



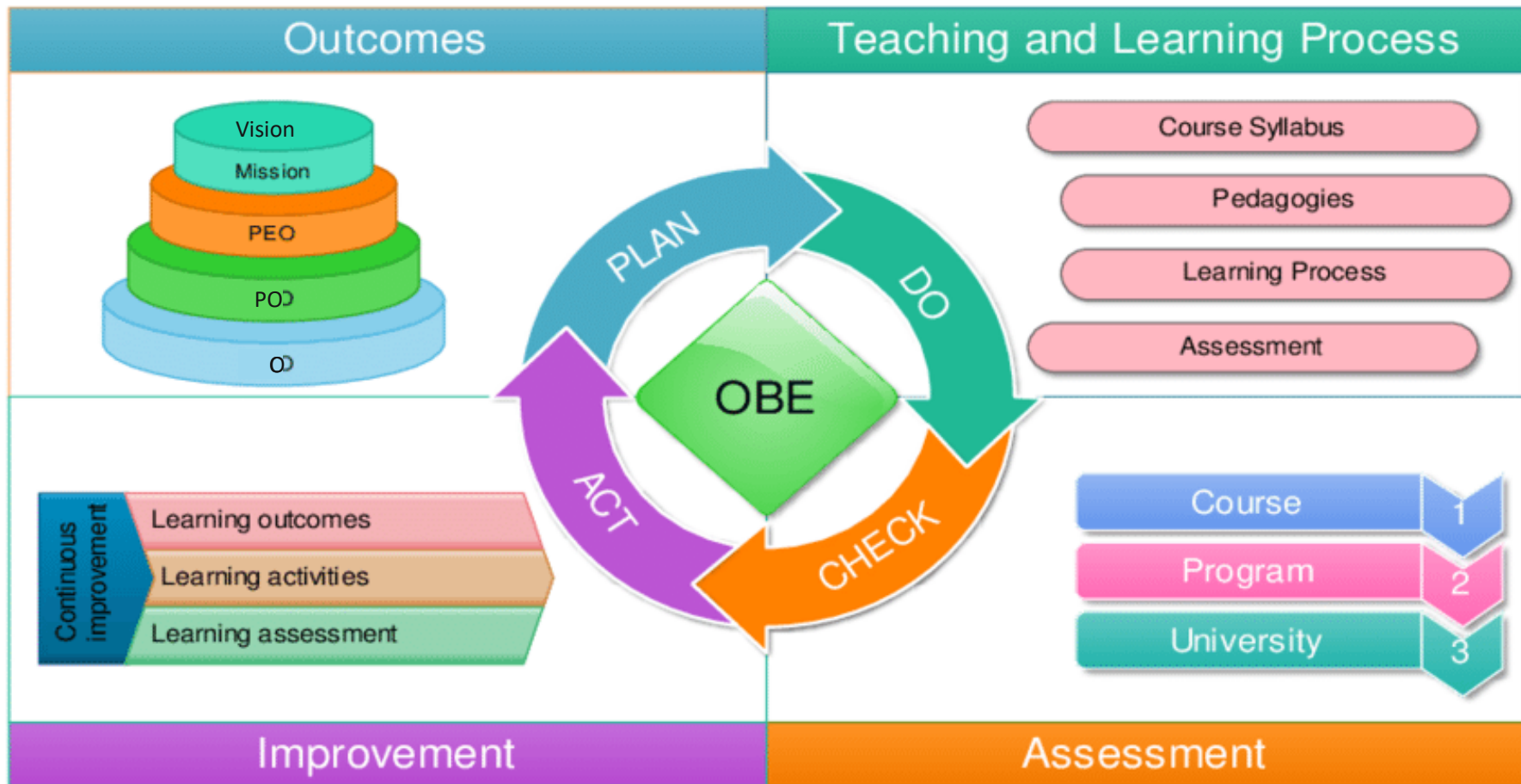
SANSKRITHI SCHOOL OF ENGINEERING  
PUTTAPARTHI

# **Outcome Based Education (OBE) Manual**

**Academic Year 2021-22**



**Team OBE  
SSE, Puttaparthi**



## INDEX

1	Vision, Mission and Quality Policy of Institute .....	3
2	OBE Framework of the Institute .....	4
3	Revised Blooms' Taxonomy .....	5
4	Action Verbs for Course Outcome .....	7
5	Guidelines for Writing Course Outcome Statements .....	8
6	Quality of Course Outcome .....	9
7	CO-PO Mapping Guidelines .....	10
8	Targets / Attainment Levels .....	12
9	Student Competency .....	13
10	Rubrics for Assessment.....	15
11	Activity Based Learning.....	16
12	List of Assessment Tools.....	17
13	CO Attainment Calculations .....	18
14	Sample List of Activities with BTL .....	21
15	Contribution of Course Attainment in PO Attainment.....	22
16	Continuous Improvement .....	23
17	List of Documents .....	24

### Abbreviations:

<b>OBE</b>	Outcome Based Education	<b>BTL</b>	Bloom's Taxonomy Level
<b>LOT</b>	Lower Order of Thinking	<b>HOT</b>	Higher Order of Thinking
<b>PEO</b>	Program Educational Objectives	<b>PO</b>	Program Outcome
<b>CO</b>	Course Outcome	<b>PSO</b>	Program Specific Outcome
<b>UE</b>	University Theory Exam	<b>POE</b>	Practical Oral Exam
<b>CE</b>	Course Exit Survey	<b>HoD</b>	Head of Department
<b>PC</b>	Program Coordinator	<b>DAB</b>	Department Advisory Board
<b>PAC</b>	Program Assessment Committee	<b>AY</b>	Academic Year

## Preamble

**Outcome Based Education (OBE)** is an educational model that forms the base of a quality education system. There is no single specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set goals. The faculty may adapt the role of instructor, trainer, facilitator, and/or mentor, based on the outcomes targeted.

