | Practical Outcomes (POs) | Unit No. | Approx. Hrs. required |
|---|---|---|---|
| 2 | Draft a job application letter with resume using computer | V | 2* |
| 3 | Mention the examples of body language used in workplace with suitable pictures and charts | II | 2* |
| 4 | Prepare a proposal of meeting and read it to given extract address | VI | 2 |
| 5 | Write the importance and guidelines of presentation skills | I I | 2* |
| 6 | Draft a detailed Progress Report | IV | 2* |
| 7 | Organize a debate on types of communication | I & II | 2 |
| 8 | Summarize an industry report using techniques of summarizing. | IV | 2 |
| 9 | Draft a complaint letter on a given topic. | V | 2 |
| 10 | Design Powerpoint presentation on any technical topic | I I | 2* |
| 11 | Explain the eight principles of effective communication | I | 2* |
| 12 | Explain various non-verbal codes with examples | II | 2 |
| 13 | Explain the importance of personal appearance stating tips of grooming for a professional | II | 2* |
| 14 | Draft a memo on given topic. | V | 2 |
| 15 | Presentation: Two barriers to communication using case study | I | 2* |
| 16 | Present a technical paper using IEEE format | III | 2* |
| | | | 32 |

Note

i. *A suggestive list of practical LOs is given in the above table. More such practical LOs can be added to attain the UOs and course outcomes. A judicial mix of minimum 12 or more practical LOs to be performed out of which the practicals marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain' Taxonomy as generally required by the industry. The size of batch for the practical should not exceed more than 20 students keeping in the maximum attainment of LOs and POs.*

ii. *Hence the 'Process' and 'Product' related skills associated with each LO of the laboratory work/practical shall have to be assessed according to a suggested sample given below.*

## 7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| S. No. | Equipment Name with Broad Specifications | Exp. S.No. |
|---|---|---|
| 1 | LCD Projector | All |
| 2 | Smart Board with Interfacing | All |
| 3 | Language Lab with Headset | All |
| – | Printer | As Relevant Applicable |





## 8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | | Topics and Sub-topics |
|---|---|---|---|
| | Writing Skills | Speaking Skills | |
| Unit – I Introduction to Business Communication | a. Justify the importance of the business communication in the given situation<br>1b. Identify the missing element in the given communication process<br>1c. Identify the type of communication in the given situation<br>1d. Identify the type of communication barrier in the given situation and its remedy | 1e. Use different types of verbal and non-verbal communication for the given situation | 1.1 Introduction to Communication – Elements, Importance, Functions<br>1.2 Types (meaning and importance) – Verbal (Oral, Written), Formal, Informal, Vertical, Horizontal and Diagonal communication<br>1.3 Principles of effective communication<br>1.4 Barriers to communication – Physical, mechanical, psychological and linguistic<br>1.5 Business communication – Meaning, characteristics and importance |
| Unit- II Non-Verbal Communication | 2a. Describe the non-verbal communication required in the given situation.<br>2b. Describe personal appearance required in the given communication situation<br>2c. Describe the given facial expressions | 2d. Use relevant facial expressions in the given situation.<br>2e. Answer questions after listening to presentations | 2.1 Introduction to Non-Verbal communication – Meaning and importance<br>2.2 Body Language: Aspects of body language: postures and gestures, proximity, facial expressions, personal appearance, dress, etiquettes and grooming, oculesics<br>2.3 Do's and Don'ts of positive and negative body language |
| Unit– III Presentation skills | 3a. Prepare seminar presentation for the given situation<br>3b. Prepare debate points for and against the given topic<br>3c. Prepare the points for power point presentation | 3d. Make seminar presentation<br>3e. Participate in debate, speaking for or against the given topic<br>3f. Make effective | 3.1 Presentation skills – tips for effective presentation<br>3.2 Guidelines for developing power point presentation<br>3.3 Presenting Technical papers |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | | Topics and Sub-topics |
|---|---|---|---|
| | Writing Skills | Speaking Skills | |
| | for the given topic. | computer presentations. | |
| Unit– IV Office Drafting | 4a. Draft the given notice using the relevant format.<br>4b. Draft the given memorandum using the relevant format.<br>4c. Prepare agenda for the given type of meetings.<br>4d. Prepare minutes of the given type of meetings.<br>4e. Prepare reports of the given type of events/projects/work carried out. | 4f. Read the agenda of the given meeting.<br>4g. Read the report of the given event.<br>4h. Initiate telephonic calls for given situation.<br>4i. Answer official phone calls for given situation. | 4.1. Office drafting, Formats and Guidelines<br>4.2. Formulating notices and memoranda.<br>4.3. Preparation of agenda and writing minutes of meetings<br>4.4. Preparation of reports- progress report, Accident reports, case study.<br>4.5. Summarizing techniques. |
| Unit-V Business Correspondence | 5a. Respond to given job ads/advertisements by writing your CV/ Resume.<br>5b. Draft business letters in the given situations.<br>5c. Draft Sales/ Quotations for the given situations.<br>5d. Compose E-mails with relevant for the given situation. | | 5.1 Business correspondence.<br>5.2 Enquiry, order and Sample/ quotation letters.<br>5.3 E-mails / notifications.<br>5.4 Difference –Curriculum Vitae, Bio-data and Resume.<br>5.5 Job application and resume writing. |

*Note: To achieve the COs and competency, above listed Learning Outcomes (UOs) need to be organized in terms of the Appropriate Level of Bloom's Cognitive Domain Taxonomy. Hence, appropriate level of the various theory practical activities should be undertaken.*

## 9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

| Unit No. | Unit Title | Distribution of practical Marks | | | |
|---|---|---|---|---|---|
| | | R Level | U Level | A Level | Total Marks |
| I | Introduction to Business Communication | 02 | 02 | 01 | 05 |
| II | Non-verbal Communication | 02 | 01 | 02 | 05 |
| III | Presentation Skills | 02 | 01 | 02 | 05 |
| IV | Office Drafting | 02 | 04 | 04 | 10 |
| V | Business Correspondence | 02 | 04 | 04 | 10 |
| | Total | 10 | 12 | 13 | 35 |





*Legends: R=Remember; U=Understand; A=Apply and above (Bloom's Revised taxonomy)*
*Note: This specification table provides general guidelines to assist teachers for their teaching and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (R, U and A) in the question paper may vary from above table.*

## 10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAMINATION.

| Weightage (20 Marks) A | Weightage (15 Marks) B | Total |
|---|---|---|
| Assessment based on PrOs. practicals conducted during semester<br>Based on computer and written skills.<br>(Minimum four questions each five marks)<br>Sample questions:<br>Eg. I Draft an email on The manager regarding the shortage of raw material at production department.<br>Note: submit the printout of mail. (Computer based)<br><br>Eg. II Write job application with resume. (written) | Oral examination based on UOs Topics mentioned in syllabus<br>(Minimum five questions each two marks to be asked.)<br>Eg. I Explain the importance of communication in professional life.<br>II. State any four guidelines of presentation skills. | (35 Marks)<br>A+B<br><br>Duration: 2 hours |

## SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect good articles from newspapers and magazines and read them to improve information.
b. Listen to Business news on TV and radio.
c. Watch videos of effective presentations on television and other learning sources for presentation skills and body language.
d. Undertake micro-projects.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.

- b. *Note to Item No. 4* does not mean only the outcomes to be matched, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About *15-20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guidelines for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provide situations for *co-curricular* activities.
- e. Arrange various *group* communication activities like *group discussion*.
- f. Show videos/animations to develop *listening skills* and enhance *vocabulary*.
- g. Use of *models, charts* for explanation.
- h. Prepare and use *power point presentations*.
- i. Guide *micro-projects* in groups as well as individually.

## 12. SUGGESTED TITLES OF MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are, in fact, an integration of CAs, DOs and ADOs. The micro-project could be industry application based, market-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary containing details of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (Sixteen) student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Study the personal appearance and grooming of employees visiting sales store, shopping mall or canteen.
b. Comparative study of Bio-data, Resume and Curriculum vitae.
c. A detailed study of guidelines required for presentation skills.
d. Short technical content using English newspaper, magazines or online resources.
e. Prepare a booklet on aspects of body language in pictorial form.
f. A detailed study of the importance of technical paper presentation.
g. Case study on the importance of Business communication in an organization.
h. Report on various forms of business advertise.
i. Study of oral presentation of famous business leader.
j. Detailed study of business etiquettes observed in organization.
k. Summarize the business article with the help of English newspapers, magazines and other sources.

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Effective Technical Communication Skills | M Ashraf Rizvi | Tata McGraw-Hill |
| 2 | Communication Skills | Sanjay Kumar and Pushp Lata | Oxford University Press |
| 3 | Personality Development and Soft Skills | Barun K. Mitra | Oxford University Press |

## 14. SOFTWARE/LEARNING WEBSITES

a. http://www.brainstorming.co.uk/tutorials/
b. http://learningtechnologies.bbk.ac.uk/
c. http://www.talkingtech.com/
d. http://animatedtext.com/
e. http://www.wordsworthelp.com/
f. http://www.mindtools.com/
g. http://www.tutorialspoint.com/
h. http://www.studylecturenotes.com/
i. http://grammarmonster.com/
j. http://presentationtips.com/

**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI**

**TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES**

**COURSE NAME : CIVIL ENGINEERING GROUP**

**COURSE CODE : CE/CS/CR/CV**

**DURATION OF COURSE : 6 SEMESTERS for CE/CS/CR ( 8 SEMESTERS for CV)** **WITH EFFECT FROM 2012-13**

**SEMESTER : FIFTH** **DURATION : 16 WEEKS**

**PATTERN : FULL TIME - SEMESTER** **SCHEME : G**

| SR. NO | SUBJECT TITLE | Abbreviation | SUB CODE | TEACHING SCHEME | | | EXAMINATION SCHEME | | | | | | | | SW (17500) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | PAPER HRS. | TH (1) | | PR (4) | | OR (8) | | TW (9) | | |
| | | | | TH | TU | PR | | Max | Min | Max | Min | Max | Min | Max | Min | |
| 1 | Estimating and Costing | EAC | 17501 | 03 | -- | 04 | 04 | 100 | 40 | -- | -- | 25# | 10 | 25@ | 10 | |
| 2 | Irrigation Engineering | IEN | 17502 | 04 | -- | -- | 03 | 100 | 40 | -- | -- | -- | -- | -- | -- | |
| 3 | Public Health Engineering | PHE | 17503 | 03 | -- | 02 | 03 | 100 | 40 | 25# | 10 | -- | -- | 25@ | 10 | |
| 4 | Concrete Technology | CTE | 17504 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 25@ | 10 | **50** |
| 5 | Design of Steel Structures | DSS | 17505 | 03 | -- | 02 | 04 | 100 | 40 | -- | -- | -- | -- | 50@ | 20 | |
| 6 | Behavioural Science $ | BSC | 17075 | 01 | -- | 02 | -- | -- | -- | -- | -- | 25# | 10 | 25@ | 10 | |
| 7 | Entrepreneurship Development | EDE | 17057 | -- | -- | 02 | -- | -- | -- | -- | -- | -- | -- | 25@ | 10 | |
| 8 | Professional Practices-III | PPT | 17058 | -- | -- | 03 | -- | -- | -- | -- | -- | -- | -- | 50@ | 20 | |
| | | | **Total** | **17** | **--** | **17** | **--** | **500** | **--** | **25** | **--** | **50** | **--** | **225** | **--** | **50** |

Student Contact Hours Per Week: **34 Hrs.**

**THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.**

Total Marks **: 850**

@ - Internal Assessment, # - External Assessment, [ ] No Theory Examination, $ - Common to all branches, #* - Online Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Fifth Semester for CE/CS/CR and Sixth Semester for CV**

**Subject Title : Estimating and Costing**

**Subject Code : 17501**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 04 | 04 | 100 | -- | 25# | 25@ | 150 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

In case of long term planning the prospective cost of the construction project is required for the planning of the budget.

Estimating and Costing determines the prospective costs of the construction project in accordance to the plans and specifications for various items of works. Quality of material, type of labour, equipments, tools, transport cost affects the rates of an item of the work. The rates of completed item of the work vary from place to place. However, learner will be able to determine the quantities and cost with reasonable accuracy and in accordance with the standards as per IS: 1200.

The topic on approximate estimate is useful for calculating approximate cost of the building / roads etc. which is further useful for the making budget provisions in the planned works.

The information on detailed estimate based on measurements and the rate of completed item of work is useful in finding comparatively accurate costs of each item of work and total cost of the buildings / roads / structures etc. which is useful for preparation of tender documents and thereafter for the execution of the work.

The rate analysis of an item of work shall help in finding out the rate per unit on the basis of material cost, labour cost, contractors profit and other probable miscellaneous expenditure required for the completed item of the work for actual execution of the works as per lead and lift.

Thus the subject shall strongly help to build professionalism among the learner by providing the knowledge and estimating skills at the project sites along with the use of software's / programmes of estimating which makes learner a perfect professional civil engineer.

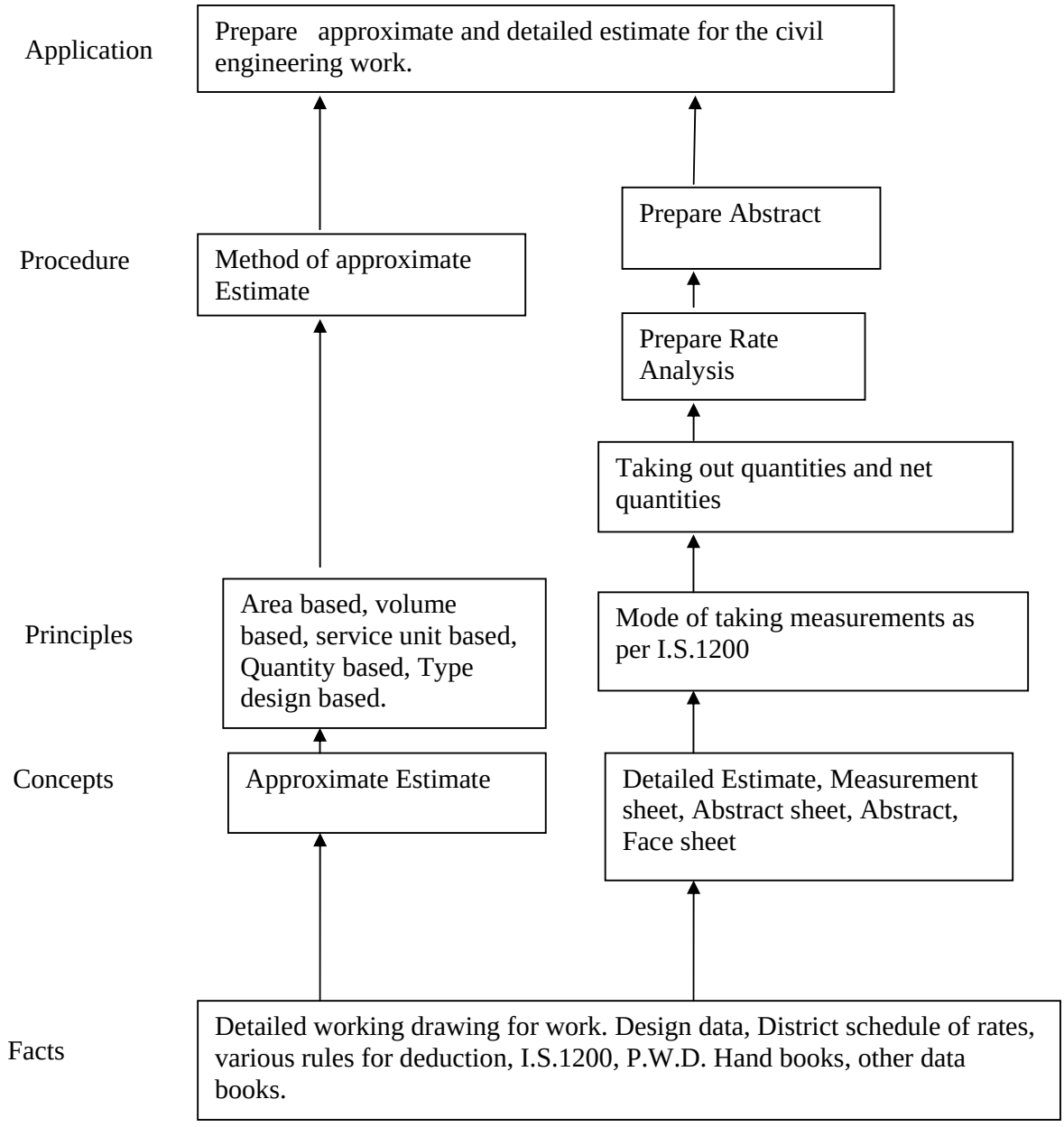
**General Objectives:**

Student will be able to:

- Understand units and modes of measurements of various items of work.
- Know the method of preparation of approximate estimates of various civil engineering works.

- Apply knowledge of preparation of check list of items of construction, rate analysis for preparation of detailed estimate of various civil engineering works.
- Understand the preparation of bill of quantities by taking measurements of completed item of work and rate of the item
- Apply computer software's to prepare estimate of building works.

## Learning Structure:



**Theory**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1. Introduction**<br>Specific objectives:<br>➢ Define and state purpose of estimating and costing.<br>➢ List different methods of approximate estimate.<br>➢ Collect local rates of materials, labour and equipments along with local terms used.<br>**Contents:**<br>• Estimates- Meaning of the term estimating and costing, purpose of estimating and costing. Types of estimates and their purpose<br>• Approximate estimate- Plinth area rate method, Cubical content method, Service unit method, Typical bay method, Approximate quantity method.<br>• Problems on plinth area rate method and use of service unit method for selection of service units for different types of buildings.<br>• Detailed estimate- Detailed estimate, revised estimate, supplementary estimate, revised and supplementary estimate, repair and maintenance estimate and their uses in practical situation. | 04 | 08 |
| **Topic 2. Mode of measurement and brief specifications**<br>Specific objectives:<br>➢ State units and modes of measurement and payments for various items of works.<br>➢ Apply rules of deductions for openings as per IS 1200.<br>➢ Use standard formats of measurement sheet, abstract sheet and face sheet.<br>**Contents:**<br>• Units of measurement and desired accuracy as per IS: 1200, Rules of deduction for openings as per IS:1200 for brick work, plastering and pointing.<br>• Sequence of execution and brief description / specification of items of work as per PWD/GOVT.<br>DSR, Standard formats of measurement sheet, Abstract sheet, face sheet. | 06 | 12 |
| **Topic 3. Preparation of estimate**<br>Specific objectives:<br>➢ Collect the data regarding cost/Sq.m for various types of buildings as per PWD and local rates.<br>➢ Prepare approximate estimates of various civil engineering works.<br>➢ Understand various items of works of different civil engineering structures.<br>➢ Prepare check list for civil engineering works.<br>➢ Apply methods of taking out quantities.<br>➢ Adopt procedure of preparing detailed estimate of RCC framed structures and Load bearing structures.<br>➢ Prepare bar bending schedule of RCC works.<br>➢ Apply various methods for earth work computation.<br>➢ Incorporate various provisions to be made in detailed estimate. | 22 | 40 |

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Contents:**<br>**3.1 Approximate Estimate ..... (16 Marks)**<br>• Plinth area/carpet area/Super built up area of building by using PWD rates and local rates<br>• Estimates of roads, highway, railways, bridges/culverts, irrigation projects and water supply projects.<br><br>**3.2 Detailed Estimate …… (12 Marks)**<br>• Data required for detailed estimate<br>• Steps in preparation of detailed estimate<br>• Preparing check list of RCC framed structure building/roads, listing of approximate % of steel required for various RCC members.<br>• Methods for taking out quantities by Long wall and Short wall method, Centre line method.<br>• Taking out quantities of various items of building (RCC framed structure and Load bearing structure), road work as per PWD method.<br>**3.3 …….. (12 Marks)**<br>• Bar bending schedule and steel quantities calculation for footing, column, beam, slab and chajja.<br>• Earthwork computation-Meaning and methods, calculation of earthwork quantity for roads and canal by average cross sectional area method, mid sectional method, Prismoidal formula method.<br>• Provisions to be made in detailed estimate for contingencies, work charged establishment, centage charges, water supply and sanitary arrangements, internal electrification etc.<br>• Meaning of the terms- Prime cost, Provisional sum, provisional quantities, Day work | | |
| **Topic 4. Rate Analysis**<br>Specific objectives:<br>➢ Understand definition, purpose and concept of rate analysis.<br>➢ Collect local rates of materials, labours and hiring charges of tools and plants with transportation charges.<br>➢ Understand the concept of lead and lift.<br>➢ Prepare rate analysis of various items of work.<br><br>**Contents:**<br>4.1 **…… (08 Marks)**<br>• Definition, purpose, importance of rate analysis, factors affecting rate analysis, procedure of rate analysis.<br>• Meaning of term lead, lift, task work, material rate and labour charges, conveyance capacity of different types of vehicle, transportation of materials and charges, categories of labours, their rates, overhead charges, contractors profit, work charge establishment and water charges.<br>4.2 …….. **(16 Marks)**<br>• Preparing rate analysis of different items of work- excavation, PCC, RCC Footing, brick masonry, stone masonry, RCC work (column, beam, lintel, slab etc.), flooring, plastering, DPC, Wood work for doors and windows frames and shutters. | 10 | 24 |

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 5. Estimate for Civil Engineering works**<br>Specific objectives:<br>➢ Prepare estimate for different civil engineering works<br>➢ Prepare sample estimate by using computer software / Excel programme.<br><br>**Contents:**<br>• Preparation of detailed estimate for: 6 to10 users septic tank, and Community well.<br>• Preparation of detailed estimate for a small RCC slab culvert.<br>• Use of computer / software / programmes for detailed estimate preparation of building works. | 06 | 16 |
| **Total** | **48** | **100** |

**Practicals:**
**Skills to be developed**

**Intellectual Skills**:

1. List various items of work with the units in a civil engineering structures.
2. Calculate quantities of various items of works

**Motor Skills:**

1. Prepare rate analysis.
2. Prepare detailed estimate of civil engineering structures.

**List of Assignments:**

1. Prepare the checklist of the following Civil Engineering works.
   i) RCC framed structure building.
   ii) Bituminous pavement road with WBM as sub-base.
2. Collection of local rate of construction material, labours, tools and equipments.
3. Preparation of approximate estimate of the various types of buildings by PWD method / guide lines. **(Teacher shall provide required drawing/data)**
   i) School Building.
   ii) Hospital Building.
   iii) Residential Building.
   iv) Auditorium Building.
4. Taking out the quantities of various items of the work for the load bearing structure by **any one method** ( Center line / Long wall and short wall )
   **(Teacher shall provide required drawing/data)**
   i) Excavation for foundation.
   ii) Plain cement concrete for foundation.
   iii) UCR masonry in foundation and plinth.
   iv) Damp proof course.
   v) Plinth filling.
   vi) Burnt Brick masonry in superstructure.
   vii) Flooring, skirting and dados.
   viii) Plastering. ( Internal , External and ceiling)
   ix) Woodwork in door frame and shutter.
   x) Painting ( inside / outside and ceiling)
5. Taking out quantities of following items for a small RCC Hall.
   **(Teacher shall provide required drawing/data)**

i) Concrete work for footing , column, beam, slab, lintel and RCC chajja
ii) Schedule of reinforcement for structural members and computation of quantities of reinforcement.
iii) Calculation of formwork for all above items (5( i) )

6. Preparing rate analysis of **any four** of the following items of building works.
   i) Excavation for the road.
   ii) PCC for foundation trenches.
   iii) UCR Masonry in foundation and plinth.
   iv) Brickwork in super structure.
   v) Plastering.
   vi) Flooring.
   vii) Teakwood frame for door / window.
   viii) RCC beams / slab.
   ix) RCC columns / footings.
   x) Coloring / Painting.

7. Prepare detailed estimate of ground floor of a RCC, (G+1) Residential Building Framed Structure (2 BHKD with attached toilet to 1 bedroom with European type WC) with dog legged staircase.[The drawing prepared in 4$^{th}$ semester in CAD may be used] Calculate also the per square meter cost of the building **(This exercise is carried out by making batch of 5 to 6 students). (Teacher shall provide required drawing/data if necessary)**

8. Calculate quantity by field measurements for the following.
   i) Flooring.
   ii) Plastering ( Internal or External )
   iii) Brickwork.
   iv) RCC stairs.

   **(Teacher shall arrange field visit batch wise)**

9. Taking out quantities of the earthwork for a road profile of 500 meter length by mid-section or mean area method. (Drawing of profile leveling prepared in 3rd semester may be used.)