OBE enhances the traditional methods and focuses on what the Institute provides to students. It shows the success by making or demonstrating outcomes using statements "able to do" in favor of students. OBE provides clear standards for observable and measurable outcomes.

### Benefits of OBE

- **Clarity:** The focus on outcome creates a clear expectation of what needs to be accomplished by the end of the course.
- **Flexibility:** With a clear sense of what needs to be accomplished, instructors will be able to structure their lessons around the students' needs.
- **Comparison:** OBE can be compared across the individual, class, batch, program and institute levels.
- **Involvement:** Students are expected to do their own learning. Increased student involvement allows them to feel responsible for their own learning, and they should learn more through this individual learning.

### India, OBE and Accreditation

From 13<sup>th</sup> June 2014, India has become the permanent signatory member of the Washington Accord. Implementation of OBE in higher technical education also started in India. The National Assessment and Accreditation Council (NAAC) and National Board of Accreditation (NBA) are the autonomous bodies for promoting global quality standards for technical education in India. NBA has started accrediting only the programs running with OBE from 2013.

The National Board of Accreditation mandates establishing a culture of outcome based education in institutions that offer Engineering, Pharmacy, Management program. Reports of outcome analysis help to find gaps and carryout continuous improvements in the education system of an Institute, which is very essential.

## Vision, Mission and Quality Policy of Institute

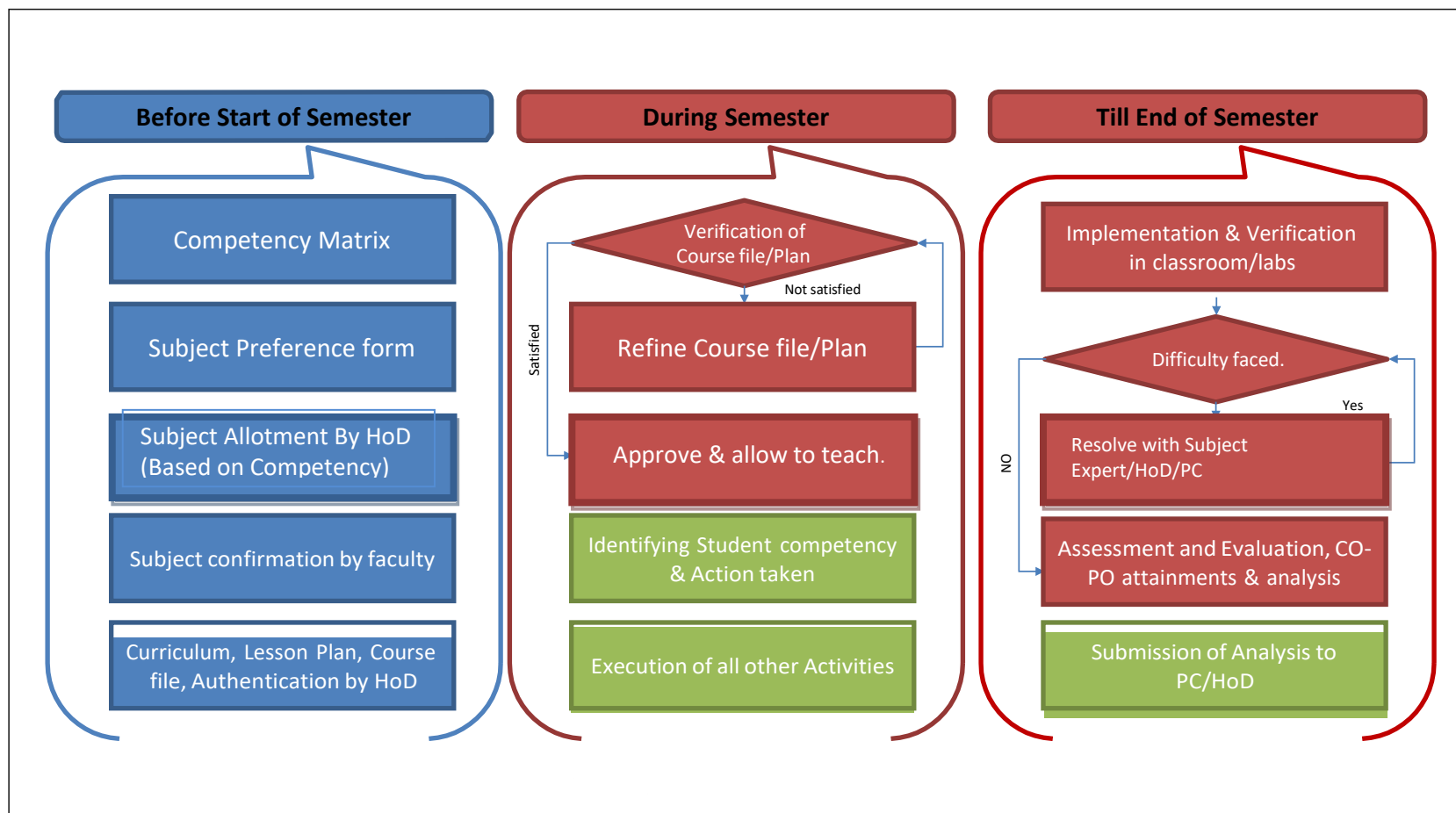
**Vision of Institute:** To develop dynamic and socially responsible engineers possessing wisdom, positive attitude, and an impeccable character.

<p><b>Mission of Institute:</b></p> <ol style="list-style-type: none"> <li>1. The college is devoted to serving society and the nation by providing quality education, and skill development programs thereby enabling the students to become skilled engineers with the right kind of knowledge.</li> <li>2. Committed towards setting new benchmarks of excellence in engineering education with emphasis on research &amp; development, innovation and services to society, industry, and the world.</li> </ol>	<p><b>Quality Policy of Institute:</b></p> <p>We at Sanskrit School of Engineering endeavor to uphold excellence in all spheres by adopting best practices in effort and effect.</p>
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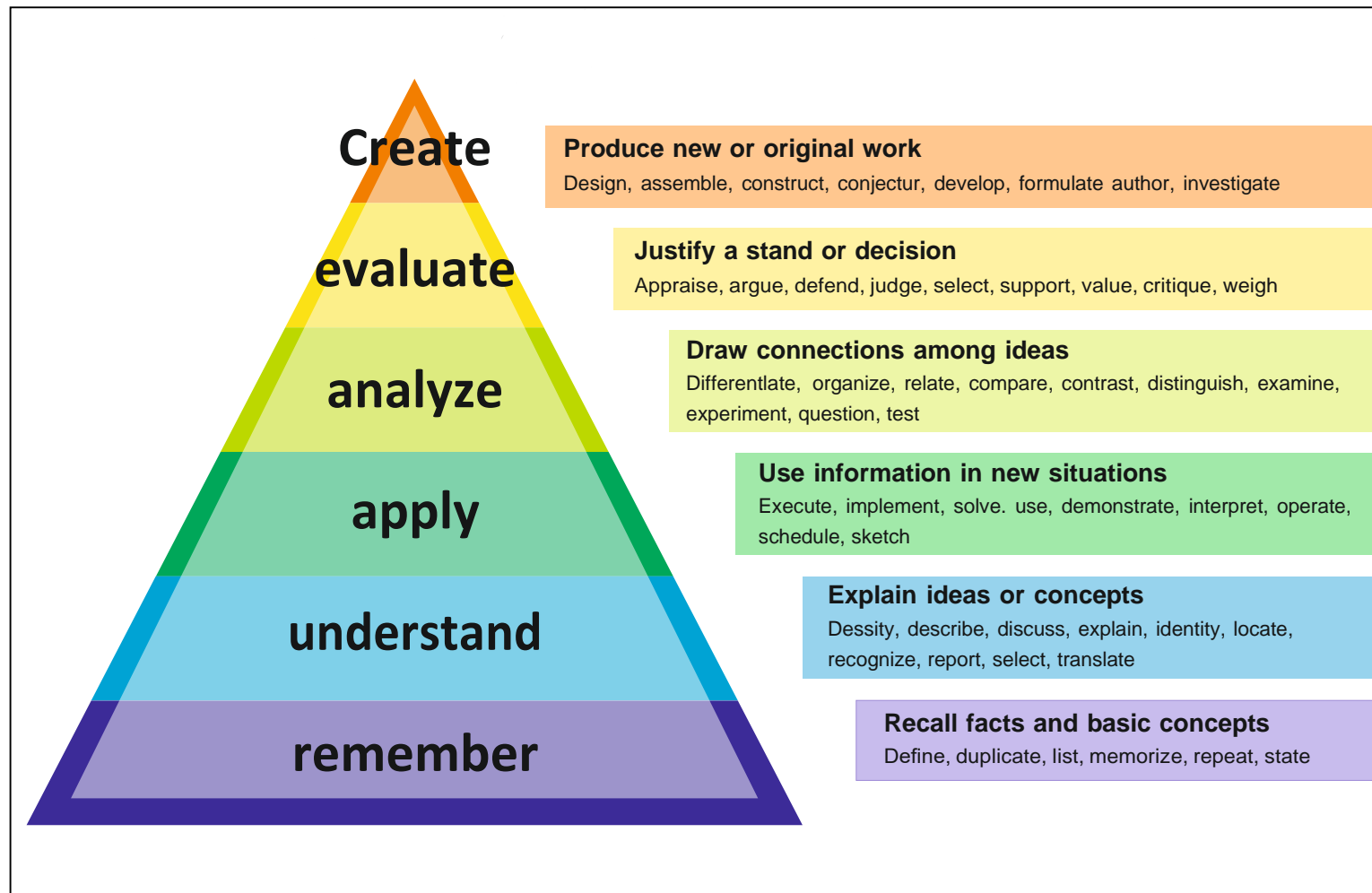
### Program Outcomes (POs)

- **PO 1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO 2: Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO 3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO 4: Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO 5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO 6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO 7: Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO 9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO 11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO 12: Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



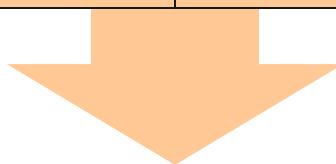


OBE Framework of the Institute



Revised Bloom's Taxonomy (BT)

The cognitive process dimensions- categories					
Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyse	Evaluate	Create
Recognizing (identifying)  Recalling (retrieving)	Interpreting  Illustrating  Classifying  Summarizing  Inferring (concluding)  Comparing  Explaining	Executing  Implementing	Differentiating  Organizing  Attributing	Checking (coordinating, detecting, testing, monitoring)  Critiquing (judging)	Planning  Generating  Producing (constructing)



The Knowledge Dimension			
Concrete Knowledge		Abstract knowledge	
Factual	Conceptual	Procedural	Metacognitive
<ul style="list-style-type: none"> <li>• Knowledge of terminologies</li> <li>• Knowledge of specific details &amp; elements</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of classifications and categories</li> <li>• Knowledge of principles &amp; generalizations</li> <li>• Knowledge of theories, models &amp; structures</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of subject specific skills and algorithms</li> <li>• Knowledge of subject specific techniques and methods</li> <li>• Knowledge of criteria for determining when to use appropriate procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Strategic Knowledge</li> <li>• Knowledge about cognitive task, including appropriate contextual and conditional Knowledge</li> <li>• Self- Knowledge</li> </ul>