10. Taking out quantities of the earthwork for a road profile of 500 meter length by using Excel / any other available software / program.

**Learning Resources:**

1. **Books:**

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 01 | Estimating and Costing in Civil Engineering | B.N. Dutta | UBS Publishers Distributors Pvt. Ltd., New Delhi |
| 02 | Estimating and Costing, Specification and Valuation in Civil Engineering | M. Chakraborti | M. Chakraborti, Kolkata |
| 03 | Estimating and Costing | S.C. Rangwala | Charotar Publication, Anand |
| 04 | Estimating and Costing | G.S. Birdie | Dhanpat Rai and Sons. |
| 05 | Civil Engineering Estimating Vol. 1 | B.S.Patil | Orient longman,mumbai |
| 06 | Estimating construction costs (fifth edition) | Robert L. Peurifoy Garold D. Oberlender | Tata McGraw Hill Education Private Ltd, New Delhi |

**2. CDs, PPTs Etc.:**

Q.E. PRO software or any equivalent Software

**3. IS, BIS and International Codes:**

| Sr. No. | Title |
|---|---|
| 01 | IS-1200- Method of measurement of building and civil engineering works |
| 02 | District Schedule of rate of PWD |

**4. Websites:**

a) www.maharashtra.gov.in
b) www.mahapwd.com
c) www.cpwd.com
d) www.newtonindia.com
e) www. ensoftindia.com

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Fifth for CE/CS/CR and Sixth for CV**

**Subject Title : Irrigation Engineering**

**Subject Code : 17502**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 04 | -- | -- | 03 | 100 | -- | -- | -- | 100 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Agriculture is the main occupation of majority of Indian Population. But Agricultural productivity is very low because of uncertainty of rainfall. Scientifically planned and developed Irrigation systems have been ensuring enhanced productivity of agriculture sector due to assured water supply to crops. There are inherent huge amount water losses in major projects and major projects are complex from the view point of operation, management and maintenance. Medium, minor and micro irrigation schemes have proved to be easier to develop and maintain and are highly efficient also.

The topics on hydrology, rainfall, runoff, yield and maximum flood discharge will be useful for reservoir planning. Information on duty, delta, base period, crop pattern and command area will be used for ascertaining crop water requirement. Various topics on data collection for irrigation project will be useful for irrigation site investigation.

Topics on earthen, gravity dams and spillway will be useful during construction of medium, minor irrigation schemes. The contents on Bandhra Irrigation, Percolation Tank and micro irrigation will be useful, for construction, maintenance of minor irrigation scheme. Topics on Diversion headwork will be useful for efficient and effective planning of barrages and weirs

Topics on canals with their types, canal, CD works and canal maintenance will be guiding factor for deciding canal alignment, location of various CD works, various maintenance parameters for a canal including the prevailing field practices.

Thus the diploma engineer is exposed to understand various factors at the planning, construction, operation, maintenance and repairs of various irrigation schemes. This will further enable a learner to come up as resourceful professional in the area of irrigation engineering. This

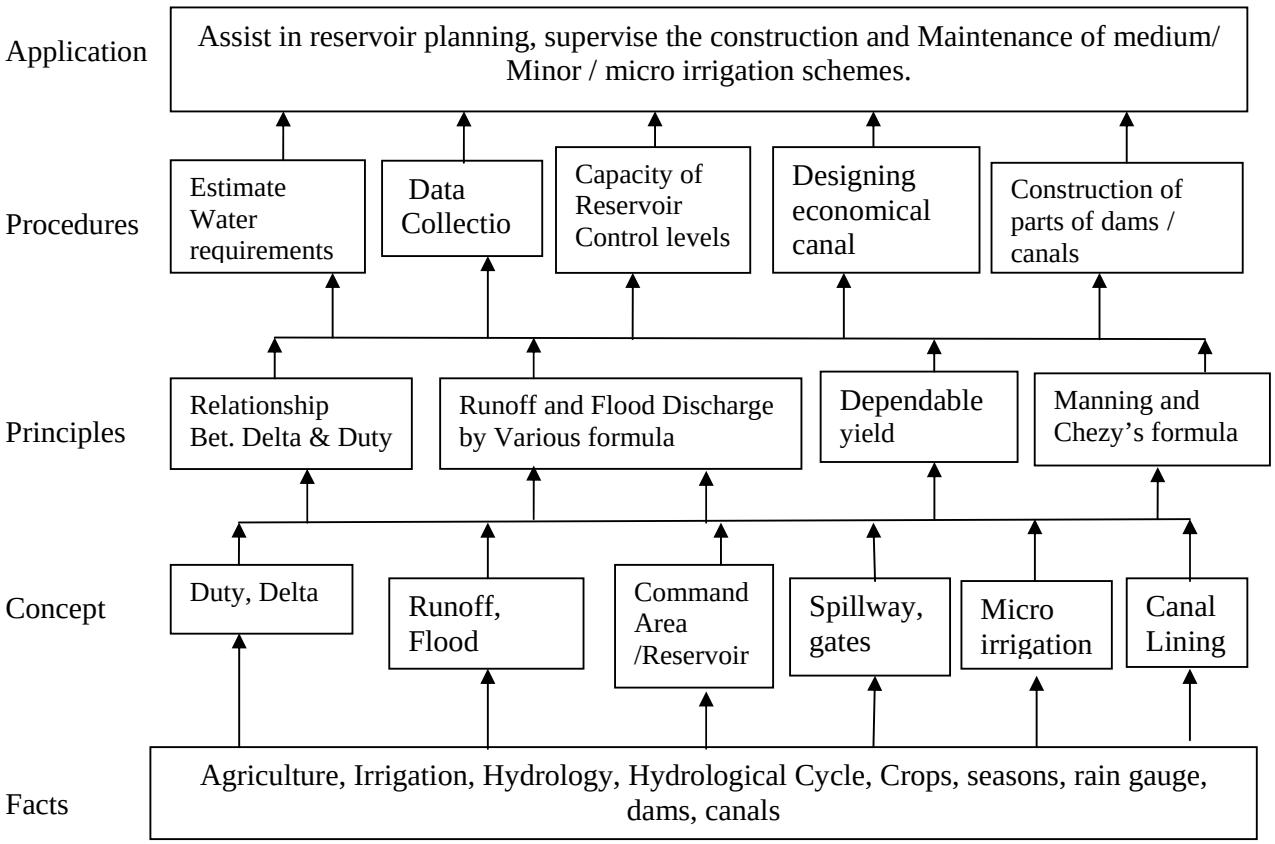
may aim at optimum use of water with minimum loss of water and achieve maximum productivity and yield.

**General Objectives:**

**Students will be able to**

1. Appreciate need of Irrigation
2. Understand Water Requirements of a command area
3. Understand aspects of Reservoir Planning.
4. Understand Construction and maintenance of Earthen and Gravity Dams
5. Understand Minor / Micro Irrigation Schemes.
6. Understand Construction and Maintenance of Canals and structures.

**Learning Structure:**



**Theory**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1. Introduction to Irrigation and Hydrology:**<br>**Specific Objectives**<br>➢ Classify irrigation projects.<br>➢ Classify irrigation.<br>➢ Estimate runoff and flood discharge.<br>➢ Calculate dependable yield from a catchment<br>1.1 Concept of Irrigation, Classification of irrigation on the basis of purpose and administration.<br>1.2 Advantages and ill effects of irrigation, methods of irrigation-such as surface<br>1.3 Concept of hydrology, Hydrologic cycle, Definition of rain fall ,rainfall intensity<br>1.4 Rain Gauge-Symons rain gauge, automatic rain gauge, its construction and functioning average rainfall, methods of calculating average rainfall.<br>1.5 Runoff, Factors affecting Run off, Computation of run off Using Inglis formula, Stranges and Binnie's tables.<br>1.6 Concept of Maximum Flood Discharge (MFD), Computation of Maximum Flood Discharge by Physical indication of past floods and by flood discharge formulae-Inglis and Dicken;s formula. Simple numerical problems.<br>1.7 Yield and Dependable yield of a catchment, determination of dependable yield. | 10 | 12 |
| **Topic 2. Water Requirement of Crops And Reservoir Planning:**<br>**Specific Objectives:**<br>➢ Estimate crop water requirement of a command area.<br>➢ Calculate reservoir capacity to meet the crop water demand of a command area.<br>➢ Enlist data required to be collected for the planning of a reservoir.<br>➢ Fix control levels of a reservoir.<br>2.1 ……. (08)<br>• Cropping seasons in Maharashtra.<br>Definition of terms – Crop period, base period, Duty, Delta, CCA, GCA, intensity of irrigation, factors affecting duty , relation between duty, delta and base period.<br>• Problems on water requirement and capacity of canal. Modified Penman method .Assessment of irrigation water.<br>2.2 ……. (10)<br>• Survey for irrigation project, data collection for irrigation project. area capacity curve,<br>• Silting of reservoir, rate of silting , factors affecting silting ,<br>• Fixing Control levels and respective storage in reservoir. Simple numerical problems on Fixing Control levels. | 12 | 18 |
| **Topic 3. Dams And Spillways**<br>**Specific Objectives:**<br>➢ Classify dams.<br>➢ Describe construction and operation of Earthen and Gravity Dam.<br>➢ Describe operation of spillway and gates.<br>➢ List various repairs and maintenance works for an earthen dam.<br>3.1 (12) | 14 | 24 |

| | | |
|---|---|---|
| ➢ Dam, Types of dams - Earthen dams and Gravity dams ( masonry and concrete) Comparison of earthen and gravity dams with respect to foundation, seepage, construction and maintenance<br>➢ Earthen Dams -<br>Components and their function, typical cross section seepage through embankment and foundation seepage control though embankment and foundation. Methods of constructions, types of failure of earthen dams and remedial measures.<br>3.2 (12)<br>➢ Gravity Dams Theoretical and practical profile, typical cross section, drainage gallery, joint in gravity dam, high dam and low dam<br>➢ Spillways-Definition, function, location and components.<br>Emergency and services, ogee spillway and bar type spillway, discharge over spillway. Energy dissipation Spillway with and with out gates,<br>Gates-<br>Radial and Vertical, procedure of maintenance and repairs of the gate (no numerical problems). | | |
| **Topic 4. Minor and Micro Irrigation**<br>**Specific Objectives:**<br>➢ Describe construction and operation of Bandhara irrigation and Percolation tanks.<br>➢ Describe construction and operation of Micro/Lift Irrigation systems.<br>➢ Distinguish Bandhara irrigation with Percolation tanks/ Micro irrigation.<br>4.1 Bandhara, construction and working Advantages and disadvantages of bandhara irrigation layout and component parts, solid and open bandhara.<br>4.2 Percolation Tanks – Need, selection of site, construction<br>4.3 Lift irrigation scheme-Components and their functions ,lay out<br>4.4 Drip and Sprinkler Irrigation- Need, components, Layout, operation and Maintenance. | 10 | 16 |
| **Topic 5. Diversion Head Works**<br>**Specific Objectives**<br>➢ Describe construction and operation of Weirs.<br>➢ Describe construction and operation of barrage.<br>5.1 Weirs – components parts, types, layout of diversion head works with its components and their function,<br>5.2 Barrages – components and their function. Difference between weir and barrage | 08 | 12 |
| **Topic 6. Canals**<br>**Specific Objectives**<br>➢ Classify canals<br>➢ Describe construction of canal.<br>➢ List various repairs and maintenance works for canals.<br>➢ Design a most economical section for the designed discharge.<br>6.1 (10)<br>• CANALS – Classification of canals according to alignment and position in the canal network. Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth. Design of most economical canal section.<br>• Canal lining - Purpose, material used and its properties. Advantages of canal lining<br>6.2 (08) | 10 | 18 |

| | | |
|---|---|---|
| • CD works- Aqueduct , siphon aqueduct, super passage, level crossing<br>• Canal regulators- Head regulator, Cross regulator, Escape, Falls and Oulets.<br>• Canal maintenance.<br>• Water logging- Causes, effects and Measures. | | |
| **Total** | **64** | **100** |

**Learning Resources:**

**1. Book:**

| Sr. No | Author | Title | Publisher |
|---|---|---|---|
| 1 | S. K. Garg | Irrigation and Hydraulic Structure | Khanna Publisher, New Delhi |
| 2 | Dr. B.C.Punmia and Dr. B.B. Pande | Irrigation Engineering and Water Power Engineering | Standard Publisher |
| 3 | N.N.Basak | Irrigation Engineering | Tata Mcgraw Hill |
| 4 | J.G.Dahigaonkar | Text Book of Irrigation Engineering | Wheeler |
| 5 | A.M.Maichael | Irrigation Theory and Practice | Dhanpatrai and sons |

**2. CDs, PPTs Etc.:**

**3. IS, BIS and International Codes:**

1. IS: 4410-Part-V-1982-Canals
2. IS: 4410- Part-VI-1983-Reservoirs.
   Part-VII-1968-Dams.
   Part-XVII-1977-Water Requirement of Crops
3. IS: 5477-Part-II,III and IV -1969-71-Storage zones of reservoirs.

**4. Websites:**

1. www.damsinternational.com
2. www.dams.org
3. www.narmada.org
4. www.guj.nwrws.gujrat.gov.in
5. www.rajirrigation.gov.in
6. www.mahairrigation.gov.in

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Fifth for CE/CR/CS and Sixth for CV**

**Subject Title : Public Health Engineering**

**Subject Code : 17503**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | 25# | -- | 25@ | 150 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rational:**

Public Health Engineering is an integral part of life. It essentially comprises of our ambience, which gives us the zest and verve in all our activities. At present man is facing one of the most horrible ecological crises, the problem of pollution of his environment which sometimes in past was pure, virgin, undisturbed, uncontaminated and basically quite hospitable for him. To maintain better public health one must have safe quality of drinking water supply, effective methods for disposal of domestic and industrial waste and pollution free environment.

The detailed knowledge about various sources of water supply, quality parameters of public water purification and conveyance of water will be useful in planning suitable water supply scheme for town/city. Topics on domestic sewage, conveyance of sewage in sewers analysis and treatment of sewage will be useful for safe disposal of this waste.

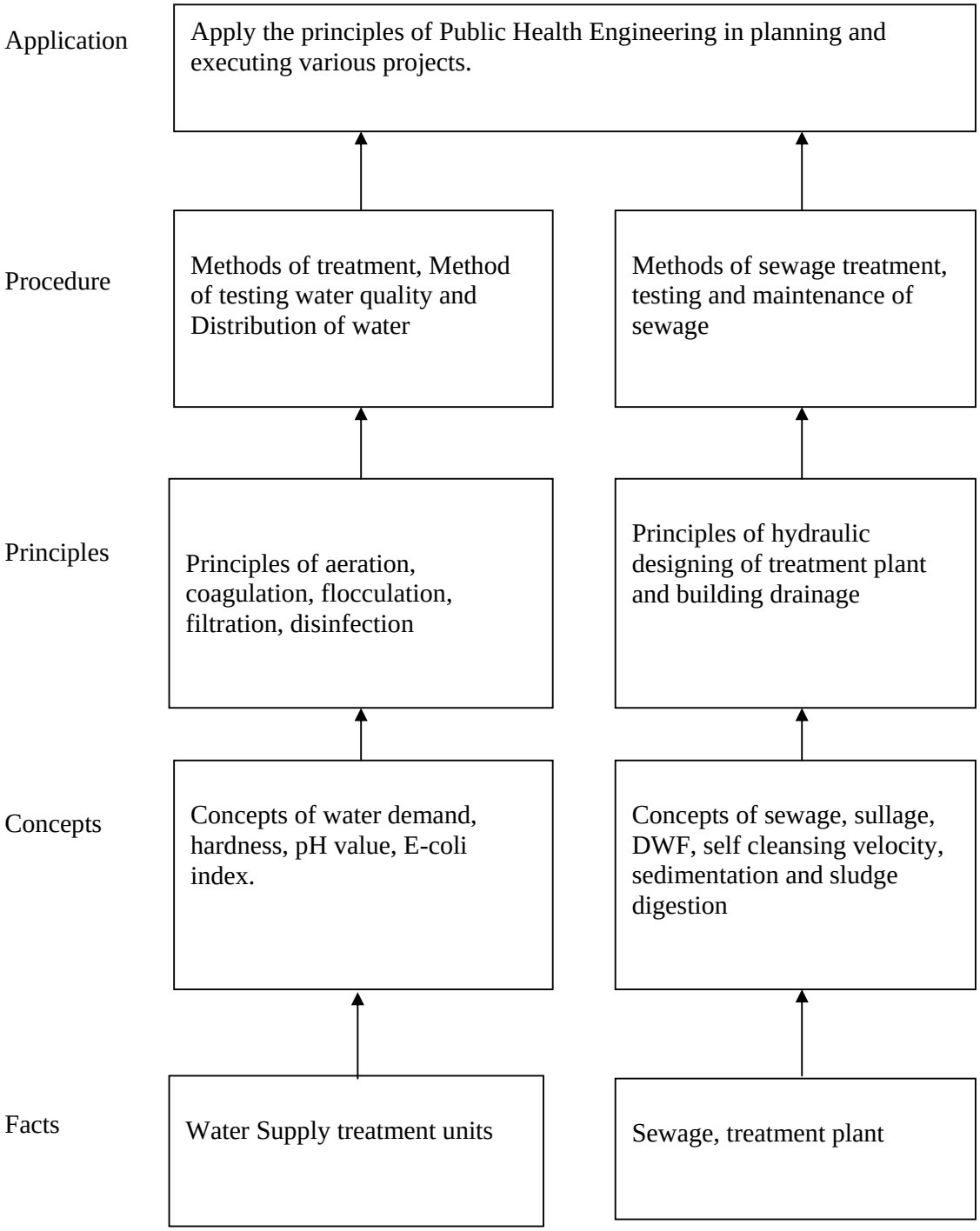
Emerging trends in sanitation and water supply will provide latest know to the students. Thus the subject will be helpful in bringing up general public health to desired safe level in respect of water supply and disposal of waste.

**General Objectives:**

The student will able to

1. Understand the terms involved in public water supply and domestic sewage.
2. Know different types of sources of water for public water supply.
3. Understand the methods for estimating.
4. Suggest the treatment required by knowing the quality of water.
5. Understand the hydraulic design of Units in treatment plant.
6. Understand different sewerage systems with their merits.
7. Analyze the quality of sewage and suggest suitable treatment of sewage.

**Learning Structure:**



**Theory:**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1] Public Water Supply**<br>**Specific objectives :**<br>➢ Draw layout of water supply scheme<br>➢ Calculate forecasted population<br>➢ Estimate quantity of water demand<br>➢ Understand working of water treatment units<br>➢ Know hydraulic design of water treatment units<br>➢ Describe functions and locations of different valves on pipes.<br>➢ Draw layouts of water distribution systems<br>➢ Draw hydraulic flow diagram of water treatment plant | | |
| **1.1 Introduction and Quantity of water……10**<br>Importance of public Health Engineering, Need to protect water supplies, flow diagram of water supply scheme, function of units, Importance of water supply project, Layout of water supply project.<br>Demands of water, Factors affecting rate of demand, Variations of water demands, Forecasting of population, Methods of forecasting of population,(Simple problems on forecasting of population), Design period, Estimating of quantity of water supply required for city or town, Types of water supply schemes. | 04 | |
| **1.2 Sources and Quality of Water……10**<br>Surface and Subsurface sources of water, Intake Structures<br>Definition and types, Factors governing the location of an intake structure, Types of intakes, Water conservation, Ground water recharging – Necessity Importance and advantages<br>Need for analysis of water, Characteristics of water- Physical, Chemical and Biological, Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN, Sampling of water, Water quality standards as per I.S. | 04 | 48 |
| **1.3Purification of Water……..18**<br>Screening- Types of screens, Aeration- objects and methods of aeration, Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation, types of sedimentation tanks,<br><br>Clariflocculator, Filtration-theory of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter, domestic filter, filter media, construction and working of slow sand filter and rapid sandfilter. Disinfection: Objects, methods of disinfection, Chlorination- Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, orthotolidine test, Miscellaneous water Treatments (Water softening, Defluoridation techniques), Advanced Water Treatments (Electrolysis, Reverse Osmosis), Flow diagram of water treatment plants, Low cost water Treatments: Necessity and importance in rural areas, Prevention of pollution of bores and bore wells. | 08 | |

| | | |
|---|---|---|
| **1.4 Conveyance and Distribution of water……10**<br>Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valves- their use, location and function on a pipeline.<br>Methods of distribution of water- Gravity, pumping, and combined system Service reservoirs - functions and types , Layouts of distribution of water- Dead end system, grid iron system, circular system, radial system ; their suitability, advantages and disadvantages. | 06 | |
| **Topic 2] Domestic Sewage**<br><br>**Specific objectives :**<br>➢ State working of sanitary fitting and sewer appurtenances<br>➢ Draw sketches of sanitary fittings and sewer appurtenances<br>➢ Calculate the BOD and COD value of sewage<br>➢ Describe working of water treatment units<br>➢ Draw hydraulic flow diagram of sewage treatment plant<br><br>**Contents:**<br>**2.1 Introduction and Building Sanitation…….18**<br><br>Importance and necessity of sanitation, Necessity to treat domestic sewage, Recycling and Reuse of domestic waste Definitions - Sewage, sullage, types of sewage.<br>Definitions of the terms related to Building Sanitation- Water pipe, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe, Building Sanitary fittings- Water closet – Indian and European type, flushing cistern, wash basin, sinks, Urinals.<br>Traps- types, qualities of good trap, Systems of plumbing - one pipe, two pipe, single stack, choice of system Principles regarding design of building drainage, layout plan for building sanitary fittings (drainage plan), inspection and junction chambers, their necessity, location, size and shape. Maintenance of sanitary units.<br><br>**2.2 Systems of Sewerage and Sewer Appurtenances…….12**<br>Types of Sewers, Systems of Sewerage.Design of sewers, self cleansing velocity and non scouring velocityLaying, Testing and maintenance of sewers.<br><br>Manholes and Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.<br><br>**2.3 Analysis and treatment of Sewage…….18**<br>Characteristics of sewage, B.O.D./ C.O.D. and significance.Aerobic and anaerobic process, Maharashtra Pollution ControlBoard Norms for the discharge of treated sewage<br>Objects of sewage treatment, General layout and flow diagram, Screening, Grit removal, Skimming, Sedimentation of sewage, Sludge digestion, Trickling filters, Activated sludge process, Disposal of sewage, Oxidation pond, Oxidation ditch.<br>Septic tank(details and design criteria), Design of septic tank to be done in practical. No numerical questions on design. | 10<br><br>04<br><br>10 | 48 |

| | | |
|---|---|---|
| **Topic 3] Plumbing**<br>**Specific objectives :**<br>• Describe of water supply arrangement<br>• Describe rainwater and sewage collection system<br>**Contents:**<br>Line diagram with mountings/pipe specials/traps of water supply arrangement for residential and public building, Sanitary Plumbing, Layout, Rainwater and sewage collection systems, Rainwater harvesting | 02 | 04 |
| **Total** | **48** | **100** |

**Practicals:**
Skills to be developed

**Intellectual Skills:**

1. Understand and identify the different methods for testing of water
2. Understand and identify the different methods for analysis of sewage.
3. Interpret the test result

**Motor Skills:**

1. Observe various chemical and physical reactions
2. Handle instruments carefully
3. Observe the digital reading on display panel
4. Observe and record the reading

**List of Practicals:**

**Water Supply Engineering:**

1. To determine pH value of given water sample.
2. To determine the turbidity of the given sample of water.
3. To determine residual chlorine in a given sample of water.
4. To determine suspended solids, dissolved solids, and total solids of water sample
5. To determine the dissolved oxygen in a sample of water.
6. To determine the optimum dose of coagulant in the given sample by jar test.
7. a. Demonstration of water purifier, Aquaguard
   b. Study of softners and contents of mineral water.

**Sanitary Engineering:**

1. To determine pH value of given waste water sample.
2. To determine the dissolved Oxygen in a sample of waste water.
3. To determine B.O.D. of given sample of waste water.
4. To determine C.O.D. of given sample of waste water.
5. To determine suspended solids, dissolved solids and total solids of waste water sample.

**List of Assignments:**

**Water Supply Engineering:**

1) Visit to water treatment plant

**Sanitary Engineering:**

1) Visit to sewage treatment plant.

**Learning Resources:**

1. **Books:**

| Sr. No. | Author | Title | Publisher |
|---|---|---|---|
| 01 | Environmental Engineering (Volume I & II ) | SantoshGarg | Khanna Publishers, |
| 02 | Environmental Engineering | Kamla A. &KanthRao D. L. | Tata McGraw Hill, |
| 03 | Water Supply and Sanitary Engineering | Birdie G. S.<br>Birdie J. S. | DhanpatRai& Sons |
| 04 | Plumbing - Design and Practice | Deolalikar S. G. | Tata McGraw Hill, |
| 05 | Industrial Water Treatment | M.N. Rao& R.L Datta | ------- |
| 06 | Introduction to Environmental Engineering | Mackenzie Davis and David A Cornwell | Tata McGraw Hill Education Prvt. Ltd.,Delhi |
| 07 | Water Supply and Sanitary Engg | Rangwala | Charotar Publishing House Pvt. Ltd. Anand (Gujrat) |

2. **CDs, PPTs Etc.: Video CD on water treatment and sewage treatment, if available.**

3. **IS, BIS and International Codes:**
   1. IS 14543:2004 IS Code for Testing of Drinking Water
   2. IS 8403 : 1977 Code of Practice disposal of Effluent from Septic Tank
   3. Drinking water **s**pecification (IS 10500:1991)
   4. BIS standard for effluent disposal printed in 1963, revised in 1968

4. **Websites:**
   1. http://en.wikipedia.org/wiki/Bisleri
   2. http://en.wikipedia.org/wiki/Aircraft_lavatory

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Fifth for CE/CR/CS and Sixth for CV**

**Subject Title : Concrete Technology**

**Subject Code : 17504**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | -- | -- | 25@ | 125 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Plain or reinforced cement concrete is extensively used as a construction material in almost all types of Civil engineering structures like buildings, roads flyovers, dams, bridges and water tanks etc. With advanced construction techniques and use of locally available ingredients of concrete, concrete has become very popular construction material.

The contents on cement and aggregate will be useful in deciding contents and quality of concrete during preparation and placing of concrete in position. Topic on quality control of concrete will be useful in execution of various items of works where concreting is involved. Thus the total contents of the subject will be useful for ensuring the quality of concrete during design preparation, transporting and placing in position for various structures. It will also provide guidelines for effective supervision and quality control of concreting work. With good knowledge of concrete materials namely cement, aggregates, water and admixtures and concreting operation namely selection of materials, mixed design, mixing, placing, compacting and finishing, curing, one can obtain concrete of desired workability and required strength.

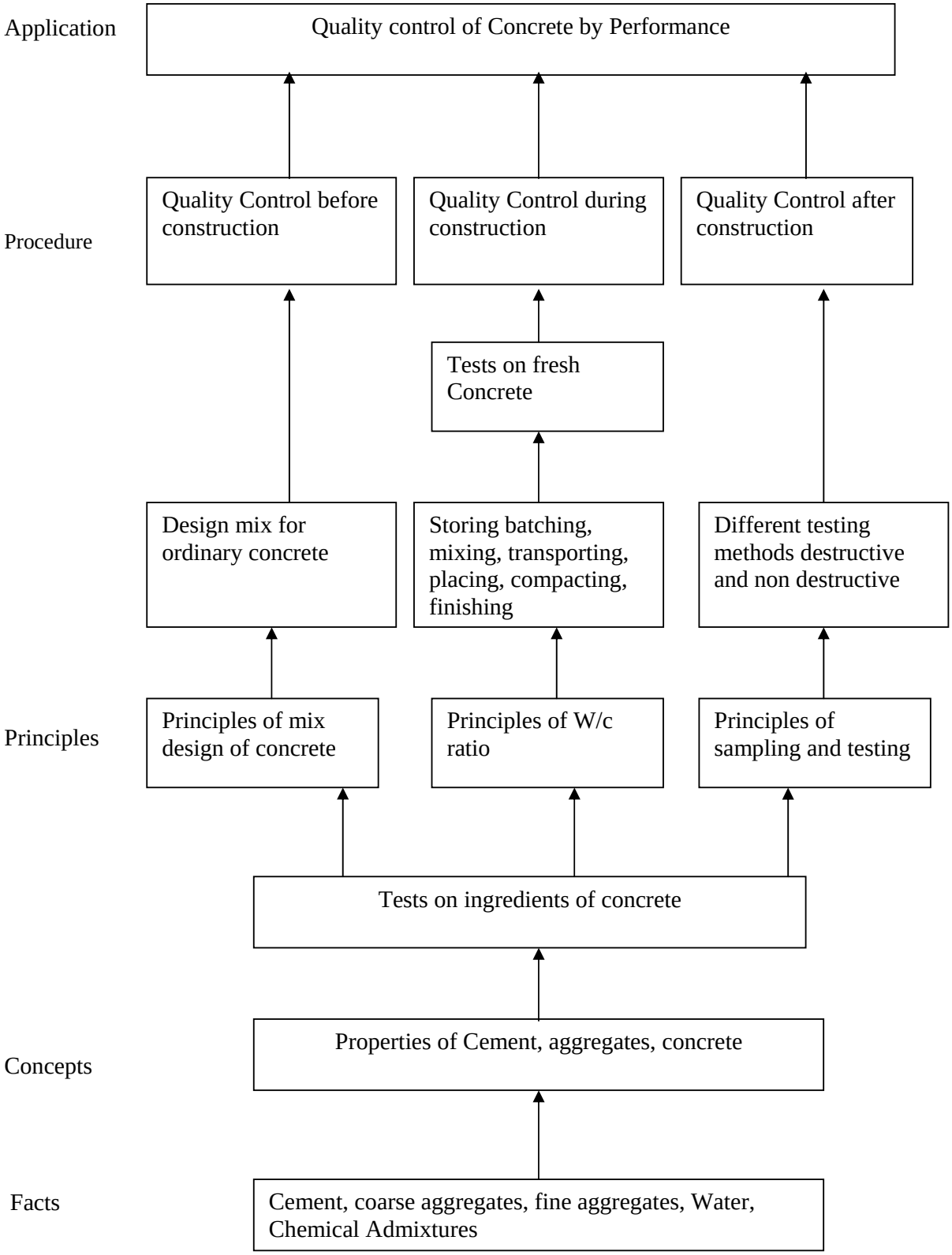
The content of this subject will enable a civil Engineering technician to acquire skills of carrying out various tests on concrete materials and concrete it self along with interpretation of test result.

**General Objectives:**

**Student will be able to -**

1. Ensure the quality of ingredients of concrete.
2. Design concrete mix.
3. Understand Techniques of quality control of concrete.

**Learning Structure:**



**Theory:**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1: Cement**<br>**Specific Objectives:**<br>➢ State physical properties and tests of cement.<br>➢ State use of various types of cement.<br>**Contents:**<br>1.1 Chemical Constituents of OPC and their effects on properties of OPC, Bogue's compounds and their properties, Hydration of cement. Physical properties of OPC-Fineness, setting, compressive strength and soundness. Different grades of OPC. 33, 43, and 53 with specifications of physical properties as per relevant IS codes.<br>Testing of OPC –field tests and laboratory tests-fineness test, standard consistency test, setting time test, compressive strength test, soundness test.<br>Storage of cement and effect of storage on properties of cement.<br>1.2 Physical properties, I.S. Specifications and field application of following types of cement :- Rapid hardening cement, Low heat cement, Portland pozzolana cement, Sulphate resisting cement, Blast furnace slag cement, White cement. | 06 | 12 |
| **Topics 2: Aggregates**<br>**Specific Objectives:**<br>➢ List and describe different properties of Aggregates.<br>➢ Carry out various Tests on the Aggregates of concrete.<br>**Contents:**<br>2.1: ……. 04 Marks<br>Requirement of Good Aggregate. Classification of Aggregate according to source, Size and Shape.<br>2.2: Properties of fine aggregates : ……. 08 Marks<br>Concept of size, specific gravity, bulk density, water Absorption and Bulking.<br>Determination of fineness modulus and grading zone of Sand by sieve analysis, determination of silt content in sand and their specification as per IS 383.<br>Determination of Bulking of sand. Concept of crushed Sand.<br>2.3 Properties of coarse aggregates: …….. 08 Marks<br>Concept of size, shape, surface texture, water absorption, soundness, specific gravity and bulk density<br>Determination of fineness modulus of coarse aggregate by sieve analysis, grading of Coarse Aggregates.<br>Determination of crushing value, impact value and abrasion value of coarse aggregate with specification. | 10 | 20 |
| **Topics 3: Concrete**<br>**Specific Objectives:**<br>➢ Describe properties of concrete.<br>➢ Carry out various tests on concrete.<br>**Contents:**<br>3.1 Introduction to concrete - …….. 08 Marks<br>Definition of concrete, necessity of supervision for concreting operation, different grades of concrete (ordinary Concrete, standard concrete and high strength concrete as per provisions of IS 456- 2000.<br>Water cement ratio:- Definition of w/c ratio, Duff Abraham w/c law, | 12 | 24 |

| | | |
|---|---|---|
| significance of w/c ratio, selection of w/c ratio for different grades of concrete prepared from different grades of OPC as per graphs specified in IS 10262 -1982, maximum w/c ratio for different grades of concrete for different exposure conditions.<br>3.2 Properties of fresh and Hardened concrete……..08 Marks<br>Definition of workability, factors affecting workability of Concrete. Determination of workability of concrete by slump cone test, compaction factor test. Range values of workability requirement for different types of concrete works. Segregation, bleeding.<br>Definition of compressive strength, durability and Impermeability of concrete. Factor affecting compressive strength, durability and Impermeability of concrete.<br>3.3 Concrete Mix Design and Testing of Concrete…08 Marks<br>Objectives of mix design, list of different method of mix design, study of mix design procedure by I.S. method as per I.S. 10262-1982 (Only procedural steps)<br>Testing of concrete:-Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results<br>Non- destructive testing of concrete:- Importance of NDT, methods of NDT - rebound hammer test and ultrasonic pulse velocity test, working principle of rebound hammer and factor affecting the rebound index, specification for deciding the quality of concrete by Ultrasonic pulse velocity as per I.S. 13311 (part 1 and 2).<br>Determination of compressive strength of concrete by rebound hammer test as per I.S. 13311, determination of Quality of concrete by ultrasonic pulse velocity test. | | |
| **Topics 4: Quality Control of Concrete**<br>**Specific Objectives:**<br>➢ Describe various concrete operations.<br>**Contents:**<br>4.1: **Concreting Operation**……**16 Marks**<br>**Batching**- Definition and Types of Batching.<br>**Mixing**- Types of Mixing and Types of mixers.<br>**Form work** : Form work for concreting, different types of form works for members like beams, slabs, Columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456-2000 provision for different structural members.<br>**Transportation**: Modes of transportation of concrete, precautions to be taken during transportation.<br>**Placing**: placing of concrete in form work, precautions to be taken while placing of concrete.<br>**Compaction of concrete**: methods of compaction, care to be taken during compaction.<br>**Finishing of concrete**: purpose of finishing, types of Finishing.<br>**Curing of concrete**: definition of curing, necessity of curing, different methods of curing and their application<br>4.2: **Waterproofing and Joints of concrete:**…….08 Marks<br>**Waterproofing**: Importance and need of waterproofing, methods of Waterproofing and materials used for waterproofing.<br>**Joints in concrete construction**: Types of joints, joining old and new concrete, methods of joining, Materials used for filling joints. | 12 | 24 |

| | | |
|---|---|---|
| **Topics 5: Chemical Admixture in concrete, Special Concrete and, Extreme weather concreting**<br><br>**Specific Objectives:**<br>➢ State the uses of admixture in concrete.<br>➢ Describe special concrete.<br><br>**Contents:**<br>5.1: Chemical admixture in concrete:…….. 08 Marks<br>Purpose of using admixtures, Properties, and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixture, air entraining admixture and super plasticizers.<br>5.2: Special Concretes:- …….. 08 Marks<br>Properties, Advantages and Limitation of the following types of Special concrete:<br>Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete, Self compacting concrete, Light weight concrete.<br>5.3: Extreme weather concreting: ……. 04 Marks<br>Effect of cold weather and hot weather on Concrete, precautions to be taken while concreting in hot and cold Weather condition. | 08 | 20 |
| **Total** | **48** | **100** |

**Practicals:**
**Skills to be developed:**

**Intellectual Skills**:
1. Analyze the given data
2. Select proper method for analysis
3. Interpret the results

**Motor Skills:**
1. Measure the quantities accurately
2. Handle instruments properly

Term work shall consist of

**List of Practicals:**
1. Determine fineness of cement preferably by Blaine's air permeability apparatus Or by sieving.
2. Determine standard consistency, initial and final setting times of OPC.
3. Determine compressive strength of ordinary Portland cement.
4. Determine silt content in sand by volume and bulking of sand.
5. Determine bulk density and water absorption of fine and coarse aggregates.
6. Determine Fineness modulus of fine and coarse aggregate by sieve analysis.
7. Determine aggregate impact value.
8. Determine aggregate abrasion value.

**Mini Project:**
Determination of design mix proportion by mass for M 20 grade of concrete using I.S. Method for given data ( such as grading zone of sand, proportion of 20 mm and 12.5 mm metals, specific gravities of cement, sand and aggregate, water absorption of sand and aggregate, compacting factor and exposure condition).

**Learning Resources:**

1. **Books:**

| Sr. No. | Author | Title | Publisher |
|---|---|---|---|
| 1 | M. S. Shetty | Concrete Technology | S. Chand Publication |
| 2 | M. L. Gambhir | Concrete Technology | Tata Mc-Graw. Hill Publishing Co. Ltd. New Delhi |
| 3 | A. M. Neville and J. J. Brooks | Concrete Technology | Pearson Education Pvt. Ltd. New Delhi |
| 4 | A.R. Santhakumar | Concrete Technology | Oxford University Press. |
| 5 | A. M. Neville | Properties of Concrete | Pearson Education Pvt. Ltd. New Delhi |

2. **CDs, PPTs Etc.:**

CD or PPT of above experiments developed by NITTTR and NPTEL (if available) shall be shown to the students on T. V. / L.C.D. projector prior to the conductance of above experiments.

3. **IS, BIS and International Codes:**

1. I.S.4031- (Part 1 to Part 6) Indian standard method of physical tests for hydraulic Cement, BIS, New Delhi.

I.S. 4031 (Part 1) - 1996 Part 1 - Determination of fineness by dry sieving.

I.S. 4031 (Part 2) - 1999 Part 2 - Determination of fineness by air permeability Method.

I.S. 4031 (part 3) - 1988 (reaffirmed 2000) Part 3– Determination of soundness

I.S. 4031 (part 4) - 1988 (reaffirmed 1995)

Part 4 - Determination of consistency of standard cement paste.

I.S.4031 (part 5) - 1988, (reaffirmed 2000) Part 5 - Determination of initial and final setting times

I.S: 4031 (part 6) - 1988, (reaffirmed 2000) Part 6 - Determination of Compressive strength of hydraulic cement other than masonry cement

2. I.S: 2386 (part i to part vi) – 1963 Indian standard methods of test for aggregate for Concrete. BIS, New Delhi.

Part i - Particle size and shape. (Reaffirmed 1997)

Part ii - Estimation of deleterious materials and organic impurities. (Reaffirmed 2002)

Part iii - Specific gravity, density, voids, absorption and bulking. (Reaffirmed 1997)

Part iv - Mechanical properties (reaffirmed 1997)

Part v - Soundness. (Reaffirmed 1997)

Part vi - Measuring mortar making properties of fine aggregate. (Reaffirmed 2002)

3. I.S: 383 - 1970 Indian standard specification for coarse and fine aggregates from Natural sources for concrete. B.I.S., New Delhi.
4. I.S: 1911 - 1959 **(**reaffirmed**)** Indian Standard methods of sampling and analysis of concrete), B.I.S.., New Delhi.
5. I.S: 456 - 2000 Indian standard, plain and reinforced concrete – code of practice. (fourth revision ), B.I.S.., New Delhi.
6. I.S: 516 - 1959 Indian standard methods of tests for strength of concrete (xii reprint December 1987), B.I.S., New Delhi.
7. I.S.: 8112- 1989 Indian standard - 43 grade ordinary portland cement Specification
8. I.S: 12269 - 1987 (reaffirmed 1999) Indian standard specification for 53 grade O.P.C..
9. I.S: 9103 - 1999 Indian standard – concrete admixtures specification
10. I.S.: 455- 1989 (reaffirmed 1995) - Indian standard – Portland slag cement specification
11. I.S.: 1489 (part 1) 1991 - Portland - Pozzolana Cement – specification part 1 fly ash based
12. I.S.: 7861 (part 1) 1975 (reaffirmed 1997) - Indian standard of practice forextreme weather concreting part 1 recommended practice for hot weather concreting
13. I.S.: 7861 (part 2) - 1981 (reaffirmed 1997) - Indian standard of practice

For extreme weather concreting part 2 - recommended practice for cold weather concreting

13. I.S : 8041 - 1990 - Indian standard - rapid hardening Portland Cement specification BIS-New Delhi
14. I.S: 12330 - 1988 (reaffirmed 1995) - Indian standard specification for sulphate resisting Portland cement
15. I.S. : 12600 - 1989 ( reaffirmed 1995) - Portland cement, low heat Specification
16. I.S. : 10262 - 1982 Indian standard recommended guidelines for concrete mix Design
17. Sp 23 handbook on concrete mixes (based on Indian standards)
18. I.S. 13311 (part-1 and 2) - 1992 methods of non-destructive testing of concrete. part-1 ultrasonic pulse velocity, part-2 rebound hammer.

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Fifth for CE/CR/CS and Sixth for CV**

**Subject Title : Design of Steel Structures**

**Subject Code : 17505**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 04 | 100 | -- | -- | 50 @ | 150 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Design of Steel Structures is a technological subject. Steel is commonly used as a construction material for various steel structures such as steel girders, steel bridges, steel trusses, columns, towers, gantry girders, chimney, railway bridges, industrial buildings, water tanks, etc. For the design of steel structures, the properties of steel, different steel sections, various grades and strength characteristics of steel are required. The analysis and design of the steel members in the curriculum is to be done as per IS:800-2007.

The topic on different types of loads will be useful for finding different stresses, members and then deciding the section for the members of the structures. The topic on design of joints will be useful for designing bolted and welded connections. The topic on design of tension and compression members will be useful for the design of relevant members in roof trusses.

The topic on design of beams, columns with column bases and steel roof truss will be useful for the complete design of steel structure.

The total content of this subject will be useful for developing insight for the design concepts and will help student in effective supervision and quality control on site.

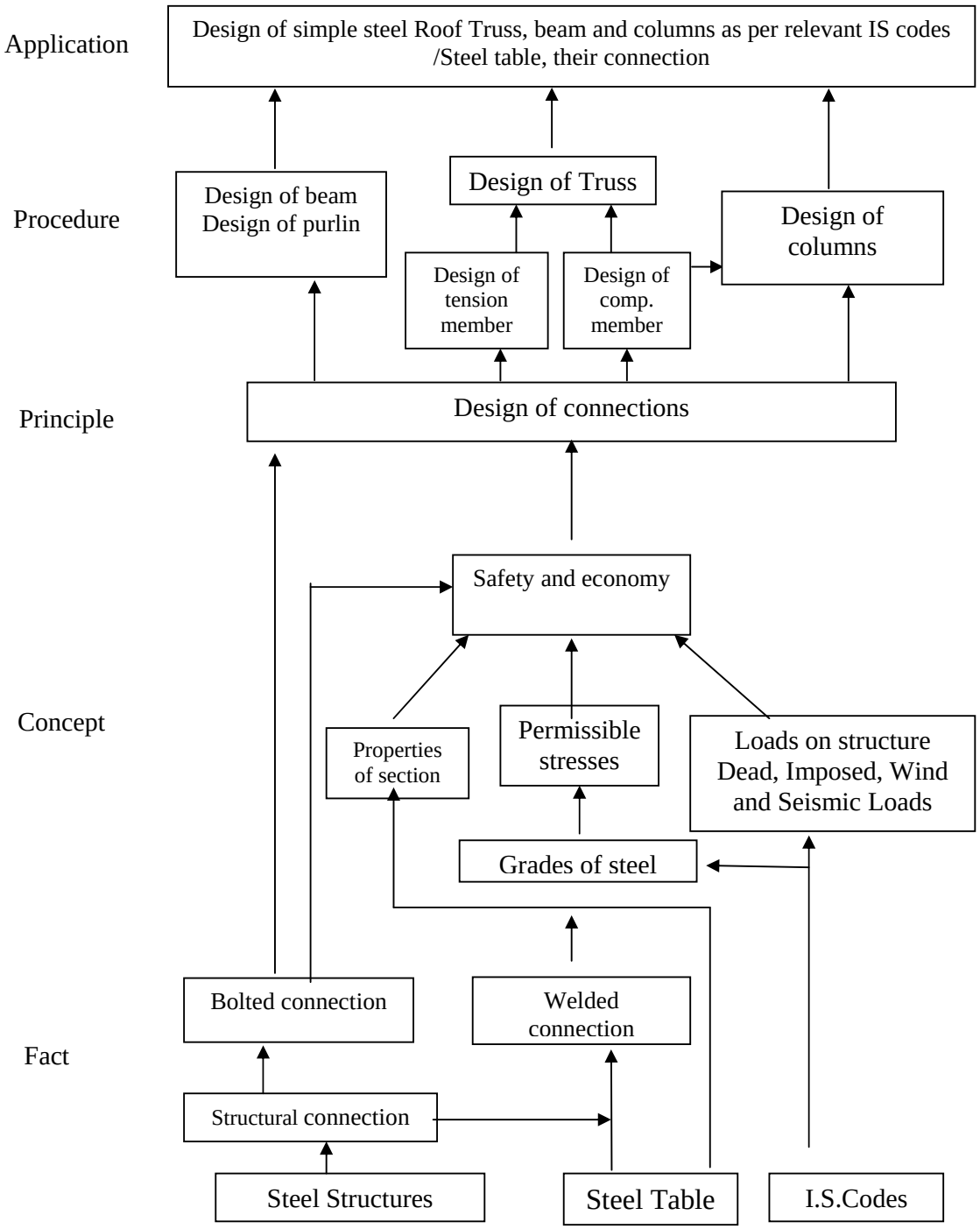
**General Objectives**:

Students will be able to:

1) Understand the analysis of forces acting on different members and select proper material and sections from steel table.
2) Understand the design of tension members, compression members, beams, purlins, column bases and steel roof trusses and understand design values for members using IS 800-2007.
3) Understand and interpret the fabrication drawings and structural drawings.
4) Understand the drawings of designed sections of steel roof truss and its connections.