## Action Verbs for Course Outcomes

Sample Action verbs:

Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyse	Evaluate	Create
Define	Explain	Solve	Analyse	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summarise	Calculate	Distinguish	Recommend	Formulate
Match	Compare	Sketch	Explain	Grade	Invent
Tabulate	Discuss	Prepare	Differentiate	Measure	Develop
Record	Estimate	Chart	Appraise	Test	Organize
Label	Express	Choose	Conclude	Evaluate	Produce

Illustration (use of action verb w.r.t knowledge dimension and order of thinking):

Use of action verbs	Factual	Conceptual	Procedural	Metacognitive
<b>Remember</b>	<b>List</b> properties of soil	<b>Recognize</b> characteristic of material	<b>Explain</b> working of pump	<b>Identify</b> strategies for report writing
<b>Understand</b>	<b>Summarize</b> features of a new product.	<b>Classify</b> adhesives by toxicity.	<b>Explain</b> assembly instructions.	<b>Predict</b> the behavior of member
<b>Apply</b>	<b>Respond</b> to frequently asked questions.	<b>Provide</b> advice to team members	<b>Carry out</b> pH tests of water samples.	<b>Use</b> modern techniques to get solution
<b>Analyse</b>	<b>Explain</b> the selection of tool/ activity.	<b>Differentiate</b> LOT and HOT	<b>Integrate</b> compliance with regulations.	<b>Assess</b> the project work
<b>Evaluate</b>	<b>Select</b> the appropriate tool	<b>Determine</b> relevance of results.	<b>Judge</b> efficiency of sampling techniques.	<b>Reflect</b> on one's progress.
<b>Create</b>	<b>Generate</b> a log of daily activities.	<b>Assemble</b> a team of experts.	<b>Design</b> efficient project workflow.	<b>Create</b> a learning portfolio.

## Guidelines for writing Course Outcome Statements

**Well-written course outcomes involve the following parts:**

1. Action verb
2. Subject content
3. Level of achievement as per BTL
4. Modes of performing task (if applicable)

**Illustration:**

Students are able to

- 1) Design column splices and bases. → Action verb (underlined)
- 2) Determine the losses in a flow system. → Subject content
- 3) Use structural analysis software to a competent Level. → level of achievement
- 4) Present seminar on real life problems. → Modes of performing task with action verb (underlined)

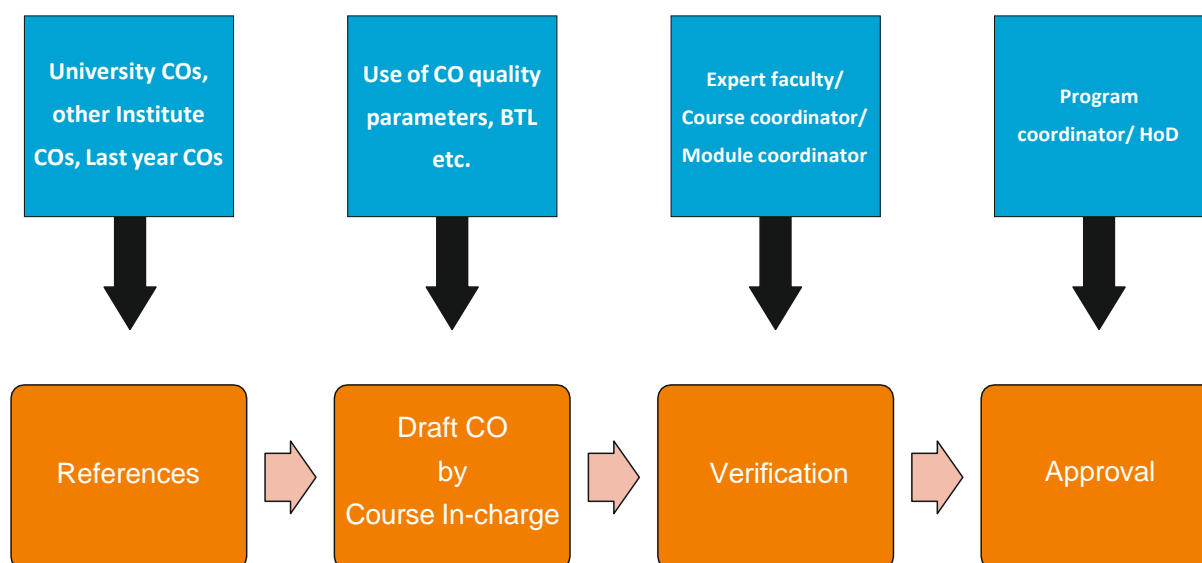
**While writing COs the following questions/points must be addressed properly.**

<b>Specific</b>	Is there a description of precise behavior and the situation it will be performed in? Is it concrete, detailed, focused and defined?
<b>Measurable</b>	Can the performance of the outcome be observed and measured?
<b>Achievable</b>	With a reasonable amount of efforts and application can the outcome be achieved? Are you attempting too much?
<b>Relevant</b>	Is the outcome important or worthwhile to the learner or stakeholder? Is it possible to achieve this outcome?
<b>Time-Bound</b>	Is there a time limit, rate, number, percentage or frequency clearly stated? When will this outcome be accomplished?

**Note:** If Laboratory is given as separate course (with course code) then there should be separate course outcomes for Laboratory.

## Quality of Course Outcome

### Process at department level to maintain quality of CO



### Guidelines/Checklist for COs:

<b>Number of COs</b>	2 to 4
<b>CO essentials</b>	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
<b>Based on BTL</b>	Understand, Remember, Apply, Analyse, Evaluate, Create
<b>Number of BTL Considered in one course</b>	Minimum 3
<b>Technical Content/ point of curriculum</b>	All curriculum contents are covered
<b>Curriculum gap</b>	Additional CO for gap identified/filling. Adds more weightage

## CO-PO Mapping Guidelines

### CONSIDER ANY TWO MINIMUM CRITERIA FOR CO-PO MAPPING JUSTIFICATION

#### **A) Contact Hours: Lecture, Tutorial and Practical**

Level	Contact Hours in Percentage (including Lecture, Tutorial & Practical)
No mapping (-)	< 5%
Low (1)	5- 15%
Medium (2)	15- 25%
High (3)	>25%

#### **Description**

Number of Lectures = 3 per week x 12 weeks = 36 Hours

Tutorial = 1 Hr x 12 Weeks = 12 Hours

Practical = 2 Hr x 12 Week = 24 Hours

Total Hrs = 36+12+24 = 72 Hrs

Example: Let, CO1 related points are engaged in 10 lectures + 1 Tutorial and 2 practical Hours

Then contact hours = 10+1+2x2 = 15 hours

Therefore, contact hours in percentage =  $(15/72) \times 100 = 20.8\%$ . Medium mapping (2)

#### **B) Number of Assessment Tools used**

Level	Assessment tools used to assess the CO
No mapping (-)	0
Low (1)	1 or 2
Medium (2)	3
High (3)	4 or more

#### **Description**

CO assessment tools: Mid-term test, end term test, class test, surprise test, oral, continuous internal assessment (Assignment, Lab practical assessment), course exit survey, University theory exam, oral exam/ practical oral exam, external feedback, Activities (Survey, guest lecture, workshop, seminar, casestudies, mini/minor projects etc.)

Every CO must be correlated with each PO and appropriate mapping may be selected.

#### **C) Key words**

Most of the times, appropriate keyword is sufficient for mapping.

Level	Keywords Used in writing COs
No mapping (-)	Key words related with LOT and not related with course or any outcomes
Low (1)	Part of PO is reflected through keywords/action verbs
Medium (2)	Major part of PO is reflected through keywords/action verbs. + moderate level performance is expected from student to achieve PO
High (3)	Exact action verb of PO + critical performance expected from student to achieve PO

### D] Critical Assessment Record for PO5 to PO12

Level	Assessment Depth
No mapping (-)	No rubric used for assessment
Low (1)	Single rubric category used for assessment
Medium (2)	Two rubric category used for assessment
High (3)	Three or more rubric category used for assessment

### Illustration

Category No.	Rubric Category	Level of Performance			
		4	3	2	1
1	Group Leader	Seeks opportunities to lead; while leading is attentive to each member	Will take lead if group insists; not good at being attentive to each member	Resists taking on leadership role; while leading allows uneven contributions	Never shows up
2	Contribution	Always contributes; quality of contributions is exceptional	Sometimes contributes; quality of contributions is fair	Rarely contributes; contributions are often peripheral or irrelevant; frequently misses team sessions	Never shows up and never contributes.
3	Cooperation	Always cooperative with all members, support good initiatives	cooperative with members, but sometimes argue	cooperative with few members, and argue most of time	Non-cooperative

### E] Assessment Type

Level	Assessment Depth
No mapping (-)	Test items (1) <b>OR</b> Nil
Low (1)	Test items (2) <b>OR</b> Assessment item (1)
Medium (2)	Test items (2) + Assessment item (1) <b>OR</b> Assessment item (2)
High (3)	Test items (2) + Assessment item (2) and More

#### Test Item:

Mid-term, End term, class test, surprise test, University theory exam (Questions + additional information)

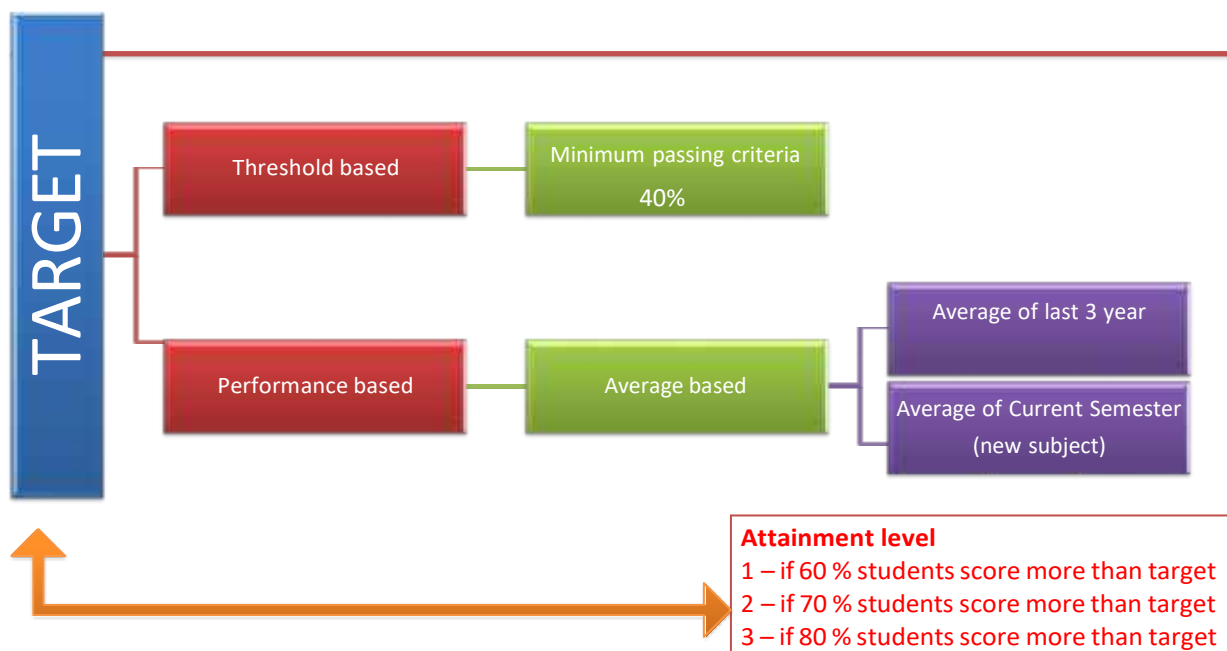
#### Assessment items:

Quizzes, Assignment problems, simulation, laboratory experiments, project, field work, report presentation, tutorials, activities, etc.

### F] Any other criteria with proper justifiable document is acceptable.

## Targets/ Attainment Levels

### SETTING TARGETS FOR ATTAINMENT



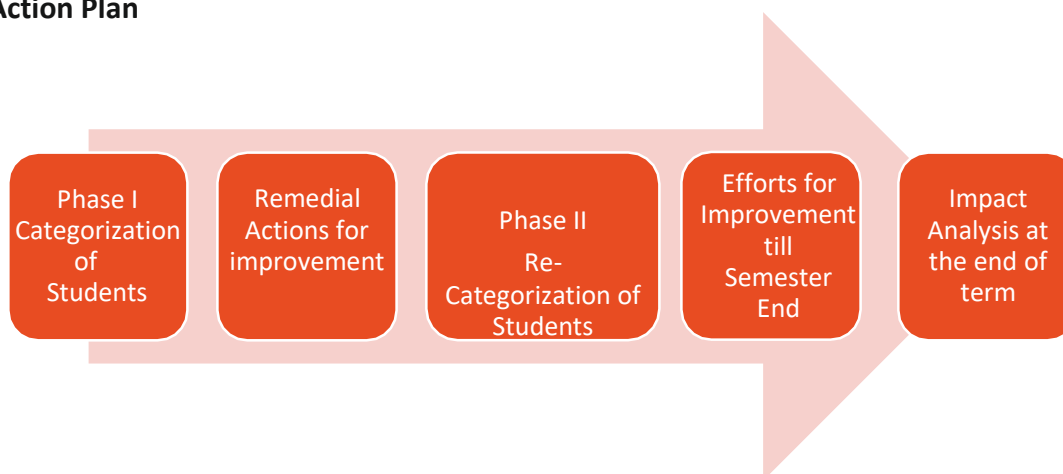
### Illustration

Case of Course	Avg % result in last year/ 3 years	Clue for keeping target	Attainment 1 if	Attainment 2 if	Attainment 3 if
Course 1	<40 %	Threshold	40 % cross target	50% cross target	60% cross target
Course 2	Above 40% but less than 50%	Threshold with high attainment level	60 % cross target	70% cross target	80% cross target
Course 3	Above 50 %	Average based	40 % cross target	50% cross target	60% cross target
Course 4	Above 80 %	Average based with high attainment level	60 % cross target	70% cross target	80% cross target



## Student Competency

### Chart of Action Plan



### Guidelines for First Year

Phase I- Categorization (After 15 Days of start of semester)	Phase II- Re-categorization (After Mid Term Result)
12 <sup>th</sup> Marks	Mid Term Result
Prerequisite Test	Timely Completion of work
Surprise Test after 15 days	Lab Performance
Attendance & Behavior	Attendance & Behavior
	Previous Semester University Result (Applicable for Sem-II)

### Guidelines for Higher Classes [SY, TY & BE]

Phase I- Categorization (After 15 Days of start of semester)	Phase II- Re-categorization (After Mid Term Result)
Previous semester University Result whichever is available	Mid Term Result
Prerequisite Test	Timely Completion of work
Surprise Test after 15 days	Lab Performance
Attendance & Behaviour	Attendance & Behavior
	Previous semester University Result

### Base Score for student category

<50% -Slow Learner

50% to 65% - Average Learner

>65%-Advanced Learner

## **Strategies for Slow, Average and Advanced Learners**

### **For Slow learners**

- Document/record of remedial classes with timetable & attendance
- Specially designed assignment/ task
- Student study group for peer to peer learning
- Individual Counseling
- Student help desk

**Note: Remedial sessions should be conducted once every week.**

### **For Average Learners**

- Additional assignment/ task
- Encouraging for timely and effective completion of work
- Conduction of quiz, orals etc.
- Solving previous year University question papers and test papers
- Presentation on technical topics/ case studies/mini projects

**Note: Activities should be on continuous basis.**

### **For Advanced Learners**

- Encouraging to present & publish papers in journals/conferences/competitions
- Guidance for GATE/ competitive Examination
- Encouraging to participate in professional activities.
- Specially designed activities to improve the portfolio of students.
- Individual guidance for career building

**Note: Activities should be on continuous basis.**

## Rubrics for Assessment

### What is Rubric?

- A scoring guide with criteria for evaluating students' work in direct relation to one or more of the PO's and a rating scale indicating differing levels of performance.

### Rubrics are:

- Used to examine how well students have met CO or PO rather than how well they perform compared to their peers.
- Typically include measurable descriptors that define expectations at each level of performance for each criterion.