5) Understand the use of IS 875-1987 part I to IV, provisions for dead loads, live loads and wind loads and seismic loads (Earthquake loads)

**Learning Structure:**



**Contents: Theory**

| Topic and contents | Hours | Marks |
|---|---|---|
| **Topic 1. Introduction**<br>**Specific Objectives:**<br>➢ State various grades of steel and their strength parameters<br>➢ List various properties of steel sections used for steel structures.<br>➢ Use steel table and IS code for finding different properties of steel sections.<br>**Contents :**<br>• Advantages and disadvantages of steel as construction material.<br>• Overview of common steel structures: Functions and components of common steel structures like steel towers, roof trusses, steel water tanks, steel bridges, gantry and crane girders, steel columns, steel chimney, building frames<br>• Types of sections used, Grades of steel and strength Characteristics use of steel table IS 808-1989. Typical stress-strain graph for mild steel and salient points in it<br>• Types of loads coming on steel structures according to IS 875-1987 part I to IV a) Dead loads b) Live loads c) Impact load d) Snow loads<br>• Loads due to seismic forces - Definition, Methods of calculating seismic forces (IS 1893-2002), Zone factor (Z), Importance factor (I), Response reduction factor (R), Fundamental natural period (T). (No numerical problems)<br>• Methods of Design: Working stress method, Limit State Method.<br>• Introduction to Limit State Method of design: Meaning and types of limit states, loads, design criteria, limit states of strength, limit states of serviceability. Factors of safety and load factors. | 03 | 08 |
| **Topic 2. Joints in Steel Structures (Limit State Method):**<br>**Specific Objectives :-**<br>➢ State types of steel joints and their modes of failure.<br>➢ Design bolted and welded steel joints.<br>**Content:**<br>**a) Bolted connections :**<br>• Type of bolts: Black bolts and High strength bolts and their use. Types of joints and failure modes. Specifications for cross-sectional area, pitch, spacing, gauge, end distance, edge distance, bolt holes for bolted connections<br>• Design strength of bolt in shear, tension and bearing<br>• Analysis and design of bolted joints for axially loaded single and double angle members<br>• Diagrams of beam-to-beam and beam-to-column bolted connections (No numerical problems)<br>**b) Welded connections :**<br>• Introduction and types of welds – butt and fillet. Advantages and disadvantages of welded connections, size of weld, throat thickness<br>• Analysis and design of welded joint (only fillet weld) for single and double angle members subjected to axial load. | 06 | 16 |
| **Topic 3. Design of Tension Members (Limit State Method)**<br>**Specific Objectives** :<br>➢ State different types of tension members.<br>➢ List types of steel sections used for tension members. | 08 | 16 |

| | | |
|---|---|---|
| ➢ Analyze and design tension member connected by bolted and welded joints<br>**Contents :-**<br>• Design of Tension Members:<br>Types of sections used. Design strength governed by yielding of section, rupture of net cross-section and block shear.<br>• Analysis and design of axially loaded single angle and double angle tension members with bolted and welded connections. | | |
| **Topic 4. Design of Compression Members (Limit State Method)**<br>**Specific Objectives** :-<br>➢ State different types of steel sections used for compression members<br>➢ Analyze and design compression member connected by bolted and welded joints<br>**Contents** :-<br>• Types of steel sections used for compression members, effective length, radius of gyration, slenderness ratio and its limits, design compressive stress.<br>• Analysis and design of axially loaded continuous angle struts connected by bolted and welded connections with gusset plate. Limits of width to thickness ratios to prevent local buckling.<br>• Stanchions and columns – Meaning and diagrams of simple and built-up sections (two angles, two I-sections, two channels placed back to back and toe to toe). No numerical problems.<br>• Introduction to lacing and battening: Meaning and purpose. Diagrams of single and double lacing and battening system. No design. | 08 | 16 |
| **Topic 5. Beams (Limit State Method)**<br>**Specific Objectives** :-<br>➢ List different sections used for beams.<br>➢ Draw loading, shear force and bending moment diagram developed in beam due to udl<br>➢ Analyze and design of simple beam sections subjected to udl<br>**Contents** :-<br>• Different steel sections used for beams, simple and built-up sections.<br>• Meaning of Plastic (Class-1), Compact (Class -2), Semi-compact (Class-3) and Slender (Class-4 sections).<br>• Flexural analysis and design of simple beams (only for Class-4 sections) which are laterally supported and subjected to uniformly distributed load<br>• Check for shear and deflections: Meaning and purpose. Diagrams of typical cross sections of bolted and welded plate girder. Diagrams showing components of plate girder. | 06 | 12 |

| | | |
|---|---|---|
| **Topic 6. Column Bases (Limit State Method)**<br>**Specific Objectives** :-<br>➢ Draw components parts of steel foundations.<br>➢ Draw the sketch of slab base and gusseted base foundations<br>➢ Analysis and design slab base foundation.<br>**Content** :-<br>• Types of steel foundations-<br>Slab Base foundations, Gusseted base foundations<br>• Design of Slab base foundations<br>• Introduction to Gusseted base Foundations: Meaning and purpose. No numerical problems on design of gusseted base foundations. | 06 | 12 |
| **Topic 7. Steel Roof Truss (Limit State Method)**<br>**Specific Objectives**:<br>➢ List types of Steel Roof trusses used in Industries. Analyze and design component parts of Steel Roof truss.<br>➢ Calculate dead load, live load and wind load acting on steel roof truss.<br>➢ Draw the detailed connections of different members at nodal points, connections at column supports.<br>**Contents**:<br>• Types of Steel Roof trusses for different spans (Simple and Compound Fink, Pratt, Howe, Fan, North Light roof truss)<br>• Calculation of panel point loads for dead load, live load and wind load as per IS 875-1987.<br>• Graphical method of finding forces in different members of truss due to dead load, live load and wind load<br>• Force combination table, design of members of truss.<br>• Design of angle purlin as per IS recommendations.<br>• Arrangement of members at supports and at joints. | 11 | 20 |
| **Total** | **48** | **100** |

**PRACTICALS:**

**Skills to be developed**

**Intellectual Skills:**

i) Design of structural components of steel structures.
ii) Interpretation of structural drawings for the components designed.

**Motor Skills:**

i) Preparing structural drawings for execution of steel structures.

Term work is to be prepared by each student as below.

Term work shall consists of sketchbook and design report of steel roof truss for an industrial building, two full imperial size sheet shall be used for drawings.

**1. Sketch Book:**

Sketch book shall consist of any eight plates out of the below mentioned.

2) Types of steel sections (like angles, channels, girders, plates, etc)

3) Sketches of different types of built up sections used as tension and compression members.
4) Types of trusses for different span.
5) Lap bolted joint and butt bolted joint, bolt failure in single and double shear.
6) Gusseted base foundation,
7) Slab base foundation
8) Connections of beam to beam and beam to column.(Framed and seated connections using bolts and welds)
9) Cross section of bolted and welded plate girder, sketch of end bearing stiffner.
10) Lacing and Battening (Single and double Lacing system)
11) Effective length of compression members for different end connections.

**2. Design of steel Roof truss:-**

1) The student should draw two full imperial size sheets covering design of steel roof truss any one of the truss- Fink, Pratt, Fan, Howe truss for span 16 to 20 m , the design shall cover calculations for the dead load, live load, wind load with a design of various elements. The drawing shall include detailing the truss for below mentioned elements

a) Key plan showing the details of factory shed.
b) Graphical analysis of loads due to dead load live load and wind load.
c) Half section of designed roof truss showing details : Support connection, connection of ridge tile, connection of purlin, roof covering and cleat angle.

**Learning Resources:**
**1. Books**

| Sr. No. | Author | Title | Publisher |
|---|---|---|---|
| 1 | Dr. V. L. Shah and Mrs. Veena Gore | Limit State Design of Steel Structures | Structures Publications, Pune |
| 2 | Dr. M. R. Shiyekar | Limit State Design of Steel Structures | PHI Learning |
| 3 | P. Dayarathnam | Design of Steel Structures | S. Chand and Company |
| 4 | Ghose | Analysis and Design Practices of Steel Structures | PHI Learning |
| 5 | Sairam | Design of Steel Structures | Pearson Publication |

**2. IS, BIS and International Code**

1. IS800-2007 Indian Standard code of practice for use of structural steel in general building construction, BIS New Delhi.
2. IS-875-1987 Part-1 to 5: Indian Standard Code for Loading Standards.
3. IS hand book No. 1 Properties of structural steel rolled section.
4. Steel tables.

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/ EE/EP/CH/PS/CD/ED/EI/CV/FE/FG/IU/MH/MI/TX/TC/DC/AU**

**Semester : Fifth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/EE/EP/CH/PS/AU and Sixth for CD/MH/IU/CV/FE/FG/MI/ ED/EI/DC/TC/TX**

**Subject Title : Behavioural Science**

**Subject Code : 17075**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 01 | -- | 02 | -- | -- | -- | 25 # | 25 @ | 50 |

**Rationale:**

With increased globalization and rapid changing business expectations, employers are looking for wide cluster of skills to cater to the changing demand. Personality traits and soft skills are playing a key role in a student's career in this changing scenario. Corporate houses look for soft skills that supplement hard skills.

Addition of behavioural science in curriculum is intended to enhance the efficiency of a person so that he can contribute to overall growth of organisation. It aims at developing insight into leadership, team building, motivation, interpersonal relationship, problem solving, decision making and aspects of personality in a technician's profile. Addition of the topic of organizational culture will further mould him/ her in the organisational role.

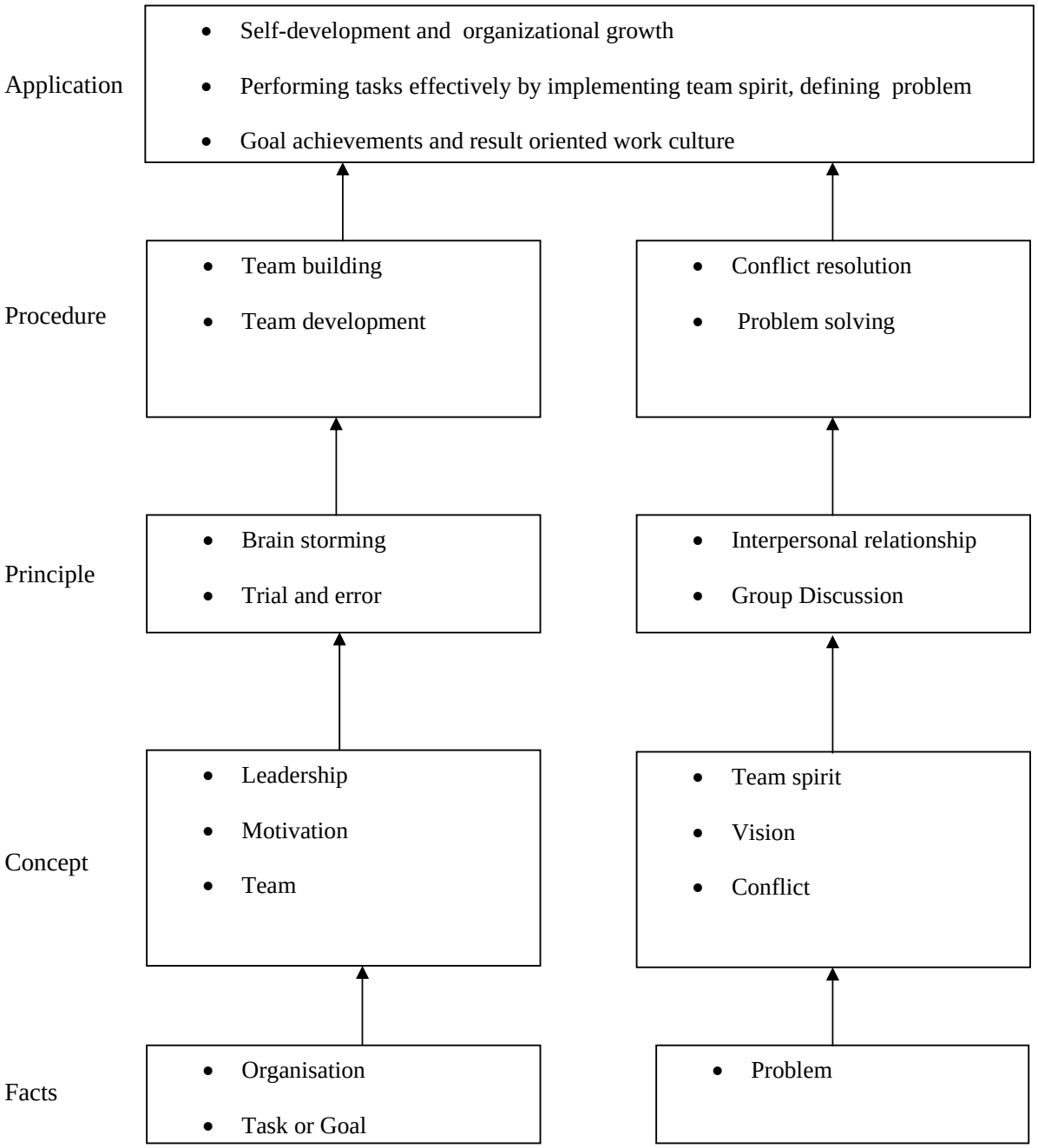
This subject of 'Behavioural Science' provides a broad base in which a technician can develop a successful career in the world of work.

**General Objectives:**

After studying this subject, the students will be able to:

1. Develop him/her as Team leader.
2. Use self-motivation and motivate others.
3. Build a team and develop team spirit among the team members.
4. Improve the interpersonal relationship skills.
5. Learn Problem solving and decision making skills.
6. Discuss a particular topic in a group and face the interview.

## Learning Structure:



**Theory:**

| Topic and Contents | Hours |
|---|---|
| **Topic 1: LEADERSHIP**<br>Contents:<br>1.1 Introduction – Importance, examples of different types of leaders.<br>1.2 Meaning and Definition of Leadership.<br>1.3 Leadership qualities – Confidence, Vision, Communication Skills, influencing people etc.<br>1.4 Types of Leadership styles, their advantages and disadvantages – Autocratic, Democratic, Delegative, Bureaucratic and Laizze Fairie. | 02 |
| **Topic 2: MOTIVATION**<br>Contents:<br>2.1 Meaning and Definition of motivation.<br>2.2 Types of motivation.<br>2.3 Maslow's Motivation theory.<br>2.4 Job characteristic model to enhance motivation. | 03 |
| **Topic 3: TEAM BUILDING**<br>Contents:<br>3.1 Definition of Team.<br>3.2 Difference between Group and Team.<br>3.3 Need for formation of good team (vision, trust, cooperation, initiative, etc.)<br>3.4 Approach to Team building (Personality based, activity based, skill based, problem solving based, etc.) | 02 |
| **Topic 4: CONFLICT RESOLUTION**<br>Contents:<br>4.1 Definition of Conflict.<br>4.2 Types of Conflict – Functional and Dysfunctional<br>4.3 Sources of Conflict – Ego, Authority, Frustration etc.<br>4.4 Positive and Negative effects of conflicts.<br>4.5 Methods of Conflict resolution – Compromising, withdrawal, forcing. | 04 |
| **Topic 5: PROBLEM SOLVING AND DECISION MAKING**<br>Contents:<br>5.1 Steps in Problem Solving.<br>5.2 Methods used for solving problems – trial and error method, brain storming, lateral thinking method.<br>5.3 Techniques used for Decision making- Decision tree, Decision Matrix, Mind Mapping etc. | 03 |
| **Topic 6: GROUP DISCUSSION AND INTERVIEW TECHNIQUES**<br>Contents:<br>6.1 GROUP DISCUSSION<br>• Objectives of Group Discussion (ability to work in team, speaking and listening skills, leadership, creativity)<br>• Does and Don'ts of Group Discussion.<br>• How to conclude Group Discussion. | 02 |

| | |
|---|---|
| 6.2 INTERVIEW TECHNIQUES<br>• Types of Interviews. (patterned, stress, behavioural)<br>• Dress Code, Body Language and Communication Skill.<br>• Probable questions for Interview.<br>• Telephonic or Video Interview. | |
| **Total** | **16** |

**Practical:**
**Skills to be developed:**

**Intellectual Skills**:

1. Develop ability to find his strengths.
2. Select proper source of information.
3. Follow the technique of time and stress management.
4. Set the goal.

**Motor Skills:**

1. Follow the presentation of body language.
2. Work on internet and search for information.
3. Prepare slides / transparencies for presentation.

**List of Practicals / activities:**

1. Form a group of 4 or 5 students and discuss the topic 'Qualities of an effective leader'. Each group will prepare its list with justification to the entire class and write an assignment under the guidance of subject teacher.
2. Form a pair of student and each one from pair will ask each other questionnaire on motivation, self-motivation, experiences that motivated him or other which him for success in the past and write an assignment under the guidance of subject teacher based on discussion.
3. Form a group of 4 or 5 students and assign them a group activity such as 'making a shape from match stick (50 to 100 match sticks) without guidance and without group discussion.
4. The group as in activity 3 will now perform the same activity. After group discussion and under guidance of subject teacher, each student from a group will write an assignment for both the activities and write their inferences with reference to group discussion, team development, team building, etc.
5. Form a group of 8 to 10 student and arrange a group activity such as;
   - Industrial visit.
   - Visit to any historical place/fort/museum, etc
   - Housekeeping and cleaning of any laboratory/seminar hall for any function.

   After the execution of activity student will write an assignment under guidance of teacher keeping in mind individual role, purpose of activity, inter dependency of work or task, coordination of person and task involved and final performance.
6. Write an assignment on interpersonal relationship and conflict management with student's personal experience of solving conflicts.
7. Form a group of 20 students and ask them to prepare a list of 8 to 10 problems affecting the institute. Subject teacher should analyze one such problem on black board using 'Fish bone technique' with the participation of students. Students will write an assignment consisting;
   - Apparent problem statement.
   - Analysis of the causes.
   - Definition of real problem.

8. The subject teacher starts the session with 'Statement of the problem' written on the black board. After ensuring that all the participants are at the same level of understanding the statement of problem, he initiates NGT (Normal Group Technique) to arrive at maximum possible number of creative solutions.
   Based on ranking matrix the group will arrive at feasible solutions and students will write an assignment consisting of;
   - Problem Statement.
   - Model of problem solving.
   - List of creative solution suggested by participants.
   - Write the most feasible solution based on given criteria.

9. Form a group of 4 to 5 students and give them a topic for GD for 10 to 15 minutes. Teacher should analyse GD on certain parameters and students will write an assignment on aspects of GD and prepare a format (suggested or designed by teacher) which gives details of GD carried out.
10. Arrange a guest lecture of H.R. Person from industry/expert in interview technique and conduct mock interview of each student. Student should write a report on this activity.
11. Arrange a visit to industry and gather information about organisation, product, turnover, work culture, vision/mission statement, quality policy, Corporate social responsibility etc and write a report on it.

**Note - Subject teacher shall guide the students in completing the assignments based on above practicals.**

**Learning Resources:**
**Books:**

| Sr. No. | Author | Name of Book | Publication |
|---|---|---|---|
| 1 | Subject Experts-MSBTE | Handbook and assignment book on Development of Life Skills-II | MSBTE |
| 2 | Dr. Kumkum Mukherjee | Principles of management and organizational behaviour | Tata McGraw Hill Education Pvt Ltd. |
| 3 | Dr.T.Kalyana Chakravarti Dr.T.Latha Chakravarti | Soft Skills for Managers | Biztantra |
| 4 | Barun K Mitra | Personality Development and soft skills | Oxford University Press |
| 5 | Priyadarshini Patnaik | Group discussion and interview skills | Foundation Books |

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Fifth for CE/CR/CS and Sixth for CV**

**Subject Title : Entrepreneurship Development**

**Subject Code : 17057**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS. | TH | PR | OR | TW | TOTAL |
| -- | -- | 02 | -- | -- | -- | -- | 25@ | 25 |

**Rationale:**

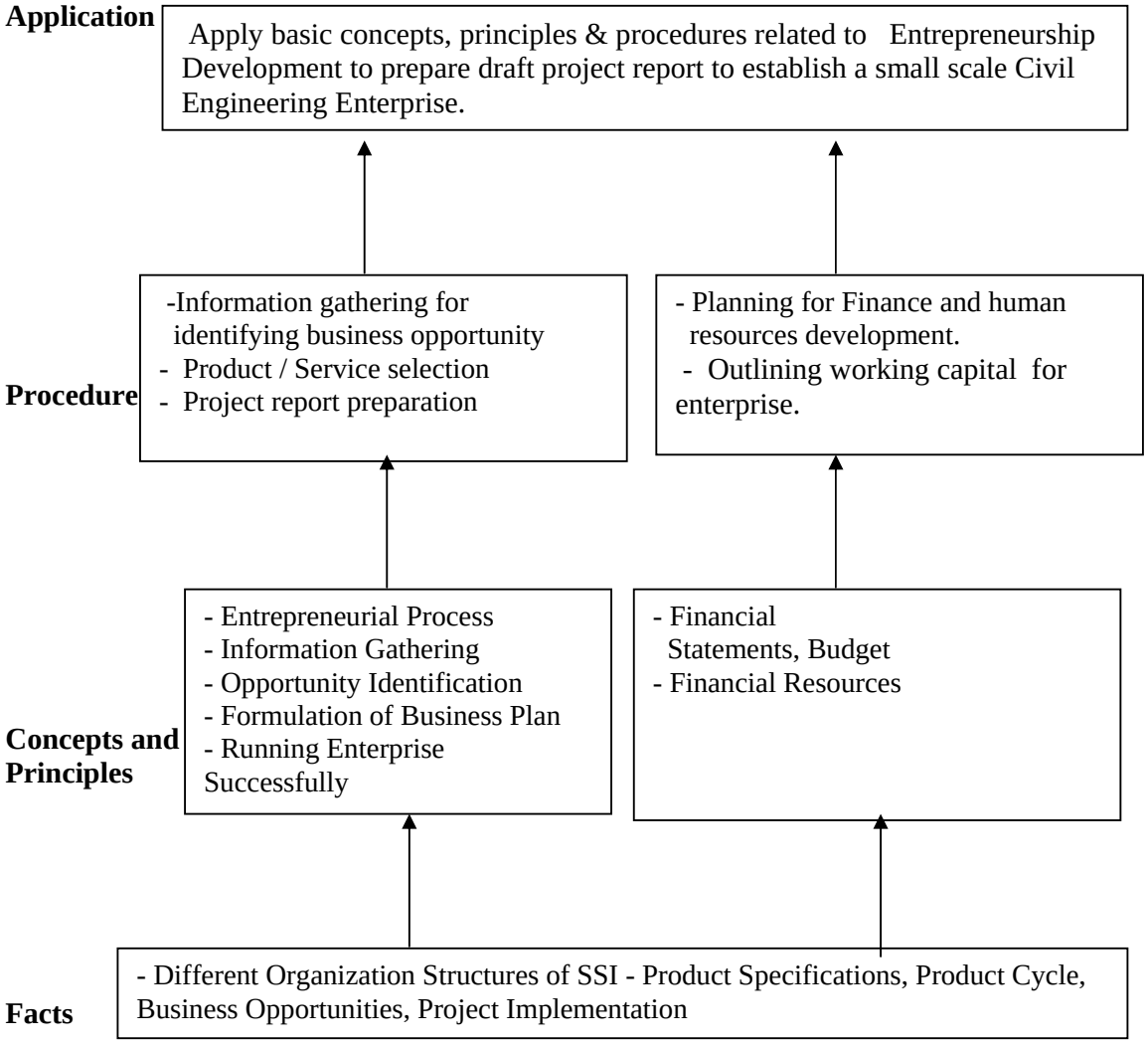
Globalization, liberalization and privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities and translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. The educational institutions should also demonstrate their uniqueness in the creation of enterprising personalities in their colleges. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

**General objectives:**

**Students will be able to**

1. Appreciate the need of Entrepreneurship development in the context of Globalization and Liberalization
2. Develop the entrepreneurial qualities.
3. Understand the enterprises establishment process.
4. Understand role of various agencies promoting Entrepreneurship development.
5. Understand financial and human resource management for an enterprise.
6. Draft a detailed project report to start a small enterprise.

**Learning Structure:**



**Theory:**

| Topics and Contents |
|---|
| **Topic 1: Small Business Enterprise and Entrepreneurship Development**<br>**Specific Objectives:**<br>Students will be able to,<br>➢ State the need of Entrepreneurship development.<br>➢ Classify enterprises<br>➢ Prepare Profile of successful entrepreneur<br>**Contents:**<br>• Concept of Enterprise, Small Business Enterprise, Entrepreneurship, Entrepreneurship Development.<br>• Need of Entrepreneurship Development-<br>Growth of small scale industries and its role in economic development, Govt. Policy in development of SSI, recent industrial policy<br>• Characteristics of entrepreneur, classification of entrepreneurs based on functional characteristics<br>• Integrated model of Entrepreneurial development<br>• Profile of successful entrepreneurs. |
| **Topic 2: Institution Supporting Enterprises**<br>**Specific Objectives:**<br>Students will be able to,<br>➢ Outline role of various agencies supporting Entrepreneurship development.<br>➢ Shortlist suitable financing agencies for financial assistance.<br>➢ Describe venture capital for establishing an enterprise.<br>**Contents:**<br>• Central level institutions- SSI board, KVIC, SIDO, NPC, NSIC, NISIET, NIESBUD, IIE, EDI,<br>• State level institutions- DI'S,DIC,SFC'S,SIDC'S,SSIDC'S<br>• Others- NABARD, Industry associations, NGOs and Research and Development labs<br>• Concept of Venture capitals. |
| **Topic 3: Establishing Small Business Enterprise**<br>**Specific Objectives:**<br>Students will be able to,<br>➢ Identify business opportunity considering local needs.<br>➢ Select product/service for the enterprise.<br>➢ Prepare draft for project report.<br>➢ Outline for registration process.<br>**Contents:**<br>• Identifying the business opportunities in civil engineering field<br>• Steps involved in establishing an enterprise-selection of a project-product/service selection, location selection, project feasibility study, business plan preparation, proforma for project report preparation<br>• Deciding the constitution of enterprise-sole proprietorship, partnership, corporation, cooperatives and franchising<br>• Registration-provisional and permanent, arrange for land, machinery and infrastructure |
| **Topic 4: Financial and Human Resources Management**<br>**Specific Objectives:**<br>Students will be able to, |

- Estimate working capital for a small enterprise.
- Outline aspects of human resource development
- Enlist Laws related to environment and pollution control

**Contents:**

- Functions of financial management, Estimating working capital
- Functions of human resource development, aspects of human resource development
- Laws related to environment and pollution control

**Intellectual Skills**:

Skills to be developed.

- Gather information and interpret/ inference of the findings.
- Identify business opportunities.
- Prepare draft project proposal.
- Develop abilities like analysis, problem solving and decision making.
- Develop Risk taking abilities.

**List of Assignments:**

1. Identification of key traits for an entrepreneur (by administering self assessment questionnaire on students to identify strengths and weaknesses)
2. Preparation of profile of successful entrepreneur
3. Visit to a small civil Engineering business enterprise to interview the entrepreneur, study his business journey and prepare profile.
4. Prepare a draft of project report for a small Civil Engineering enterprise.
5. Prepare a chart showing various agencies to be contacted for starting an enterprise.

**Note:** Above assignments shall be completed in tutorial hours.

**Learning Resources:**

**1. Books:**

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Entrepreneurship and Small Business Management | P. M. Charantimath | Pearson Education, New Delhi |
| 2 | Entrepreneurship Development Small Business Enterprises | P. M. Charantimath | Pearson Education, New Delhi |
| 3 | India land of a Billion Entrepreneurs | Upendra Kachru | Pearson Education, New Delhi |
| 4 | Entrepreneurship Development | CPSC, Manila | Tata Mcgraw-Hill Publishing Company Limited, New Delhi |
| 5 | Entrepreneurship - Successfully Launching New Ventures | Bruce R.Barringer R.Daunce Ireland | Pearson Education, New Delhi |
| 6 | Stay Hungry Stay Foolish | Rashmi Bansal | CIIE, IIM,Ahmedabad |
| 7 | Entrepreneurship | Alpana Trehan | Wiley India, Delhi |
| 8 | Entrepreneurship | Robert Hisrich M.P.Peter D.A.Shephard | Tata Mcgraw-Hill Publishing Company Limited, New Delhi |

**2. CDs, PPTs Etc.:**

**Video Cassettes;**

b. 5 Success stories of first generation Entrepreneur

c. Assessing Entrepreneurial Competencies
d. Business opportunity selection and guidance
e. Planning for completion and growth
f. Problem solving – an Entrepreneur skill.

Source : EDI study material , Ahmedabad( near village Bhat, via Ahmedabad Airport and Indira Bridge), P.O Bhat-382428, Gujrat
Phone No. 079-3969163, 3969153
Email: ediindia@sancharnet.in
Website: www.ediindia.org

**3. Websites:**

1. www.ssi.nic.in
2. www.lubindia.org
3. www.laghu-udyog.com
4. www.techsmall.com
5. www.gin.sme.ne.ip
6. www.enterweb.org
7. www.entrepreneur.com
8. www.ediindia.org
9. www.bplans.com
10. www.sba.gov
11. www.pipdic.com
12. www.opportunityindia.net

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Fifth for CE/CS/CR and Sixth for CV**

**Subject Title : Professional Practices-III**

**Subject Code : 17058**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| -- | -- | 03 | -- | -- | -- | -- | 50@ | 50 |

**Rationale:**

Due to globalization and competition in the private and service sectors, the employment is based either on campus interview competitive test. In such process of selection normally the competencies like general confidence, leadership, and communication and presentation skill, problem solving techniques are normally ascertained through various tests.

The topic on group discussion will provide an opportunity for development of confidence in the students and enhance the communication and presentation skills.

Through information the student will be trained in assessing the information from various means and presenting the information in the specific format.

Various industrial visits will provide an avenue to a student to observe and understand various construction processes in the construction industry. Visits will expose a student to newer and latest technology, material and use of various machines in the construction industry. This will further impose his theoretical knowledge and may encourage him to become versatile in the profession as a diploma engineer.

**Practicals:**
**Objectives:**
**To develop the following skills**
**Intellectual Skills**:

1. Understand Leadership and problem solving skill through group discussion.
2. Understand the Preparation of legal documents of project.
3. Assess quality control parameters at site.
4. Give feasible solution for the burning problems for the benefit of society.

**Motor Skills:**

1. Do Information search?
2. Enlist information and data.
3. Take Field observations.
4. Prepare power point presentation.

| Name of the activity | Hours |
|---|---|
| **1. Group Discussion/ Expert Lecture (any one topic per batch)**<br>Suggested areas are,<br>i) Safety measures at construction site<br>ii) Green building<br>iii) Disaster Management<br>iv) New Trends in Civil Engineering as a service industry/Future challenges in Civil Engineering. | 06 |
| **2. Information Search and Data Collection (Any one topic)**<br>i) Housing project<br>ii) Legal documents required for an apartment building, such as P.R Card, 7/12, city survey map, sale-deed, N.A. order, building permission and completion certificate. (List and collect all sample documents) | 12 |
| **3. Industrial Visit (Any one)**<br>i) RCC framed structure building for study of its detail.<br>ii) Residential /Public building to study plumbing system<br>iii) Dam/canal/spill-way and gates.<br>iv) Water treatment/ sewage treatment plant. | 12 |
| **4. Seminar / Power Point Presentation (Any one)**<br>The seminar topic should be related to the latest technology/problems pertaining to civil engineering. Each student shall submit a report of 10to20 pages and deliver seminar for 10 minutes. | 18 |
| **Total** | **48** |

**List of assignment to be done by each student as a term work.**

**1. Report on Group Discussion**
The report should consist of: Name of topic, date of discussion, group size, name of group leader, introduction of the topic, concept, need, procedure, causes, sequence / operation, new trends, preventive measures, benefits to the society, conclusion(report should be of 3 to 5 pages).

**2. Report on information search and data collection**

The report should consist of: Title, Introduction, Need list of documents / photos / information searched from internet / magazines / reference books / Xerox document from Government Office to be attached and conclusion of the exercise. Help of owner/contractor/site engineer/ architect etc. may be taken.

**3. Report on industrial visit**

The report should consist of: Title, date of visit, place of visit, address of the project, contact numbers, type of the project, cost of the project/unit, Material Management, Labour Management, Tools and plants management, advanced techniques used, out put of the project, safety measures, flow chart, Xerox copies of plans/layout/drawings and conclusion.

**4. Seminar/power point presentation:**

The report should consists of: Name of topic, introduction, concept, facts, principles, procedures, latest technology, problem, litrature, solutions, benefits to the society, alternative methods, cost and benefit ratios, feasibility of the project, sample calculations and approximate costing, Xerox copies of drawings, layout, line plan, flow chart, pie chart or any graphical representation and conclusion etc. for the work / topic of the seminar. Presentation of 10 mints is expected.

**Learning Resources:**

1. Indian concrete journal.
3. Indian water works association journal.
4. Inside outside journal.
5. A to Z construction by Mantri Publishing House.
6. District Industries Centre - Project reports.
7. Building bye laws and rules of local bodies/ Town planning Acts.
8. Professional communication skills (Revised edition) by A.K. Jain, S. Chand & Co. Ltd New Delhi.
9. Technical communication with CD by Kogent Learning solutions by Wiley India Publications.
10. Effective Technical communication by Ashraf Rizvi, Tata McGrahill, New Delhi.
11. Guide to Presentations third editions by Mary Munter, Pearson Education.
12. The ACE of Soft Skills, Attitude, communication, and etiquettes for success, 1st edition by Gopalswamy Ramesh by Pearson Education.
13. Internet web sites.
    www.slideshow.com
    www. Maharashtra.gov.in

## Industrial Training (Optional)

- Students who have completed industrial training in summer vacation after 4th Semester will be granted exemption for activities related to topic 1 to 4.

- These students shall submit report of Industrial training signed and certified by authorities from Industry. Student will give seminar on industry training attended by him.

- Evaluation will be done on seminar and report submitted by student.

**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI**

**TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES**

**COURSE NAME : CIVIL ENGINEERING GROUP**

**COURSE CODE : CE/CS/CV**

**DURATION OF COURSE : 6 SEMESTERS for CE/CS ( 8 SEMESTERS for CV)** **WITH EFFECT FROM 2012-13**

**SEMESTER : SIXTH** **DURATION : 16 WEEKS**

**PATTERN : FULL TIME - SEMESTER** **SCHEME : G**

| SR. NO | SUBJECT TITLE | Abbreviation | SUB CODE | TEACHING SCHEME | | | EXAMINATION SCHEME | | | | | | | | SW (17600) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | PAPER HRS. | TH (1) | | PR (4) | | OR (8) | | TW (9) | | |
| | | | | TH | TU | PR | | Max | Min | Max | Min | Max | Min | Max | Min | |
| 1 | Management $ | MAN | 17601 | 03 | -- | -- | 1&½ | 50#* | 20 | -- | -- | -- | -- | -- | -- | |
| 2 | Highway Engineering | HEN | 17602 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | 25# | 10 | 25@ | 10 | |
| 3 | Contracts and Accounts | CAA | 17603 | 04 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 50@ | 20 | |
| 4 | Design of R.C.C. Structures | DRS | 17604 | 03 | -- | 04 | 04 | 100 | 40 | -- | -- | 25# | 10 | 50@ | 20 | **50** |
| 5 | **Elective (Any One)** | | | | | | | | | | | | | | | |
| | Solid Waste Management | SWM | 17605 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 25@ | 10 | |
| | Plumbing Services | PSE | 17607 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 25@ | 10 | |
| 6 | Project | PRO | 17088 | -- | -- | 06 | -- | -- | -- | -- | -- | 50# | 20 | 50@ | 20 | |
| | | | **Total** | **16** | **--** | **16** | **--** | **450** | **--** | **--** | **--** | **100** | **--** | **200** | **--** | **50** |

Student Contact Hours Per Week: **32 Hrs.**

**THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.**

Total Marks **: 800**

@ - Internal Assessment, # - External Assessment, [ ] No Theory Examination, $ - Common to all branches, #* - Online Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI**

**TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES**

**COURSE NAME : DIPLOMA IN CIVIL AND RURAL ENGINEERING**

**COURSE CODE : CR**

**DURATION OF COURSE : 6 SEMESTERS** **WITH EFFECT FROM 2012-13**

**SEMESTER : SIXTH** **DURATION : 16 WEEKS**

**PATTERN : FULL TIME - SEMESTER** **SCHEME : G**

| SR. NO | SUBJECT TITLE | Abbreviation | SUB CODE | TEACHING SCHEME | | | EXAMINATION SCHEME | | | | | | | | SW (17600) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | PAPER HRS. | TH (1) | | PR (4) | | OR (8) | | TW (9) | | |
| | | | | TH | TU | PR | | Max | Min | Max | Min | Max | Min | Max | Min | |
| 1 | Management $ | MAN | 17601 | 03 | -- | -- | 1&½ | 50#* | 20 | -- | -- | -- | -- | -- | -- | |
| 2 | Highway Engineering | HEN | 17602 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | 25# | 10 | 25@ | 10 | |
| 3 | Contracts And Accounts | CAA | 17603 | 04 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 50@ | 20 | |
| 4 | Design of R.C.C. Structures | DRS | 17604 | 03 | -- | 04 | 04 | 100 | 40 | -- | -- | 25# | 10 | 50@ | 20 | **50** |
| 5 | **Elective (Any One)** | | | | | | | | | | | | | | | |
| | Solid Waste Management | SWM | 17605 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 25@ | 10 | |
| | Plumbing Services | PSE | 17607 | 03 | -- | 02 | 03 | 100 | 40 | -- | -- | -- | -- | 25@ | 10 | |
| 6 | Rural Engineering | REN | 17087 | -- | -- | 02 | -- | -- | -- | -- | -- | -- | -- | 50@ | 20 | |
| 7 | Project | PRO | 17088 | -- | -- | 06 | -- | -- | -- | -- | -- | 50# | 20 | 50@ | 20 | |
| | | | **Total** | **16** | **--** | **18** | **--** | **450** | **--** | **--** | **--** | **100** | **--** | **250** | **--** | **50** |

Student Contact Hours Per Week: **34 Hrs.**

**THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.**

Total Marks **: 850**

@ - Internal Assessment, # - External Assessment, No Theory Examination, $ - Common to all branches, #* - Online Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

**Course Name : All Branches of Diploma in Engineering / Technology**

**Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/ CW/EE/EP/EU/CH/CT/PS/CD/ED/EI/CV/FE/IU/MH/MI/TX/TC/FG**

**Semester : Sixth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/CW/EE/EP/EU/CH/CT/PS/TX/TC/FG and Seventh for MH/MI/CD/ED/EI/ CV/FE/IU/FE**

**Subject Title : Management**

**Subject Code : 17601**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | -- | 1&½ | 50#* | -- | -- | -- | 50 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Management concepts are universal and it is a multidisciplinary subject. They are equally applicable to different types industries like Manufacturing, Service and Trade as well as different kind of business activities like industry, army, school, hospital, retail shops etc. Also, at the end of diploma course polytechnic students are expected to enter in to the Industrial Environment. This environment is altogether different and new to the students. A proper introduction and understanding of management fundamentals is therefore essential for all these students.

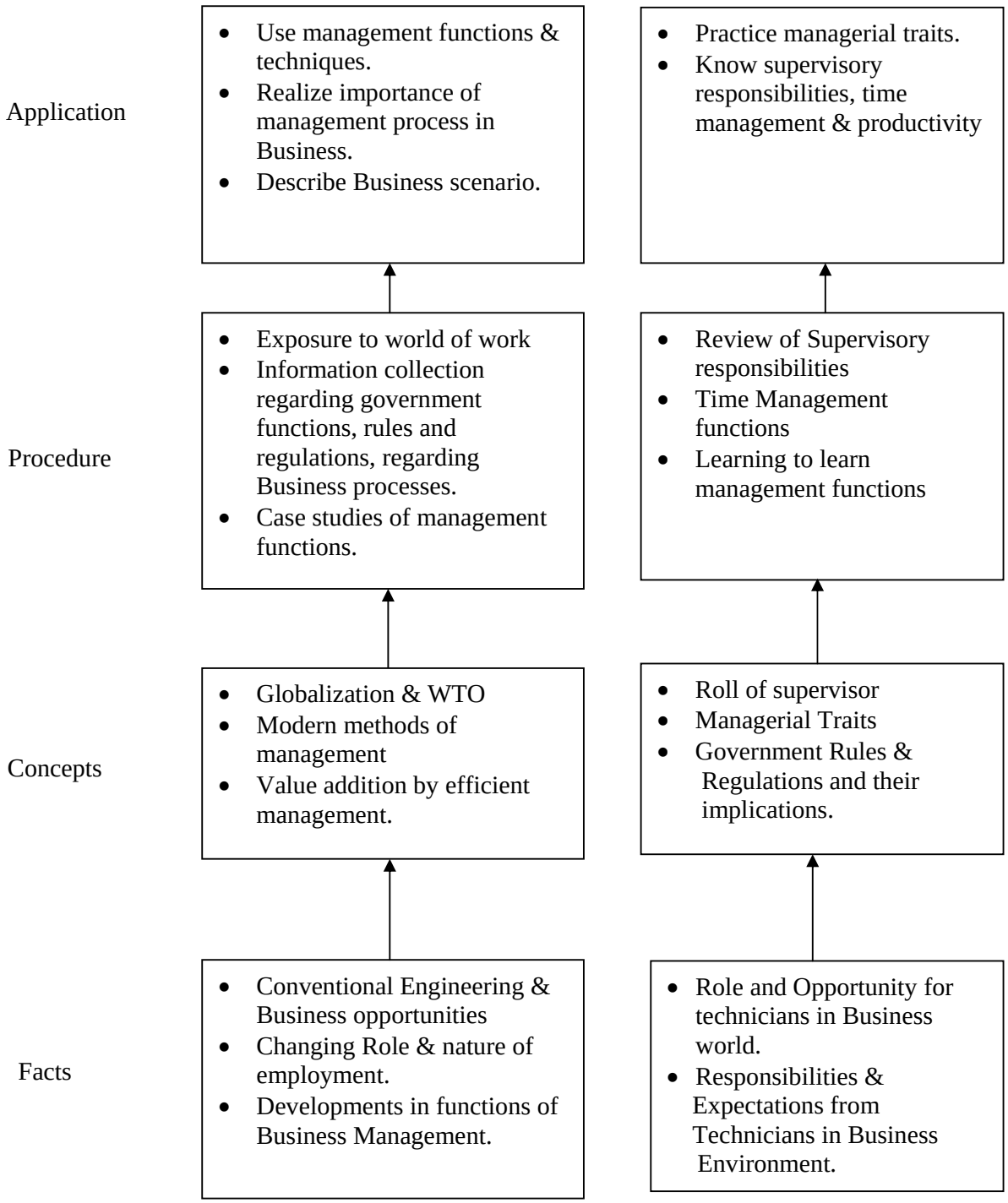
Contents of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

**Objective:**

The students will able to:

1. Get familiarized with environment related to business processes.
2. Know the management aspects of the organisations.
3. Understand Role & Responsibilities of a Diploma engineer.
4. Understand importance of quality improvement techniques.
5. Appreciate need and importance of safety in industries.
6. Understand process of Industrial finance and its management.
7. Know the latest trends in industrial management.

**Learning Structure:**



**Contents: Theory**

| Topic and contents | Hours | Marks |
|---|---|---|
| **Topic 1: Overview of Business**<br><br>**Specific Objectives:**<br>➢ State various business types and sectors<br>➢ Describe importance of globalisation<br>1.1. Types of Business<br>• Service<br>• Manufacturing<br>• Trade<br>1.2. Industrial sectors Introduction to<br>• Engineering industry<br>• Process industry<br>• Textile industry<br>• Chemical industry<br>• Agro industry<br>• IT industry<br>• Banking, Insurance, Retail, Hospitality, Health Care<br>1.3 Globalization<br>• Introduction<br>• Advantages & disadvantages with respect to India | 02 | 04 |
| **Topic 2: Management Process**<br><br>**Specific Objectives:**<br>➢ State various management principles<br>➢ Describe different management functions<br>2.1 What is Management?<br>• Evolution<br>• Various definitions of management<br>• Concept of management<br>• Levels of management<br>• Administration & management<br>• Scientific management by F.W.Taylor<br>2.2 Principles of Management (14 principles of Henry Fayol)<br>2.3 Functions of Management<br>• Planning<br>• Organizing<br>• Directing<br>• Controlling<br>• Decision Making | 08 | 08 |
| **Topic 3: Organisational Management**<br><br>**Specific Objectives:**<br>➢ Compare different forms of organisation , ownership for a specific business<br>➢ Describe types of departmentation<br>3.1 Organization :<br>• Definition | 08 | 08 |

| | | |
|---|---|---|
| • Steps in organization<br>3.2 Types of organization<br>• Line<br>• Line & staff<br>• Functional<br>• Project<br>3.3 Departmentation<br>• By product<br>• By process<br>• By function<br>3.4 Principles of Organisation<br>• Authority & Responsibility<br>• Span of Control<br>• Effective Delegation<br>• Balance ,stability and flexibility<br>• Communication<br>3.5 Forms of ownership<br>• Proprietorship<br>• Partnership<br>• Joint stock<br>• Co-operative Society<br>• Govt. Sector | | |
| **Topic 4: Industrial Safety and Legislative Acts**<br><br>**Specific Objectives:**<br>➢ Describe types of accidents & safety measures<br>➢ State provisions of industrial acts.<br>4.1 Safety Management<br>• Causes of accidents<br>• Types of Industrial Accidents<br>• Preventive measures<br>• Safety procedures<br>4.2 Industrial Legislation - Necessity of Acts<br>Important Definitions & Main Provisions of following acts:<br>• Indian Factory Act<br>• Workman Compensation Act<br>• Minimum Wages Act | 08 | 06 |
| **Topic 5: Financial Management (No Numerical)**<br><br>**Specific Objectives:**<br>➢ Explain functions of financial management<br>➢ State the sources of finance & types of budgets.<br>➢ Describe concepts of direct & indirect taxes.<br>5.1 Financial Management- Objectives & Functions<br>5.2 Capital Generation & Management<br>• Types of Capitals - Fixed & Working<br>• Sources of raising Capital - Features of Short term, Medium Term & Long Term Sources<br>5.3 Budgets and accounts<br>• Types of Budgets | 08 | 08 |

| | | |
|---|---|---|
| • Fixed & Variable Budget - Concept<br>• Production Budget - Sample format<br>• Labour Budget - Sample format<br>• Profit & Loss Account & Balance Sheet - Meaning, sample format, meaning of different terms involved.<br>5.4 Meaning & Examples of -<br>• Excise Tax<br>• Service Tax<br>• Income Tax<br>• Value Added Tax<br>• Custom Duty | | |
| **Topic 6: Materials Management (No Numerical)**<br><br>**Specific Objectives:**<br>➢ Describe concept of inventory, ABC analysis & EOQ.<br>➢ Describe purchase functions & procedures<br>➢ State features of ERP & MRP<br>6.1 Inventory Concept, its classification, functions of inventory<br><br>6.2 ABC Analysis - Necessity & Steps<br>6.3 Economic Order Quantity Concept, graphical representation, determination of EOQ<br>6.4 Standard steps in Purchasing<br>6.5 Modern Techniques of Material Management<br>• Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP<br>• Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP | 08 | 08 |
| **Topic 7: Quality Management**<br><br>**Specific Objectives:**<br>➢ State Principles of Quality Management<br>➢ Describe Modern Technique & Systems of Quality Management<br>7.1 Meaning of Quality<br>Quality Management System – Activities, Benefits<br>Quality Control - Objectives, Functions, Advantages<br>Quality Circle - Concept, Characteristics & Objectives<br>Quality Assurance – Concept, Quality Assurance System<br>7.2 Meaning of Total Quality and TQM<br>Components of TQM – Concept, Elements of TQM, Benefits<br>7.3 Modern Technique & Systems of Quality Management like Kaizen,5'S',6 Sigma<br>7.4 ISO 9001:2000 - Benefits, Main clauses. | 06 | 08 |
| **Total** | **48** | **50** |

**Learning Resources:**
**Books:**

| Sr. No | Author | Name of Book | Publisher |
|---|---|---|---|
| 01 | Dr. O.P. Khanna | Industrial Engineering & Management | Dhanpat Rai & Sons New Delhi |
| 02 | Banga & Sharma | Industrial Engineering & Management | Khanna Publication |
| 03 | Dr. S.C. Saksena | Business Administration & Management | Sahitya Bhavan Agra |
| 04 | W.H. Newman<br>E. Kirby Warren<br>Andrew R. McGill | The process of Management | Prentice- Hall |

**E Source:**

nptel.iitm.ac.in
http://iete-elan.ac.in/subjects/amIndustrialMgmt.htm

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Sixth for CE/CS/CR and Seventh for CV**

**Subject Title : Highway Engineering**

**Subject Code : 17602**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | -- | 25# | 25@ | 150 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Today's civil Engineering. Diploma Technician has to work on various civil Engineering. Projects like multistoried buildings, Industrial buildings, Roads, Water Supply, Sanitary Schemes & also on Various Irrigation Structures like Dams, Percolation tanks, Bridges etc. Infrastructural facility like Roads plays a major role in the development of the country.

Road is the important largest and basic mode of Transportation in India. Road Transportation is the most effective and economical means of Transportation. A large scope in Design, Construction and maintenance of Road is present in our country.