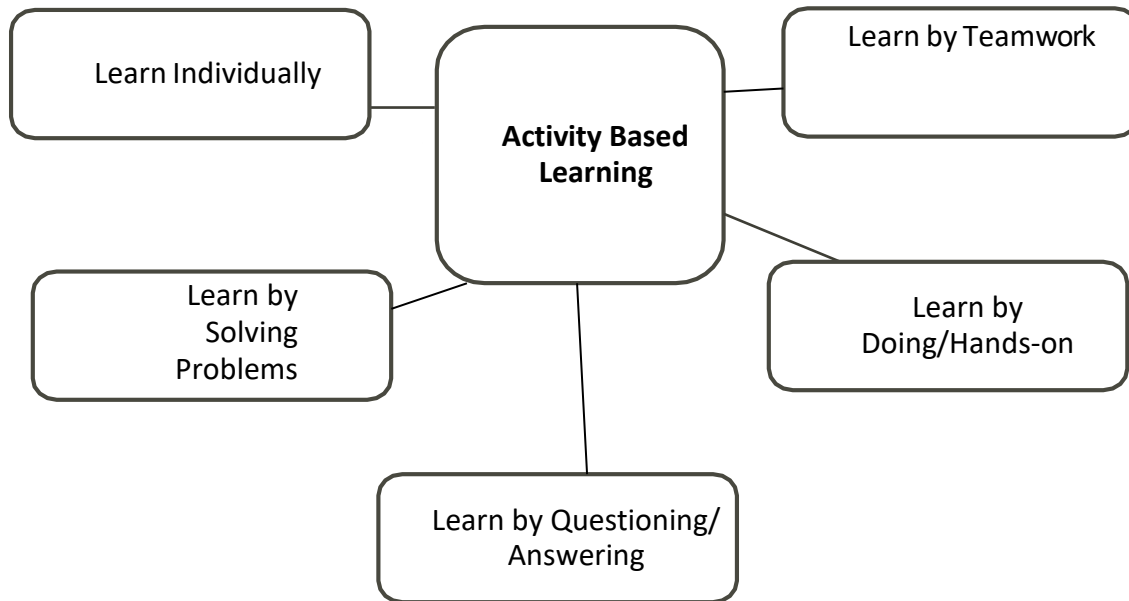
### Sample Rubrics for CO assessment in Laboratory: (10 Marks)

Category	Level of Performance		
	3 marks	2 marks	1 marks
<b>Performance in Lab (3)</b>	<ul style="list-style-type: none"> <li>Able to perform experiment independently within prescribed time</li> <li>The result is close or to standard value.</li> </ul>	<ul style="list-style-type: none"> <li>Able to perform experiment within prescribed time</li> <li>Large deviation of result from standard value</li> </ul>	<ul style="list-style-type: none"> <li>Able to perform the experiment partially with no results.</li> </ul>
<b>Level of Understanding / Q&amp;A (3)</b>	<ul style="list-style-type: none"> <li>Able to show strong theoretical background of experiment</li> <li>Able to interpret proper data to reach conclusion</li> </ul>	<ul style="list-style-type: none"> <li>Partially show strong theoretical background of experiment</li> <li>Partially able to interpret data to reach conclusion.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of theoretical background of experiment or lack of interpretation of data</li> </ul>
	Documentation Level		
	4 marks	3 marks	2 marks
<b>Quality of Submission (4)</b>	<ul style="list-style-type: none"> <li>Graphs, table, contents are well constructed.</li> <li>All-important calculations and result have been clearly made.</li> <li>Conclusions/ observations/ comments done clearly</li> </ul>	<ul style="list-style-type: none"> <li>Shortfalls found in any of the contents of the report viz. graphs, tables, calculations, results, conclusions/ Comments, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Report submitted but not written properly.</li> </ul>

Rubric maximum score = 4+3+3 (high marks) = 10 (100%)

Rubric minimum score = 1+1+2 (low marks) = 4 (40%)

## Activity Based Learning



### Examples:

MOOC, Flipped Classroom, Think Pair Share, Think Pair Solo, Four Corners, Round Robin, Collaborative Learning, Jig-Saw Puzzle, Matrix Method, Peer Learning, Work-Based Learning, Problem-Based Learning, Personalized Learning, Group Discussion, Debate, Case Studies, Fish Bowl, Reciprocal Teaching, etc.

## List of Assessment Tools

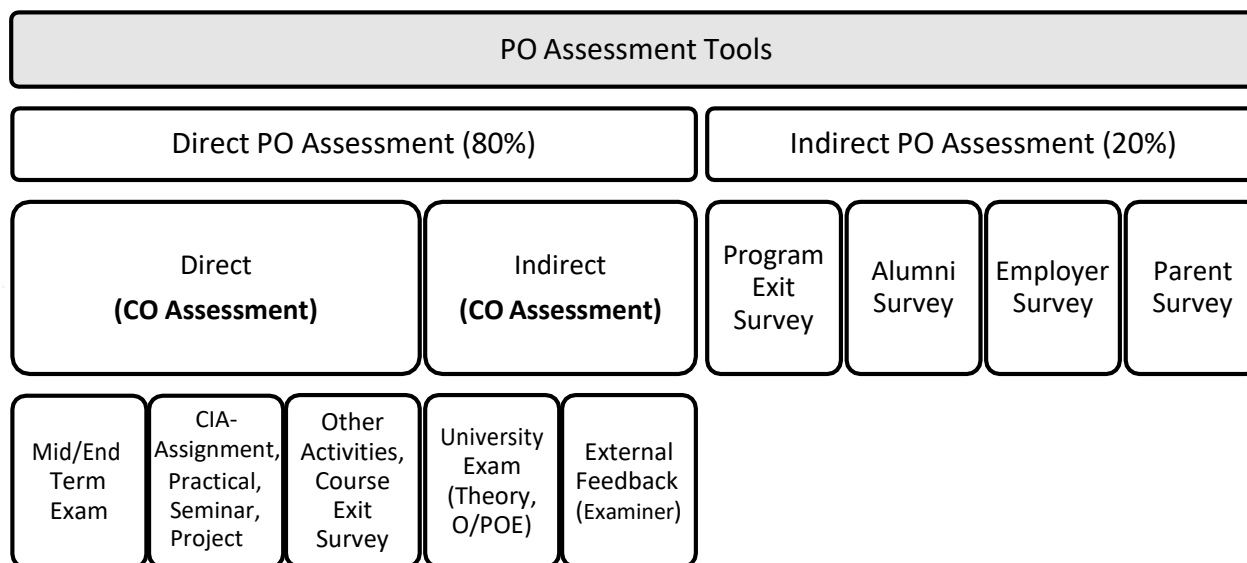
**All (Direct + Indirect) CO Assessment Tools = PO Direct Assessment Tools**