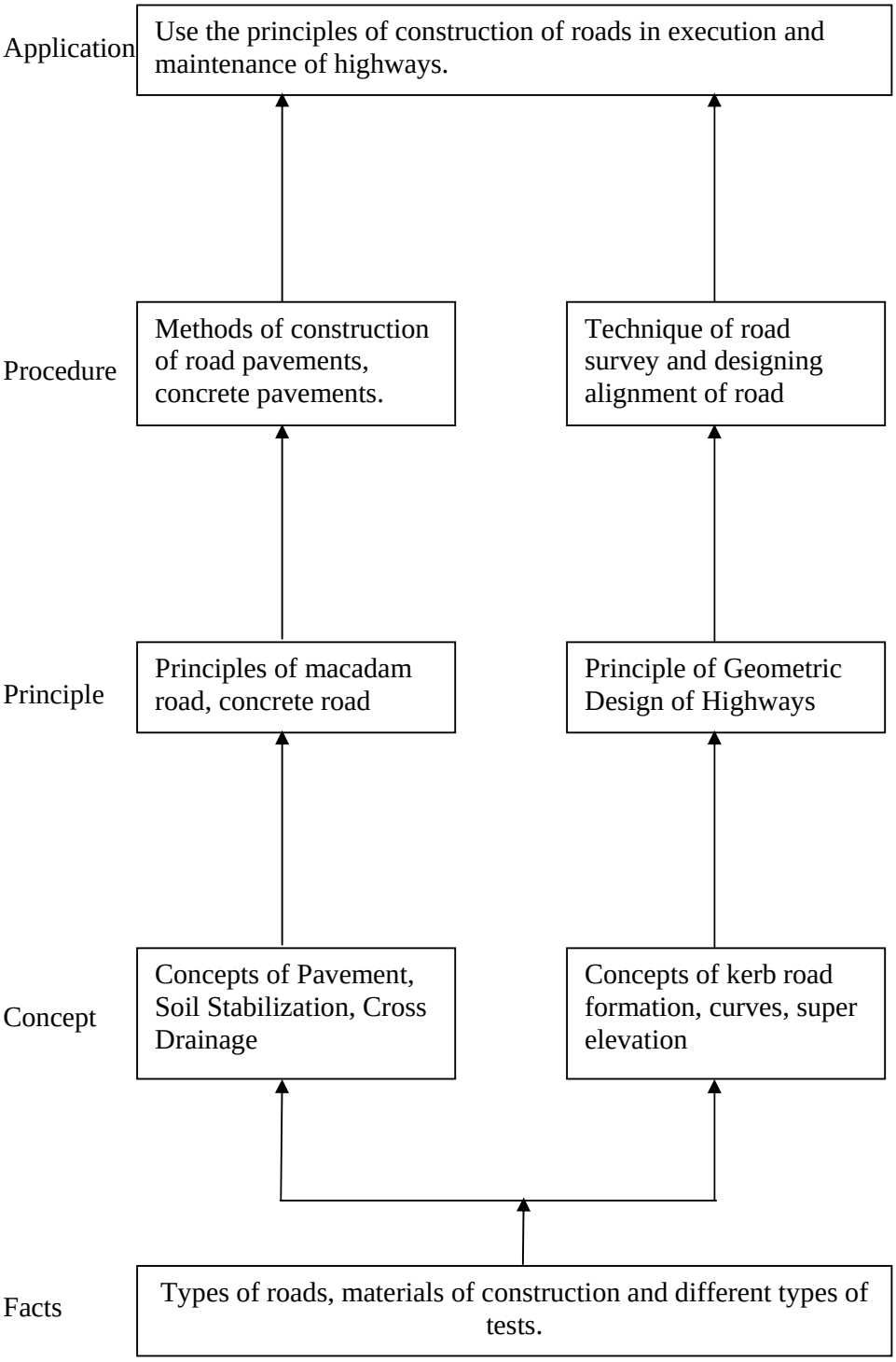
Diploma Engineering students have large scope in jobs as well as different Construction activities in Road Construction. This project gives the knowledge and skills required to carry out the survey, investigation, planning, design, construction and maintenance works related to Road Constructions.

**General Objective:**

Student should be able to:

1) Know the importance and classification of Road.
2) Understand the types of Surveys and Investigation for location of new Roads.
3) Understand the different methods of Road Construction.
4) Apply the Equipments used in Road Constructions.

**Learning Structure:**



**Theory**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 01: Importance and Classification of Roads.**<br>**Specific Objectives :**<br>➢ State the importance of Transportation.<br>➢ List classification of Roads.<br>**Contents :**<br>• Importance of Transportation.<br>• Different Modes of Transportation.<br>• Classification of Roads.<br>• Characteristics of Road Transport. | 02 | 04 |
| **Topic 02: Investigation of Road Project**<br>**Specific Objectives :**<br>➢ Describe types of surveys<br>➢ Draw L section & C/S of roads.<br>**Contents :**<br>• Reconnaissance survey preliminary survey and location survey for road project.<br>• Fixing the alignment of road, factors affecting road alignment.<br>• 'L' section & cross section of roads.<br>• Drawing required for road project.<br>• Keymap, Index map, Preliminary survey plan, detailed location survey plan, 'L' section & C/s of C.D. works, Land acquisition plan. | 02 | 08 |
| **Topic 03: Geometric design of Roads.**<br>**Specific Objectives :**<br>➢ State the maximum and minimum I.R.C. specification for Camber, Kerbs, Gradient, Slight distance, Super elevation.<br>➢ Sketch standard cross section of Highway in cutting and embankment.<br>**Contents :**<br>• Camber- definition, types, IRC specification.<br>• Kerbs, road margin, road formation, right of way.<br>• Design speed- IRC specifications.<br>• Gradient- Definition, types of IRC specifications.<br>• Slight distance- Definition, types, IRC specifications.<br>• Super elevation- Definition, minimum & maximum values of super elevation methods of providing super elevation.<br>• Sketching of standards cross-sections of national highway in embankment & cutting.<br>• Simple numerical problems on camber, side distance & superelevation. | 12 | 24 |
| **Topic 04: Construction of Roads**<br>**Specific Objectives :**<br>➢ List the different materials used in road construction.<br>➢ Describe the construction of earthen roads, soil stabilized roads, water bound macadam roads, bituminous roads & concrete roads.<br>**Contents :**<br>• Types pf road materials - soil, aggregates, bitumen, cement concrete.<br>• Pavement- objective, structures and functions of pavement | 12 | 24 |

| | | |
|---|---|---|
| components, types of pavements rigid and flexible<br>• Construction of earthen roads, general terms used, borrow pits, spoil bank lead & lift, balancing of earth work, construction procedure.<br>• Soil stabilized roads- necessity, methods of soil stabilization.<br>• Water bound macadam roads- materials used, size & grading of materials used, construction procedure including precautions rolling.<br>• Construction- bitumen asphalt, emulsion, cutback tar, common grades, adopted for construction.<br>• Types of bituminous surface, prime coat, tack coat, seal coat, surface dressing, procedure of construction , full grout , semi grout<br>• Cement concrete pavements- Method of Construction ,Construction joints, joint filling, joint sealer. | | |
| **Topic 05: Traffic Engineering**<br>**Specific Objectives :**<br>➢ Define the traffic density, traffic capacity and traffic volume.<br>➢ State the traffic control devices.<br>**Contents :**<br>• Traffic Engg. Definition, Traffic characteristics.<br>• PUC, Traffice density, traffic capacity.<br>• Traffic volume study- objects and uses, counting of Traffic volumes, PCU.<br>• Traffic control devices – road<br>• Signs, Marking, Signals, Traffic Island and its types - Divisional, Channelizing, Pedestrian, Rotary. | 04 | 08 |
| **Topic 06 : Hill Roads**<br>**Specific Objectives :**<br>➢ Describe the procedure for the alignment and geometric of hill roads.<br>➢ Sketch the drainage structures in hill roads.<br>**Contents :**<br>• Alignment survey for hill roads.<br>• Geometric of hill road - width, formation, camber construction of hill roads.<br>• Drainage structures in hill roads, side drains, catch water.<br>• Land Sides- causes and prevention. | 02 | 08 |
| **Topic 07: Drainage and maintenance of roads.**<br>**Specific Objectives :**<br>➢ State the purpose of road drainage.<br>➢ State the importance and repairs of roads.<br>**Contents :**<br>• Purpose of high drainage.<br>• Surface drainage system in urban roads, cross drainage.<br>• Sub-Surface drainage- Longitudinal drains and cross drains.<br>• Necessity of maintenance of roads.<br>• Classification of maintenance operation – routine and periodic maintenance, special repairs and resurfacing.<br>• Maintenance of W.B.M., bituminous and cement concrete roads. | 04 | 08 |
| **Topic 08 : Earth Moving Equipments & High way Machineries**<br>**Specific Objectives :**<br>➢ List the different types of Excavating Equipments<br>➢ State the use and Working of Compacting Equipments.<br>**Contents :** | 10 | 16 |

| | | |
|---|---|---|
| • Excavating Equipments: Bulldozers, Scrappers, Graders, Power Showels, JCB.<br>• Use and Working of Excavating Equipments.<br>• Compacting Equipments : Rollers, Plain Rollers, Sheep Tooted Roller, Vibratory Roller, Pneumatic Rollers<br>• Use of Compacting Equipments.<br>• Hot Mix Bitumen Plant : Bitumen Road Paver | | |
| **Total** | **48** | **100** |

**List of Assignments:**

1. Prepare a Road Project of 1 km length for proposed MDR having one cross drainage work
2. Visit to road under construction to study the construction of W.B.M. road / tar road / concrete road
3. Develop detailed drawing of cross section of (1) M.D.R. (2) State Highway () National Highway (4) Express Highway in cutting & banking (Any two)
4. Understand the traffic volume at Road intersection in city/Town (Draw Traffic flow chart) at road intersection. No. of users using road
5. Visit to WBM. / Bituminous/concrete roads to observe the different defects in the road and suggest remedial measures
6. Test on Bitumen Penetration
7. Test on Bitumen (a) softening point (b) Flash and fire point
8. Visit to Road construction site for studying different equipments like Jcb, power shovel, dozer, rollers – Hot mix plant / paver.

**Learning Resources:**
**Books:**

| Sr. No. | Author | Title | Publisher Address |
|---|---|---|---|
| 01 | Khanna & Justo | Highway Engineering | Khanna Publication |
| 02 | L.R.Kadiyali | Traffic Engineering | ---- |
| 03 | N.L.Arora, S.P. Luthara | Transportation Engineering | I.P.H. New Delhi |
| 04 | Vazarani & Chandola | Transportation Engineering | Khanna Publication |
| 05 | Biridi & Ahuja. | Road, Highway, Bridges | S.B.H. New Delhi |
| 06 | Kamala. | Transportation Engineering | T.M.H. New Delhi |
| 07 | --- | DATA Book of P.W.D. | ---- |

1. **IS / International Codes:** IRC 36-1970, IRC 16-1965, IRC 20 - 1966.

2. **CDS and PPTS:** Search for google.
   Mahindra heavy earthmoving equipments
   **BEML** heavy earthmoving equipments
   COSMOS Construction equipments
   UNIVERSAL Construction equipments

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Sixth Semester for CE/CS/CR and Seventh Semester for CV**

**Subject Title : Contracts and Accounts**

**Subject Code : 17603**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 04 | -- | 02 | 03 | 100 | -- | -- | 50@ | 150 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

For infrastructure development various construction projects are required to be undertaken. These projects are to be executed by entering into a legal contract. For this purpose the diploma student shall have adequate knowledge of different types of contract and accounting procedures for effecting the payments. .

Knowledge about the procedure of execution of work by P.W.D. will be useful while working as an engineer in P.W.D. and executing various works. The topic on different types of contract, conditions of contract will enable the student to use the specific type of contract for execution of work.

Concept of Tender and knowledge about preparation of tender documents, writing specification for different items of work will be helpful to prepare actual Tender papers and contract documents which are required before starting construction.

Topic on measurement book and nominal muster roll will be useful for execution of petty works at site. The information on various departmental procedures and different types of forms used by P.W.D. as well as various construction firms, will be useful to prepare bills and different modes of payment to contractors.

The knowledge of valuation will helpful in future while preparing valuation report for the purposes like buying, selling, for mortgage deed, for rent fixation, etc.

This subject will help the student in implementing actual field practices, this will make student further more competent in the execution of civil engineering works.

**General Objectives:**

The students shall be able to:

1. Understand various types of contract with the purpose of each type.
2. Understand different conditions of contract and it's use in execution of work.
3. Appreciate importance of specification of various items of construction.
4. Understand the procedure and different forms for the preparation of tender documents.
5. Know techniques of evaluation.

**Theory**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic: 1 Procedure of Execution of Work By P.W.D.**<br>**Specific objectives**<br>➢ State the meaning and purpose of administrative approval and technical sanction.<br>➢ Draw organization structure of p.w.d.<br><br>**Contents**<br>• Organizational structure of p.w.d., functions of their personnel. P.w.d. Procedure of initiating the work, Administrative approval, technical sanction, budget provision.<br>• Methods used in p.w.d. for carrying out works contract method and departmental method, rate list method, piece work method, day's work method, department method. | 06 | 12 |
| **Topic: 2 Contracts**<br>**Specific objectives**<br>➢ State purpose of different types of contracts<br>➢ State Advantages, Disadvantages with suitability of each contract.<br><br>**Contents**<br>2.1 …….04<br>• Definition of contract, Objects of contract, requirements of valid contract<br>2.2 Types of engineering contract with advantages and disadvantages ,their suitabilities ……..….10<br>• Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage and cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract.<br>2.3 ……..06<br>• Classification of contractor, Registration of contractor, Built operate transfer (BOT) Project: Objectives, scope, advantages, disadvantages, examples. | 14 | 20 |
| **Topic: 3 Tender and Tender Documents**<br>**Specific objectives**<br>➢ Draft tender Notice.<br>➢ State procedure of submitting tender documents.<br>**Contents**<br>3.1 ……..12<br>• Definition of tender, necessity of tender, types-local and Global<br>• Tender notice, points to be included while drafting tender Notice, drafting of tender notice.<br>• Meaning of terms: earnest money, security deposit, validity period, right to reject one or all tenders, corrigendum to tender notice and its necessity.<br>3.2 Tender documents ……08<br>• List, schedule a, schedule b, schedule C<br>• Terms related to tender documents - contract conditions: time limit, time extension, penalty, defective material and workmanship, | 14 | 20 |

| Topic and Contents | Hours | Marks |
|---|---|---|
| termination of contract, suspension of work, subletting of contract, extra items, escalation, arbitration, price variation clause, defect liability Period, liquidated and unliquidated damages.<br>• Filling the tender by contractor and points to be observed by Contractor.<br>• Procedure of submitting filled in tender document, procedure of opening tender , comparative statement, scrutiny of tenders ,award of contract, acceptance letter and work order.<br>• Unbalanced tender, ring formation. | | |
| **Topic: 4.Accounts In P.W.D.- Payment To Contractors**<br>**Specific objectives**<br>➢ State the use of Measurement book and Nominal muster roll.<br>➢ State different modes of payments and their use.<br>**Contents**<br>4.1 Various account forms and their uses –----------.(08)<br>• Measurement Books, Nominal Muster Roll, Imprest Cash, Indent, Invoice, Bills, Vouchers, Cash Book, Temporary Advance. Heads of Accounts.<br>4.2 Mode of Payment to the contractor- ----------(08)<br>• Interim Payment and its necessity, Advance Payment, Secured Advance, on Account payment, Final Payment, First And Final Payment, Retention money, Reduced rate payment, Petty advance, Mobilization advance. | 06 | 16 |
| **Topic: 5. Specification**<br>**Specific objectives**<br>➢ Prepare detail specifications of various items<br>➢ Write the rules for specification writing.<br>**Contents**<br>• Necessity and importance of specifications of an items, points to be observed in framing specifications of an item, Types of specification - Brief and Detailed, Standard and Manufacturers specification.<br>• Preparing Detailed Specifications of items in civil engineering works from each of following: building construction, Irrigation Engineering ,Transportation Engineering , Public health Engineering<br>• Legal Aspects of Specification. | 08 | 12 |
| **Topic: 6.Valuation**<br>**Specific objectives**<br>➢ State factors affecting value of property.<br>➢ Calculate the capitalized value.<br>**Contents**<br>6.1 ……..08<br>• Definition and Necessity of Valuation. Definitions - Cost, Price, Value, Characteristics of Value, Factors Affecting Value.<br>• Types of Value: - Book Value, Scrap Value, Salvage Value, Speculative Value , Distress Value, Market Value, onopoly Value, Sentimental Value, Factors Affecting Value.<br>6.2 ……..12<br>• Depreciation, Obsolescence, Sinking Fund. Methods of Calculation of Depreciation – Straight Line Method, Sinking Fund Method, Constant Percentage Method Quantity Survey Method. | 16 | 20 |

| Topic and Contents | Hours | Marks |
|---|---|---|
| • Computation of Capitalized Value, Gross Income, Outgoing, Net Income, Years Purchase. Types of Outgoing and Their Percentages. Fixation of Rent as Per PWD Practice. Simple numerical problems. | | |
| **Total** | **64** | **100** |

**Practicals:**
**Skills to be developed:**

**Intellectual Skills**:

1. Draft brief tender notice for civil engineering constructions.
2. Prepare tender document for construction of a residential building and other civil engineering work.
3. Write the detailed specification.
4. Prepare valuation report for land and building.

**Term work will be prepared by each student in the form of following assignments.**

**List of Assignments:**

1. Collect Tender notices published in Newspapers for various items of civil engineering works (At least 5) Write salient features of item.
2. Draft Tender notices for construction of a Civil engineering work (i.e. W.B.M. road & Residential building.
3. Collect Old set of tender document and write a report containing Name of work, location, estimated cost of work, conditions of contract etc.
4. Prepare Tender document for the Building. Teacher shall form group of FIVE students. Each group shall use independent drawing (Submission Drawing prepared in third semester can be used) Detailed estimate prepared for RCC building in Estimating & Costing shall be used.
5. Collect various Account Forms from PWD and write a report stating Name and numeric code of form with its use.
6. Write a report on PWD store procedure and PWD Account procedure with details of cash book, indent, petty advance etc. For it Guest lecture of PWD official may be arranged for providing the data for writing of above report.
7. Write Detailed specification for one item from each of following
   a. Building construction b. Irrigation Engineering.
   c. Transportation engineering. d. P. H. Engineering.
8. Visit to Valuators office to understand his/her profile and one case study of valuation of building.

**Learning Resources:**

**1. Books:**

| Sr. No. | Author | Title | Publisher |
|---|---|---|---|
| 01 | B. N. Datta | Estimating and Costing in Civil Engineering | UBS Publishers |
| 02 | S. C. Rangwala | Estimating and Costing, Specification and Valuation in Civil Engineering | Charotar Publication |
| 03 | B. S. Patil | Civil Engineering Contracts and Accounts Vol. I,II | Orient Longman |
| 04 | S. C. Rangwala | Valuation of Real Properties | Charotar Publication |
| 05 | Dr. V. K. Raina | Construction Management and Contract Practices | Shroff Publishers & Distributers Pvt. Ltd. |

**2. Web Sites:** www.constructionmanagementprocess.com

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Sixth for CE/CR/CS and Seventh for CV**

**Subject Title : Design od R.C.C. Structures**

**Subject Code : 17604**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 04 | 04 | 100 | -- | 25# | 50@ | 175 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rational:**

Design of RCC Structures is the subject at Technology Level. The pre-requisite knowledge, skills and competencies for this subject are expected to be achieved by studying the subjects Mechanics of Structures and Theory of Structures in earlier semesters.

Limit State Method is to be used in the design of RCC structures. IS:456-2000 is to be used for analysis and design and IS:875-1987 is to be used for Loading Standards. Analysis and design of building elements like slabs, beams, columns, footings and dog-legged staircase will be useful in structural design of an RCC building. Emphasis is also on preparation and interpretation of structural drawing and detailing. An elementary terminology of earthquake engineering and exposure to ductile detailing as per IS:13920-2002 has been provided through a separate topic.

An introductory topic on prestressed concrete will be useful to acquaint the learner with the another common mode of use of concrete.

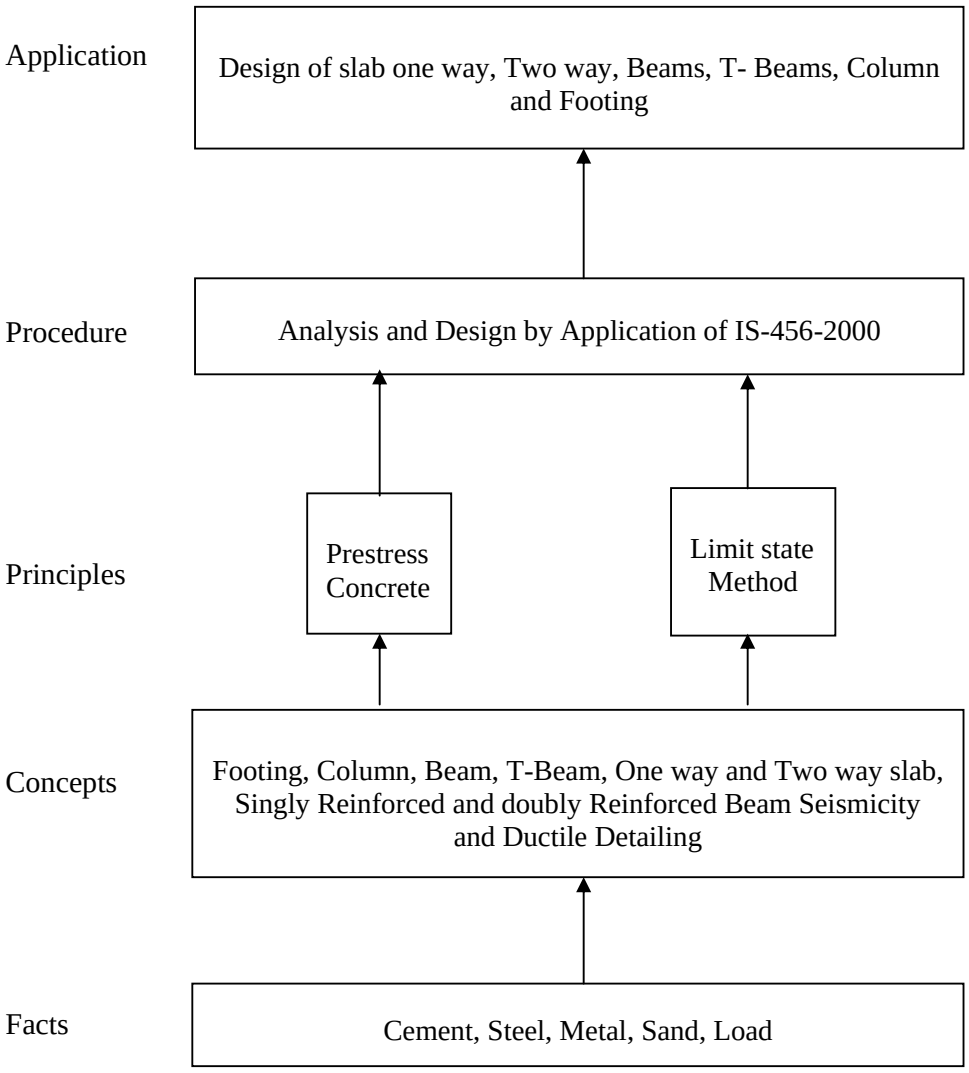
Thus the contents of the subject will be useful to the diploma technician in effective supervision and quality control on site.

**Objectives**:

Students will be able to:

1. Understand the basic principles and procedure of design of slab, beam, column and footing of RCC building as per IS:456-2000
2. Understand reinforcement detailing of RCC structural members.
3. Understand design of singly reinforced, doubly reinforced and flanged section of beams, simply supported one way & two way slabs, cantilevers slab, axially loaded columns and footings by limit state method.
4. Understand, read and interpret structural drawings.
5. Understand ductile detailing of structural components of buildings.

**Learning Structure:**



**Theory**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1 : Introduction to Limit State Method**<br><br>**Specific Objectives** :<br>➢ State purpose of reinforcement in RCC<br>➢ Define limit states<br>➢ Enlist various types of loads on structures<br><br>**Content:**<br>• Definition of RCC, functions of reinforcement, material properties, use of IS:456-2000<br>• Definition and types of limit states, partial safety factors for material strength, characteristic strength<br>• Types of loads, use of IS:875-1987, characteristic load, design load | 02 | 04 |
| **Topic 2 : Analysis and Design of Singly Reinforced Rectangular Sections by Limit State Method**<br><br>**Specific Objectives** :<br>➢ Draw strain and stress diagrams<br>➢ Calculate design constants and ultimate moment of resistance<br>➢ Design balanced and under-reinforced singly reinforced rectangular sections<br><br>**Content :**<br>• Limit State of collapse (flexure) : assumptions, stress-strain relationship for concrete and steel, strain diagram and stress block diagram for singly reinforced section, design parameters and constants, ultimate moment of resistance<br>• Under- reinforced, over-reinforced and balanced sections : meaning and comparison<br>• Analysis and design : Numerical problems on determination of design constants, ultimate moment of resistance, ultimate load carrying capacity, design of balanced and under-reinforced sections<br>• IS specifications regarding spacing, cover, minimum reinforcement, effective span, etc. in beams | 06 | 16 |
| **Topic 3 : Analysis and Design of Doubly Reinforced Rectangular Sections by Limit State Method**<br><br>**Specific Objectives**:<br>➢ Decide whether beam should be designed as doubly reinforced<br>➢ Draw strain and stress diagram for beams<br>➢ Calculate ultimate moment of resistance<br>➢ Design doubly reinforced balanced beams<br><br>**Content :**<br>• Meaning and conditions for providing doubly reinforced beams<br>• Analysis of doubly reinforced sections : strain and stress diagrams, numerical problems on ultimate moment of resistance<br>• Design of doubly reinforced sections : Numerical problems on | 06 | 16 |

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|---|---|---|
| balanced design | | |
| **Topic 4 : Analysis and Design of Flanged Beams by Limit State Method**<br>**Specific Objectives** :<br>➢ Calculate effective flange width<br>➢ Determine ultimate moment of resistance<br>➢ Design flanged beam by carrying out load analysis<br><br>**Content :**<br>• Meaning and conditions for formation of flanged (T and L) beams, comparison with rectangular beams, effective width of flange<br>• Analysis of singly reinforced flanged beams: Introduction to cases of neutral axis in i) flange and ii) web. Numerical problems on Moment of Resistence for the case of neutral axis in the flange only. | 06 | 12 |
| **Topic 5: Shear and Bond by Limit State Method**<br>**Specific Objectives** :<br><br>➢ Calculate ultimate shear strength of beam<br>➢ Design beam for shear<br>➢ Draw reinforcement detailing diagram for shear<br>➢ Apply check for bond to beams and slabs<br><br>**Content :**<br>**5.1 Shear:** … (08 Marks)<br>Meaning of shear in RCC beams and slabs. IS code specifications. Various forms of shear reinforcement in beams. Use of bent up bars. Zones of minimum shear reinforcement. Numerical problems on design of beams for shear<br>**5.2 Bond:** … (04 Marks)<br>Meaning of bond in RCC. IS code provisions. Meaning and calculation development length in tension and compression. | 06 | 12 |
| **Topic 6 : Design of Slabs by Limit State Method**<br>**Specific Objectives** :<br>➢ Decide type of slab from the given plan<br>➢ Design various types of slabs<br>➢ Draw reinforcement detailing diagram for slabs<br>**Content :**<br>• Definition and classification of slabs as one-way and two-way slabs, support conditions, main and distribution steel, I.S. specifications regarding spacing and cover for reinforcement, effective span, minimum reinforcement<br>• Limit state of serviceability for slabs: Check for deflection<br>• Design of slabs : Procedure and numerical problems on design of one-way simply supported slabs, cantilever slabs, two-way simply supported slabs with corners free to lift and waist slab of dog-legged staircase (No problem in the theory exam on design of dog legged staircase) | 08 | 16 |
| **Topic 7: Design of Columns and Footings by Limit State Method**<br><br>**Specific Objectives** :<br>➢ Calculate ultimate load carrying capacity of a given axially loaded | 06 | 16 |

| | | |
|---|---|---|
| column<br>➢ Design a column and draw reinforcement detailing<br>➢ Design isolated sloped footing and draw reinforcement detailing<br><br>**Content :**<br>**7.1 Axially Loaded Short Columns** … (12 Marks)<br>• Limit state of collapse in compression : assumptions, minimum eccentricity, slenderness ratio, short and long columns, calculation of ultimate load carrying capacity of axially loaded short rectangular and circular columns<br>• Load analysis for a column : calculation of load on an axially loaded column from beams at a floor and at various floor levels in a building<br>• Design of axially loaded short rectangular and circular columns: problems on design as per IS specifications for minimum and maximum reinforcement, transverse reinforcement, cover, etc.<br><br>**7.2 Axially Loaded Footings** … (04 Marks)<br>• Introduction to various types of RCC footings like isolated stepped and sloped footings, combined footings, piles<br>• Design of isolated square sloped footing: Flexural design with checks for one-way shear, two-way shear and bond. (Problems on design of footing for bending moment only in theory examination paper) | | |
| **Topic 8 : Seismicity and Ductile Detailing**<br>**Specific Objectives** :<br>➢ Define basic terms in seismicity<br>➢ Draw ductile detailing diagrams for common RCC members as per IS:13920-2002<br><br>**Content :**<br>• Definition, magnitude and intensity of earthquake. Zones<br>• Earthquake damages to RCC Buildings like bond failure, shear cracking, slab tearing. Remedies<br>• Ductile Detailing Provisions in IS:13920-200 | **04** | **04** |
| **Topic 9 : Introduction to Prestressed Concrete**<br>**Specific Objectives :**<br>➢ Compare prestressed concrete with RCC<br>➢ Distinguish between pre-tensioning and post-tensioning<br>➢ Enlist losses of prestress<br><br>**Content :**<br>▪ Meaning of prestressed concrete, comparison with RCC. Advantages and disadvantages of prestressed concrete.<br>▪ Methods of prestressing, pretensioning and post-tensioning<br>▪ Losses of prestress : meaning and list of losses<br>(No numerical problems shall be asked in written examination on this chapter) | **04** | **04** |
| **Total** | **48** | **100** |

**Practicals:**

Skills to be developed

**Intellectual Skills:**

1. Design of structural components
2. Interpretation of structural drawings

**Motor Skills:**

1. Preparing structural drawings

Term work shall consist of the following:

**1. Mini-project on structural design of a G + 2 framed residential building:**

Design of slabs, beams, columns and footings for a simple plan of a G + 2 residential building based on the contents taught in the theory. Students should be encouraged to prepare their own architectural plan otherwise teacher will provide separate data of plan, dimensions and material grades separate for separate groups or batches of students; maximum batch size not exceeding 20.

The students shall submit the design details in the following form:

a) Design Report as included in the Lab. Manual prescribed by MSBTE.
b) Two full imperial size drawing sheets finished in pencils containing i) key-plan ii) reinforcement detailing for sample slabs and beams, column, column footing of each type and staircase iii) schedules of slabs, beams, columns and footings iv) design notes

**2. Study and Interpretation of Professional Structural Drawings:**

Professional structural drawings including reinforcement detailing of the components slabs, beams, columns, footings and stair-case shall be collected from nearby consultants. Teacher shall set at least 10 objective questions on each of the five components based on the drawing sheets obtained. Each student shall write the answers in the corresponding exercise in the Lab. Manual of MSBTE.

**Learning Resources:**
**Books:**

| Sr. No. | Author | Title | Publisher |
|---|---|---|---|
| 1 | Dr. V. L. Shah & Dr. S. R. Karve | Limit State Theory and Design of Reinforced Concrete Structures | Structures Publications, Pune |
| 2 | N.C.Sinha & S.K.Roy | Fundamentals of Reinforced Concrete | S. Chand & Co., New Delhi |
| 3 | N.Krishna Raju & R.N.Pranesh | Reinforced Concrete Design Principles and Practice | New Age International, Mumbai |
| 4 | S.U.Pillai & Devdas Menon | Reinforced concrete Design | Tata Mcgraw Hill |
| 5 | P. C.Varghase | Limit State Design of Reinforced Concrete | Prentice Hall of India, |
| 6 | N.Krishna Raju | Prestressed Concrete | Tata McGraw Hill, Mumbai |
| 7 | T.Y.Lin | Design of Prestressed Concrete | Wiley India |

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|---|---|---|---|
| | | Structures | |
| 8 | David Dowrick | Earthquake Resistant Design and Risk Reduction | Wiley India Pvt.Ltd., New Delhi |
| 9 | Steven L. Kramer | Geotechnical Earthquake Engineering | Pearson Education |

**I.S. Codes:**

1. IS 456:2000 - Plain and Reinforced concrete code of Practice
2. SP16- Design Aids for reinforced concrete to IS 456
3. I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures.
4. SP 24 - Explanatory Handbook on IS 456
5. IS 1343-1980 - Indian Standard code of (Reaffirmed 1990) Practice for Prestressed concrete.
6. SP34 : 1987 - Handbook on concrete reinforcement and Detailing.
7. IS 13920-1993 Ductile Detailing of R. C. Building subjected to Seismic forces.

**Softwares:**

1. Struds
2. Scadds/nucleus r(200)
3. Build master
4. Staad.pro.vsi
5. Etabs.9.5

**1. Field Visits:**

Structured field visits can be organized with proper planning to construction sites to view the following points:

i) Reinforcement detailing of components like slabs, beams, columns, footing, staircase
ii) Main concreting operations like batching, mixing, transporting, compacting and curing on site
iii) Stacking of material like cement, sand, metal, steel, etc. on the site
iv) Formwork for the various components
v) Cutting and bending of bars on site
vi) Verification of sample details in the structural drawing with the reinforcement actually provided on site

**2. Development / Use of MS PowerPoint Slide Shows:**

i) Students can be asked to take digital photographs and videos of the details observed in the field visits. MS PowePoint Slide Shows and MS Movie maker clips can be developed from the photographs and videos by the students as special credit assignments.
ii) Slide shows on earthquake damages and ductile detailing can be screened

**3. Experts' Lectures / Demonstrations:**

Experts' lecture-demonstration presentations can be organized on the following topics :

i) Modern site practices
ii) Use of software packages for design
iii) Case study of a major construction project

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Sixth for CE/CR/CS and Seventh for CV**

**Subject Title : Solid Waste Management (Elective)**

**Subject Code : 17605**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | -- | -- | 25@ | 125 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Industrialization and Urbanization is increasing day by day. As a result of this the generation of solid waste is a major problem all over the country within the urban as well as rural area. In view of this the management of solid waste produced is of prime need to keep the environment safe and clean.

Information on classification and characteristics of solid waste will enable to decide appropriate decision about the collection and transportation of waste produced. Various disposal methods of solid waste will enable to recommend suitable method of disposal of solid waste with economy and acceptable environmental constraints including reuse and recycle wherever applicable.

Content on other types of solid waste such as biomedical waste, Construction waste, E-waste and plastic waste will useful in deciding appropriate method for collection, transportation and disposal of these wastes.

Thus, the knowledge of solid waste management with the concept like recycling, recovering and reuse will lead to proper disposal with acceptability. This will further lead to keeping the natural resources condemnation free.

**General Objectives:**

Students will able to

1. Understand various types of solid waste produced with their characteristics
2. Understand different methods of collection, transportation and disposal of solid waste.
3. Apply different method of disposal of solid waste for safe disposal.
4. Understand concept of Bio medical waste, E-waste and Industrial waste.
5. Understand recycling and reuse of solid waste.
6. Understand different transportation equipments with their limitations.

**Theory:**

| Topic and Contents | Hours | Marks |
|---|---|---|
| **Topic 1: Introduction**<br>**Specific objectives :**<br>➢ State meaning of solid waste<br>➢ List types of solid waste<br>➢ Write the impact of solid waste<br>➢ List characteristics of solid waste<br>➢ List waste management techniques<br><br>**Content :**<br>• Definition of solid waste<br>• Meaning of different solid waste - Domestic waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.<br>• Sources of solid waste<br>• Classification of solid waste - hazardous and non-hazardous waste.<br>• Physical and Chemical characteristics.<br>• Impact of solid waste on environment.<br>• Solid waste management techniques - solid waste management Hierarchy, waste prevention and waste reduction.<br>• Factors affecting on solid waste generation. | 08 | 16 |
| **Topic 2: Storage, Collection and Transportation of Municipal Solid Waste.**<br>**Specific Objectives :**<br>➢ State methods of storage of municipal solid waste.<br>➢ List methods of collection of municipal solid waste.<br>➢ List various transportation equipment<br>➢ Draw the organization pattern of solid waste management.<br><br>**Content :**<br>• Storage of municipal waste.<br>• Collection methods of municipal waste.<br>• Tools and Equipments - Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community Bin like movable and stationary Bin.<br>• Transportation of municipal waste.<br>• Transportation vehicles with their capacity and working-Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumper, Compactor vehicles. Transfer station- meaning, necessity, location<br>• Organization pattern of solid waste management. | 08 | 16 |
| **Topic 3 : Disposal of Solid Waste**<br>**Specific objectives** :<br>➢ List the types of disposal of solid waste<br>➢ Describe the process of composting.<br>➢ Describe the process of land filling.<br>➢ Describe the process of incineration.<br>**Content :**<br>3.1 Composting of waste …….. 08<br>• Principles of composting process<br>• Factors affecting on composting process | 12 | 24 |

| | | |
|---|---|---|
| • Methods of composting -<br>A) Manual Composting - Bangalore method, Indore Method<br>B) Mechanical Composting - Dano Process<br>C) Vermicomposting- Concept<br>3.2. Land filling technique **……** 08<br>• Factors for site Selection<br>• Land filling methods-Area method, Trench method and Ramp method<br>• Leachate and its control<br>• Biogas from landfill<br>• Advantages and Disadvantages of landfill method<br>3.3 Incineration of waste …….. 08<br>• Introduction of incineration process.<br>• Types of incinerators-Multiple chamber incinerators and Municipal incinerators<br>• Products of incineration process with their use<br>• Pyrolysis of waste –Definition, methods, Advantages and Disadvantages of incineration process | | |
| **Topic 4: Special Types of Solid Wastes.**<br>**Specific Objectives :**<br>➢ List various types of special waste.<br>➢ Describe method of collection and disposal of biomedical waste, E-waste and industrial waste.<br>**Content:**<br>4.1 Biomedical Waste …….. 06<br>• Definition of Biomedical Waste<br>• Sources and generation of Biomedical Waste<br>• Classification of Biomedical Waste Management technologies.<br>4.2 E-waste ……..06<br>• Definition of E- waste<br>• Varieties of E- waste<br>• Dangers of E- waste<br>• Disposal of E- waste<br>• Recycling of E- waste<br>4.3 Industrial waste …….06<br>• Variety of industrial waste<br>• Collection of disposal of industrial waste<br>• Control measures of industrial waste.<br>• Recycling of industrial waste.<br>4.4 Biomedical waste ……..06<br>Biomedical waste management & handling as per rule 1998. | 12 | 24 |
| **Topic 5: Health aspect and public Involvement in solid waste management**<br>**Specific Objectives:**<br>➢ Know health aspect during handling and processing.<br>➢ State stages for public involvement<br>**Content :**<br>• Health aspect during handling and processing<br>• Health problem during time of segregation, reuse, recovery, recycling of solid waste. | 04 | 10 |

| | | |
|---|---|---|
| • Public Involvement and participation in Solid waste management. | | |
| **Topic 6: Recycling of Solid Waste**<br>**Specific objectives :**<br>➢ Describe the process of recycling<br>➢ State marketing strategies for recyclables.<br>➢ Planning, Designing and implementation of recycling program.<br>➢ State benefits of recycling.<br>**Content :**<br>• Introduction, purpose of recycling<br>• Benefits of recycling.<br>• Methods of collecting recyclables.<br>• Solid waste recycling in India. | 04 | 10 |
| **Total** | **48** | **100** |

**Practicals:**
**Skills to be developed:**

**Intellectual Skills**:
1. Understand various types of solid waste.
2. Understand various methods of disposal of solid waste with their suitability.
3. Understand rules and regulation during handling and disposal.

**Motor Skills:**
1. Observe methods of disposal of solid waste.
2. Prepare PowerPoint presentation of disposal of special waste.
3. Collect information of solid waste management in local area.

**Term work will be prepared by each student in the form of assignments as below.**
**List of Assignments:**
1. Visit report on solid waste disposal plant nearby city
2. Visit report on composting plant.
3. Visit report on Biogas plant.
4. Visit report on vermicomposting plant.
5. Visit report on biomedical waste treatment plant.
6. Visit report on Industrial solid waste treatment plant.
7. Collect information of various machinery used for collection and transportation of Solid waste.
8. Understand health aspect during handling and transportation of solid waste.
9. Visit repot on transfer station.
10. Study organization pattern of solid waste management.

*Student should prepare visit report by considering following points
(For sr. no.1 to 6 above)
1. Name and Location of Site
2. Sketch showing elements of plant
3. Raw material
4. Process
5. Production and capacity of plant
6. Advantages and Disadvantages
7. Financial assistance by govt. or any other statutory body.
8. Any other information.
9. Minimum two photograph of each visit attached to visit report.

(Size of photo10cmx12cm)
(For sr. no.7 above)

1. List of machinery
2. Working of machinery
3. Capacity of machinery
4. Feasibility of machinery.
5. Any other information.

**Learning Resources:**
**Books:**

| Sr. No | Author | Title | Publisher |
|---|---|---|---|
| 1 | Dr. A. D. Bhide | Solid Waste Management | -- |
| 2 | Gorge Techobanoglous | Solid Waste | McGraw Hill |
| 3 | D.L. Manjunath | Environmental Studies | PEARSON Publication |
| 4 | Gottas | Composting | -- |
| 5 | K.Sasikumar | Solid Waste Management | PHI learning |
| 6 | Khopkar S.M. | Environmental Pollution | New Age International limited |
| 7 | Edwards and Lofty | Earthworm Biology | -- |
| 8 | Anindita Basak | Environmental Studies | PEARSON Publication |
| 9 | Rao C.S. | Environmental Pollution Control Engineering | Wiley Eastern Limited |
| 10 | B. B. Hosetti | Prospect and Perspectives of Solid Waste Management | NEW AGE International limited |

**Websites:**

1. www.hsagolden.com
2. www.almitrapatel.com
3. www.yousee.in
4. www.skgsangha.org
5. www.epa.gov/epaoswer/non-hw/muncipal/index.htm
6. En.wikipedia.org/waste-management

**Course Name : Civil Engineering Group**

**Course Code : CE/CR/CS/CV**

**Semester : Sixth for CE/CR/CS and Seventh for CV**

**Subject Title : Plumbing Services (Elective)**

**Subject Code : 17607**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| 03 | -- | 02 | 03 | 100 | -- | -- | 25@ | 125 |

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

A properly systematic course in Plumbing is not available in India. Plumbing though crucial but remained as neglected subject. As a result, there is a great demand to well trained Plumbing Professionals in the building industry.

Plumbing service is necessary for proper water supply & efficient drainage facility in a building. As buildings are becoming more complex and more modern plumbing materials and systems are available in India, it is necessary to include the same in the Civil Engineering curriculum.

Plumbing services are important component of Civil Engineering. Internal plumbing contributes to around 15% of the construction cost.

Indian Plumbing Association (IPA) has adopted, reviewed and revised the Uniform Plumbing Code of International association of Plumbing and Mechanical officials to suit Indian practices, customs and Laws. The code is published as Uniform Plumbing Code – 2008 India (UPC1).

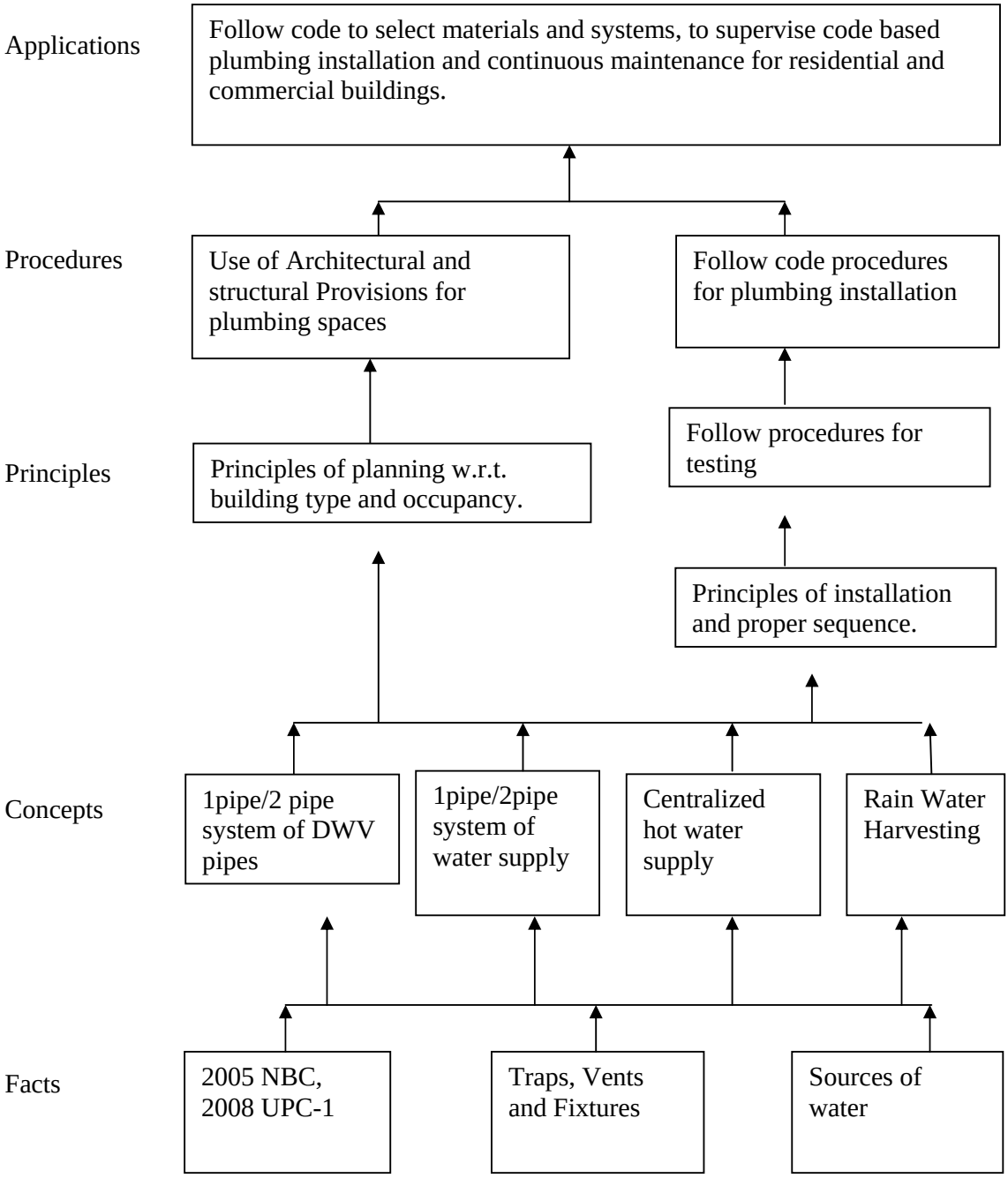
Need of proper use of Plumbing code must be code based education and training in Plumbing will have better job opportunities and improved income. The formal education in Plumbing will improve the plumbing system design and installation standards, thereby ensuring health and safety of people, structure and environment.

**General Objectives:**

The student will be able to,

1. Understand proper coordination of plumbing work with Architects and structural engineers.
2. Interpret plumbing drawings.
3. Select proper plumbing materials & systems.
4. Supervise plumbing installation as per UPC - 2008.
5. Understand methods to conserve water and energy.
6. Follow safety measures at site.
7. Follow standards for installation as per code practice.

**Learning Structure:**



**Contents: Theory**

| Topic and contents | Hours | Marks |
|---|---|---|
| **Topic 1: Introduction to Codes, Architectural and Structural Coordination.**<br>**Specific objectives:**<br>➢ Use relevant Code (UPC – 2008).<br>➢ Maintain proper coordination amongst different agencies.<br>➢ Select proper materials for plumbing.<br>➢ Follow local municipal laws.<br>**Contents:**<br>**1.1 :** Importance of plumbing, history of ancient plumbing, model code- roles, scope, purpose and use of codes and standards in building industry, approvals, AHJ(Authority Having Jurisdiction) general regulations, minimum standards, labeling, alternative materials, sewers required, damage to drainage system, improper location, workmanship, prohibited fitting and practices, engineered systems, water conservations, protection of pipes and structures, water proofing, rat proofing.<br><br>**1.2:** Architectural and structural coordination (not included in UPC1 and ITM ) Architectural and Structural provisions for Plumbing systems, coordination required during the planning stage, various agencies involved and their roles, policy decisions, schematic alternatives, planning spaces for plumbing systems, water tanks, pump room, centralized hot water system, toilet locations, toilet planning, plumbing shafts, basement and terraces planning. Structural parameters, sunken toilets, location of columns and beams, post tensioned slabs, importance of ledge walls, waterproofing. Local Municipal laws, domestic and fire static water requirements, water sources, prohibited fittings and systems. | 04 | 10 |
| **Topic 2 : Plumbing Terminology**<br>**Specific objectives:**<br>➢ Define terms used in plumbing.<br>➢ List plumbing fixtures.<br>➢ List drainage system and their joints.<br>➢ List different valves used in water supply and drainage with their function.<br>**Contents:**<br>Definition , use/ Location purpose and sketches of the following<br><br>**2.1:** Plumber Plumbing fixture: accessible / readily accessible, aerated fitting, bathroom group, carrier, flood level rim, floor sink, flush tanks, lavatories, macerating toilet system, plumbing appliances, flushometer valve<br>**2.2:** Traps, indirect waste, vent blow off, development length, parts of vent system - stack vent, branch vent, continuous vent, individual vent, dirty arm, FOG (Fat, Oil and Grease) disposal system receptors, slip joint.<br>**2.3:** Drainage - adapter fitting, adjusted roof area, AAV (Air Admittance Valve), air break, air gap, area drain, bell and spigot joint, building drain, branch, DFU, grease interceptor, roof drain, smoke test, stack, joints.<br>**2.4:** Water Supply: Angle valve, anti- scald valve, check valve, gate valve, PRE (Pressure Relief Valve), back flow, bypass, cross connection, ferrule, gray water, joints. | 06 | 16 |
| **Topic 3: Plumbing Fixtures and Fixture Fittings.**<br>**Specific objectives :** | 08 | 14 |

| | | |
|---|---|---|
| ➢ State use of different plumbing fixtures.<br>➢ Draw plan and elevation of fixture and fitting with standard dimension.<br>➢ State use of different plumbing fittings required for specific situation.<br>➢ Know installation standard for fixtures as per code.<br><br>**Contents:**<br>Different types of plumbing fixtures, shapes/ sizes, capacities, situation and where used:<br>**Ablution Fixtures -** Wash basin, sinks (kitchen sinks cleaner sinks) bath tub, flushing cistern, drinking fountain.<br>**Soil Fixtures -** water closets, urinal, mop sink, bidets, slop sinks plumbing fittings for Ablution fixtures and Soil fixtures<br>**Water Conserving Fixtures-** Water cooler, cloth washer, hot and cold water system, display fountain. Installation standard for plumbing fixtures, dimension in plan and elevation | | |
| **Topic 4: Traps, Interceptors, Indirect Waste and Vents.**<br>**Specific objectives :**<br>➢ State purpose of different traps and trap seals.<br>➢ Describe proper methods of installing indirect waste piping.<br>➢ State requirement and purpose of venting.<br>➢ State installation standard as per code.<br><br>**Contents:**<br>**4.1:----------06**<br>Traps- Definition, function, Requirement of good trap, trap arms, Development length, trap seals, venting to traps, trap primers, Classification of traps. prohibited traps,<br>**4.2:----------06**<br>System of plumbing for building drainage-Two pipe system, one pipe system, waste receptors, dish washers, drinking fountain.<br>**4.3**:----------**08**<br>Vent- purpose of venting, trap seal protection, materials, vent connection, flood rim level, , vent stacks, water curtain and hydraulic jump, cleanouts, venting of interceptors, vent sizing. | 10 | 20 |
| **Topic 5: Sanitary drainage and storm drain.**<br>**Specific objectives :**<br>➢ State purpose of single and two pipe systems of plumbing.<br>➢ List different pipe materials and joints.<br>➢ Draw sketches for protection of pipes and structures.<br>➢ State sizing of horizontal and vertical pipes.<br>➢ List storm drains requirements, roof drains, sub drains and sub soil drains.<br><br>**Contents:**<br>**5.1: ---------- 10**<br>Preamble on single and two pipe systems, different pipe materials and jointing methods, special joints, hangers, and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices, hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below inverted level, suds relief, building sewers, trenching, testing sumps and pumps, sizing of horizontal and vertical pipes. | 10 | 20 |

| | | |
|---|---|---|
| **5.2: ---------- 10**<br>storms drain required, prohibited connections, subsoil drains, sub drain, gutters/ channels/scuppers, roof drains, strainers, leaders, conductors and connections, collect/ capture storm water, discharging storm water, safety, traps required, prohibited installations. | | |
| **Topic 6: Water Supply, Gray and Reclaimed Water**<br>**Specific objectives:**<br>➢ State sources of water.<br>➢ Understand hot and cold water distribution system.<br>➢ Differentiate potable and non potable water.<br>➢ Learn gray water, reclaimed water and rain water harvesting.<br>➢ Understand gray water approvals, specification, drawing and safety signs used.<br>➢ Understand rain water harvesting.<br><br>**Contents :**<br>**6.1: ----------12**<br><br>Preamble on municipal water, sources of water, potable and non potable water, reclaimed water, water storage , hot and cold water distribution system, backflow protection, air gap, cross connection control, pipe materials and jointing method, alternative materials, hangers, and supports, workmanship, prohibited fittings and practices, protection of pipes and structures, pressure control, unions, thermal expansion, types of valves, installation and testing, disinfection, protection of underground pipes, color codes and arrow marking, introduction to wsfu.<br>**6.2: ----------08**<br>Definition of gray water, approvals, specification, and drawing, safety, total gray water discharge, holding tanks, valves and piping, reclaimed water system, definition of reclaimed water, pipe identification, installation, safety signs, valves, cross connection, approved uses, Rain water harvesting in plumbing systems. | 10 | 20 |
| **Total** | **48** | **100** |

**Skills to be Developed:**

**Intellectual Skills:**

1. To identify plumbing fixtures and fittings.
2. To interpret plumbing installation with UPC-I and ITM.
3. To identify valves used in water supply and drainage system with their function.
4. To interpret plumbing drawings for multistoried buildings.

**Motor Skills:**

1. Ability to draw plan and elevation of fixtures and fittings with standard dimensions.
2. Ability to learn sizing of horizontal and vertical pipes used in drainage system.
3. Ability to draw toilet layouts, urinals and different manholes.

**Practicals: Term work will be prepared by each student in the form of assignments as below.**

**List of Assignments:**

1. Draw sketches of installation details of plumbing fixtures and fittings in plan, elevation and section; with standard dimensions (Minimum 4)
2. Interpretation of sample plumbing drawings for multistoried building.
3. Draw toilet layouts, plans, elevations and sections of selected case. Give dimensions.
4. Prepare layout of internal and external (outside the toilet) DWV pipes and fittings of a selected case. If possible, write pipe diameters.
5. **Seminar:** Students can select any topic from contents by referring codes, text book, professional magazines, technical papers published and websites of manufacturers and make a seminar presentation in 10 minutes using power point. Weightage is assigned for contents and presentation skills. (Students can work in a group of two.)
6. **Site visit report:** Visit any plumbing site and submit a report on observation on plumbing system, architectural and structural provisions, pipe materials work method, safety and recommendations based on the provisions of UPC-I and ITM.

**Learning Resources:**

**1. Books:**

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Plumbing Engineering | S. M. Patil | Seema Publication, Mumbai. |
| 2 | Plumbing Design and Practice | S. G. Deolalikar | Tata McGraw-Hill |
| 3 | Plumbing Technology Design and Practice | Lee Smith | Delmar Publication |
| 4 | Practical Plumbing Design Guide | James C. Church | Mcgraw-Hill (T) |
| 5 | Plumbing and Illustrated Guide to the Plumbing codes. | Michal Casey, Duglas Hannes, Redwood Kardon | -- |

**2. IS, BIS AND INTERNATIONAL CODES:**

- 2008 Uniform plumbing code – India (UPC-I )
- 20080Illustrated training manual (ITM).
- Extracts from IAPMO India

**3. Websites:**

- www.plumbing services.com.
- www.cookandlees.com
- www.mepdesignservices.com
- www.plumbing.1800anytyme.com
- www.dyno.com/plumbing.

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Sixth for CE/CR/CS and Seventh for CV**

**Subject Title : Rural Engineering**

**Subject Code : 17087**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS. | TH | PR | OR | TW | TOTAL |
| -- | -- | 02 | -- | -- | -- | -- | 50@ | 50 |

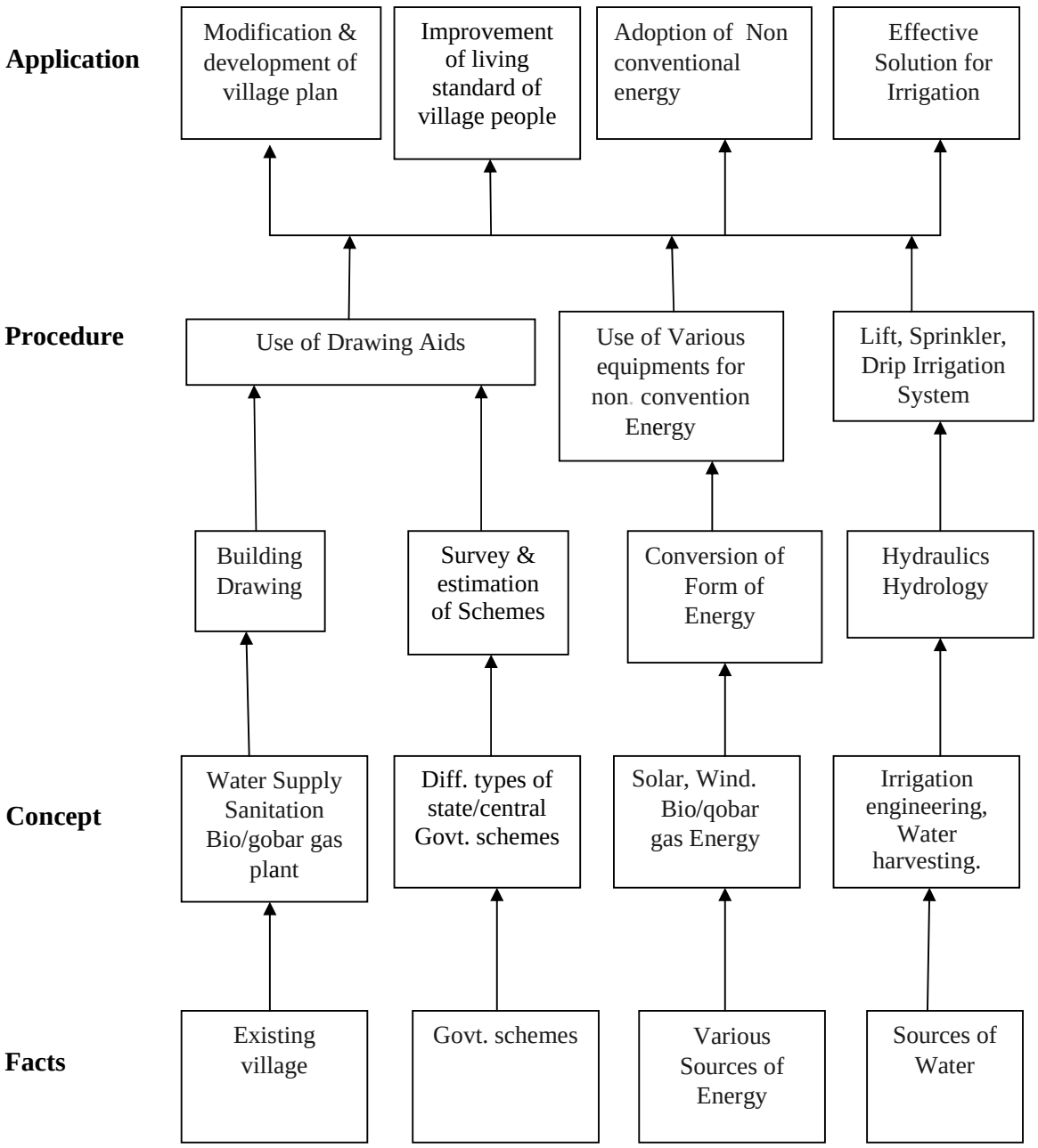
**Rationale:**

This subject is a means of the transfer of civil engineering technologies studied by the students in all semesters of the course towards rural development.

Agriculture Industry is the largest industry in India. The economy of the country largely depends upon the agricultural productions. Transfer of technology will enable the farmers to increase the yield of different crops. This will aim at sustainable development of villages which is necessary for nation building. About 65% of the population resides in villages. The development of village through different contents of this subject like water shed management, irrigation system, cottage industries, various central and state government schemes is possible due to techniques of transfer of technology.

Thus the upliftment of villages due to rural engineering contents may reduce the migration of rural population to urban population.

**Learning Structure:**



**Theory:**

| Topics and Contents |
|---|
| **Topic 1: Introduction**<br>• Importance of Rural Engg.<br>• Role of Civil Engg. Student in Rural development<br>• Socio-Economical Survey- Purpose<br>• Need assessment Survey-Use<br>• Existing living in rural area- Residential accommodation, communication (Roads), light, drinking water, facility sanitary arrangements, Electrical Power, Health, medical facility.<br>• Modification and improvement Suggested through Survey. |
| **Topic 2: Water shed management**<br>• Definition<br>• Different types of water shed management structure eg. Gabian structure, Underground Bandhara , Kolhapur type weir , Cement Plug, Contour Bunding, Terracing, Rain Water Harvesting (mention types )<br>• Their use and importance |
| **Topic 3: Irrigation Systems**<br>• Purpose<br>• Types Drip irrigation, sprinkler irrigation, Lift irrigation<br>• Sample layout, component parts, its effects |
| **Topic 4: Cottage Industry**<br>• Importance of cottage industry in rural development<br>E.g. Brick Manufacturing, cement block/ concrete block manufacturing. brief process, its impact |
| **Topic 5: Different types of central Govt. and state Govt. Schemes**<br>• Need of Different types of schemes.<br>• Role of civil Engg. Student in the development of rural area.<br>• Different Schemes (The provisions- and purpose/ use)<br>– Indira Awas Yojana<br>– Swajal Dhara Yojana<br>– Jawahar Well Yojana |
| **Topic 6: Non conventional energy**<br>• Scope of non Conventional energy<br>• Different types Solar enrage, bio gas, wind mill etc.<br>• Use, advantages and disadvantages |

❖ **Reference Books :** Govt. Publication/ Hand Books

**Practicals:**

**Skill's to be developed**

**Intellectual Skills**

1) Use knowledge of civil engineering for solving the problems of rural population.
2) Inspire the villagers for using non conventional energy appliances.
3) Provide support services as a Civil Engineer for rural population.

**Motor Skills**

1) Spare their services for various development schemes of state/central Govt.
2) Provide guidance to start cottage industries related to Civil Engineering.
3) Provide services for developing and propagating the programmes of water shed management

**Term work shall consist of reports on of the following assignments:**

1. Socio Economic and Educational survey of village: write a report to identify the need of village. The following is the suggested format (may be detailed further) for collection of factual information at village level. Additional to home to home information may also be collected by devising a suitable format to collect relevant personal and family information. Carryout chain and compass survey along the roads of village locating homes and main features. Draw plan and show on it the proposed development.

- **Short village profile**
  - Name of Village
  - Block
  - District
- **Total Population**
- **Population** Caste wise/ Male-Female/Age.
- **Total Houses :-** (a) Properly built (b) Unproperly built
- **Existing facilities available:-** eg. School, College, Hospital, Bank, Post office, Sanitation system, Approach road, Internal road, Drinking water etc.
- Total Below Poverty Line Card holder
- Total Above Poverty Line member's (Above Rs. 18,000/- Per year )
- Total White card holder (Above Rs. One lakh)
- Natural resources available- Ponds / River/ Well/ Tube well
- Number of Wells/ Bore wells

2. Visit to the Structures built under water shed management program (at least two structures) Prepare neat labeled sketches and report with the following points: site selection, materials required/ procurement of material, process of construction, use, conclusion.
   1. Gabian structure
   2. Underground Bandhara
   3. Kolhapur type weir
   4. Cement Plug, Contour Bunding, Terracing.
   5. Rain Water Harvesting
3. Report writing on the following with neat labeled sketches/ layout (Minimum area considered @ o.5 Hector's) Minimum One
   - 3.1 Sprinkler Irrigation System, with capacity calculation, head and discharge calculation, power calculation for pump, pressure calculation for pipe.
   - 3.2 Drip Irrigation System with capacity calculation, head and discharge calculation, Power calculation for pump, pressure calculation for pipe.
   - 3.3 Layout of Lift Irrigation, with capacity calculation, head and discharge calculation, power calculation for pump, pressure and diameter calculation for pipe.
4. Report writing under the guidance of teacher on any one of the cottage industries related to civil engineering regarding.
   (Report consists of raw marital required, processes of molding / casting, equipment required, etc.)
   - 4.1 Brick Manufacturing.
   - 4.2 Cement Block /concrete precast block and pole manufacturing.
   - 4.3 Stone Crusher /Artificial sand.
   - 4.4 M. S. fabrication.
5. Collecting information regarding schemes declared by State / Central Govt. in which Civil Engineer has effective participation. (at least one)
   1. Indira Awas Yojna
   2. Walmiki Awas Yojna
   3. Swajal Dhara Yojna
   4. Jawahar Well Yojna
   5. Village / Farm Tank.

6. Collecting information regarding use of non-conventional energy source like - Solar energy, Bio / Gobar Gas plant, wind mill etc.
7. A Study report on Concept of Community Polytechnic in India regarding its role in upliftment of rural population, its area of working, such as manpower development, transfer of technology, technical support services, information dissemination, community services. A visit to nearest Community Polytechnic shall be arranged. A visit report shall be prepared covering all aspects.

**Learning Resources**

**1. Books**

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Irrigation Engg. | S. K. Gurg | Laxmi |
| 2 | Building construction | S. Chand | Valey |

**2. Websites:**

www.rural.nic.in
www.lgd.gov.bd
www.rurdev.usda.gov
www.nabard.org
www.ldeorg.org

**Course Name : Civil Engineering Group**

**Course Code : CE/CS/CR/CV**

**Semester : Sixth for CE/CS/CR and Seventh for CV**

**Subject Title : Project**

**Subject Code : 17088**

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|
| TH | TU | PR | PAPER HRS | TH | PR | OR | TW | TOTAL |
| -- | -- | 06 | -- | -- | -- | 50# | 50@ | 100 |

**Rationale:**

Apart from supervising construction and maintenance of civil engineering works a Diploma Engineer has to carry out survey, collect, analyze and synthesize the data. He / She has also to refer handbooks, I. S. Codes and design small structures on the basis of knowledge of different subjects.

Due to changing scenario the role of Diploma Engineer is becoming more prominent and has to acquire professional abilities and develop confidence to face civil engineering problems.

This subject is intended to apply civil engineering principles, rules and regulations to solve a real life problem and to provide a feasible solution. For this He / She will collect data through survey work and referring various information resources and prepare drawings, designs, estimate and write a detailed project report.

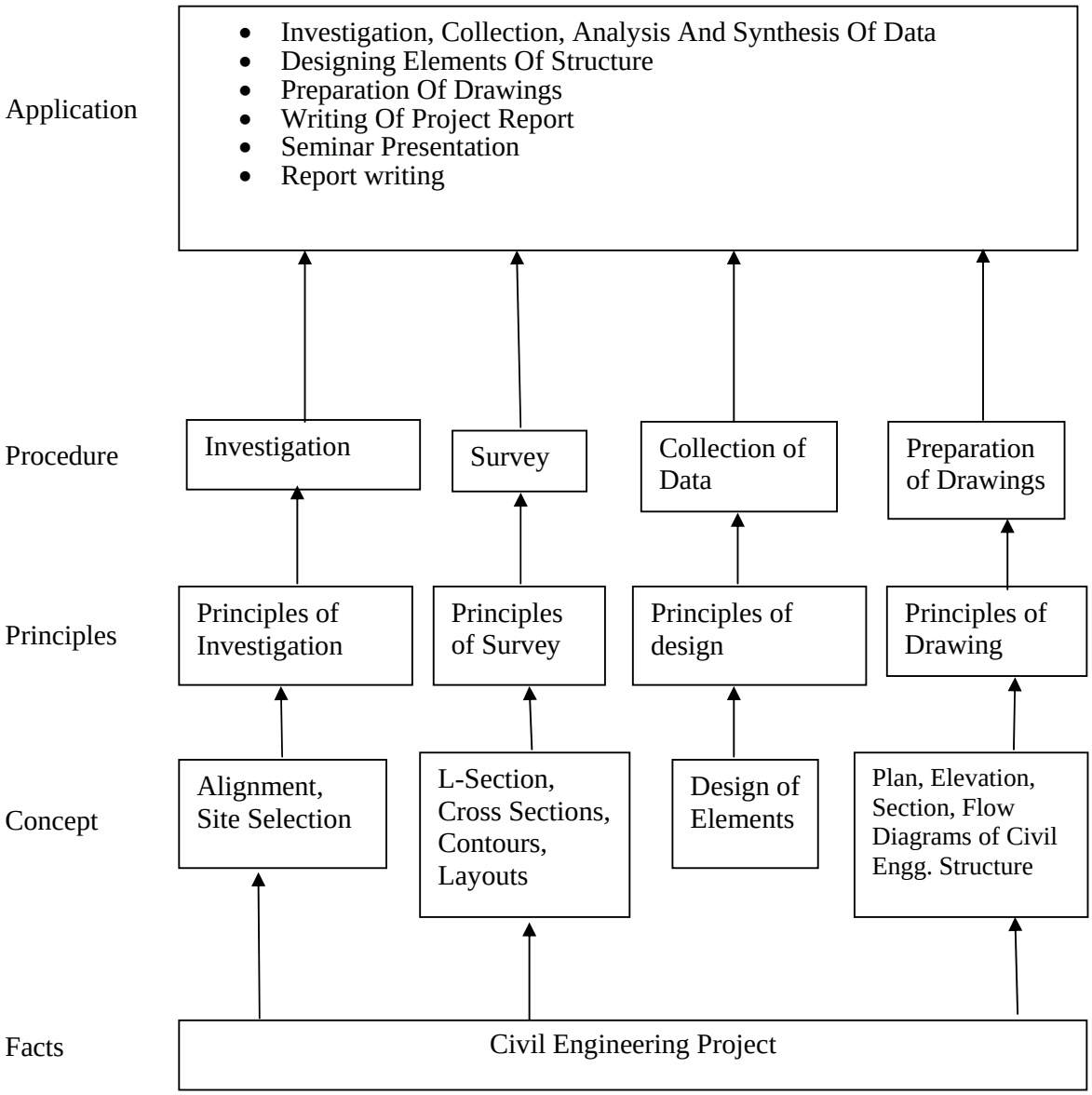
The project and seminar activities will provide students the exposure to handle real life problems and their solutions and prepare him/her to enter confidently in the world of work.

**Objectives:**

Students will be able to:

1) Collect the information for a given project.
2) Apply principles, theorems and bye-laws in the project planning and design.
3) Interpret and analyze the data.
4) Develop professional abilities such as persuasion, confidence, perseverance and Communication skill.
5) Develop presentation skill.
6) Enhance creative thinking.
7) Report writing.

**Learning Structure:**



**Notes: The batch of students for the project shall be limited to 06 students.**

**Project:**

Skills to be developed:

**Intellectual Skills:**

1) Decide and collect data for projects.
2) Read and interpret the drawing, data.
3) Apply the principles, rules, regulations and bye-laws.
4) Design the components.
5) Prepare format for reports.

**Motor Skills:**

1) Prepare drawings for project.
2) Use of computer for drawing, networking.
3) Work in a group for a given task.
4) Prepare a report.

**List of Projects:**

Following are the areas of suggested civil engineering projects to be undertaken by a group of students. The project can be selected from the following civil engineering systems like

- Building construction system
- Transportation Engineering
- Irrigation Engineering
- Public health Engineering
- Management

**The project report should preferably be in the following format:**

- Topic and objectives.
- Collection of data.
- Literature Survey.
- Required survey work.
- Design of components.
- Preparation of required drawing, if any.
- Preparation of Estimate.
- Management and construction procedure.
- Resources scheduling and networking.
- Benefits to society.
- Conclusion.

**List of Civil Engineering Projects:**

1) K.T. Weir.
2) Lift Irrigation scheme.
3) Micro irrigation -Drip/Sprinkler Irrigation.
4) Junction planning for city roads/planning for roads for congested area/parking studies etc.
5) Watershed development of small catchments.
6) Rain water harvesting for domestic or public building.

7) Campus development.
8) Interior design and decoration.
9) Concrete mix design.
10) Bridge design.
11) Structural Audit
12) NDT of any RCC building.
13) Solid waste management.
14) Hospital waste disposal.
15) Recycling of resources.
16) Manufacturing of pre-cast concrete products.
17) Prestressed concrete.
18) Non conventional sources of energy.
19) Concrete pipe manufacturing unit.
20) Advance construction techniques.
21) Transfer of technology to villages.
22) Planning and design for residential apartments/commercial complex.
23) Planning and design of water treatment plant for given data.
24) Planning and design of water supply scheme for given layout.
25) Planning and design of sewage treatment plant for given data.
26) Planning and design of sanitary scheme for given layout.
27) Concrete materials.

Any other similar project can be selected.

**Term Work:** Shall consist of -- Detailed project report in above format.
Separate drawing sheets covering details of the project, if any shall also be prepared.

**Learning Resources:**

1) Civil Engineering Hand Books / Reference books.
2) Civil Engineering Magazines/Journals.
3) Relevant IS / International codes.
4) PWD Handbooks / M.I. Manuals.
5) Material/Machinery / Product Catalogues.
6) Related Websites for technological information.
7) www.projectreport.com
8) www.howstuffworks.com