### Sample CO Assessment Tools

- Mid Term Test
- End Term Test
- Quiz
- Assignment
- Practical/ Lab work
- Industrial Visit, Workshop
- Other Task/Activity
- University Exam
- Oral/POE
- Course Exit Survey
- External Feedback (External Examiner/Trainer, Campus Placement Technical Expert)

**Direct Tools:** (Measurable in terms of marks and w.r.t. CO) Assessment done by faculty at Institute level

**Indirect Tools:** (Non measurable in terms of marks and w.r.t. CO) Assessment done at University Level



### Sample Indirect PO assessment Tools

- Program Exit Survey
- Alumni Survey
- Employer Survey of Alumni
- Parent Feedback

## CO Attainment Calculations

### Attainment Weightage:

Consider following weightage for PO Assessment Tools

PO Assessment Tools	
Direct PO Assessment (80%)	Indirect PO Assessment (20%)

Consider following weightage for CO Assessment Tools

PO Direct Assessment Tools = CO Assessment Tools		
Direct CO Assessment	Indirect CO Assessment	
20	80	University BE Curriculum
60	40	University CBCS (from 2018 FY batch)

### Illustration of Internal Test Examination Attainment:

Course	Engg. Mathematics
Maximum Marks	30
Number of Students Appeared	60
Passing Level (Threshold Based Target)	12 (40% here)

Now, we need target (mentioned above in table) and marks of all students to calculate attainment. The table below shows marks of all students

5	23	5	11	21	0
0	12	5	2	7	4
0	22	3	3	10	7
5	18	9	20	17	24
23	8	25	16	9	10
12	2	8	11	22	4
26	13	2	1	30	19
24	22	16	10	1	2
12	21	8	25	11	4
24	9	22	20	20	17

Now

Number of student achieving 12 or more marks	28
% of students achieving 12 or more marks	$(28/60) \times 100 = 46.6\%$

- 1 – if 40 % students score more than target
- 2 – if 50 % students score more than target
- 3 – if 60 % students score more than target

**Then Attainment is = 1 (from 46.6%)**



### Illustration of Feedback/Rubric Based Assessment & Attainment

Course	SOM
Maximum Marks	5
Number of Students Appeared	60
Passing Level (Threshold Based Target)	3 (>50% here)

Now, we need target (mentioned above in table) and response/feedback of all students to calculate attainment. The table below shows score/response of all students

4	3	3	1	2	5
3	3	2	1	2	4
4	2	5	5	1	5
1	1	5	2	2	4
2	2	5	3	5	1
2	4	2	5	2	1
3	4	4	2	4	3
5	2	4	3	2	5
5	5	4	4	4	2
5	4	4	2	3	5

Now

Number of student giving 3 or more score	37
% of students with 3 or more marks	$(37/60) \times 100 = 61.7\%$

1 – if 40 % students score more than target

2 – if 50 % students score more than target

3 – if 60 % students score more than target

**Then attainment is = 3 (from 61.7%)**

\*\*\*

#### Overall Attainment of CO

Let's assume CO1 is assessed using any 2 direct + 2 Indirect CO assessment tools, then

A. Overall CO Attainment = (Weightage x Direct CO attainment) + (Weightage x Indirect CO attainment)

**For University regular BE Curriculum and**

B. Overall CO Attainment = (20 % x Direct CO attainment) + (80% x Indirect CO attainment)

**For University CBCS Pattern,**

C. Overall CO Attainment = (60 % x Direct CO attainment) + (40% x Indirect CO attainment) for Autonomous Pattern

**# Note: Appropriate % weightage distribution may be considered for any number of direct/indirect assessment tools with proper justification at department/faculty level.**

## Illustration

Course CO	PO											PSO			BTL
	1	2	3	4	5	6	8	9	10	11	12	1	2	3	
C202.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	Remember
C202.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	Understand
C202.3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	Apply
C202.4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	Apply
C202.5	-	-	3	-	2	-	-	-	-	-	2	-	-	-	Analyse
C202.6	-	-	-	-	3	2	-	-	-	-	-	3	-	-	Analyse

So we finalize this assessment tools and then weightages

CO1 to CO4: Midterm & or end term + Continuous assessment (Assignment) + UE (PO1, 2)

CO5: Mid & or End term + Assignments + **Activity (rubric for PO5, 12)** + UE (PO3)

CO6: Mid & or End term + Assignments + **Activity (rubric for PO5, 6)** + UE (PSO1)



### Sample List of Activities with BTL

Activities	Possible BTL	PO Mapping
Tutorial- Write-ups	Understand, Apply	Any relevant PO from 1 to 4
Practical-Experiments	Understand, Apply, Analyse, Evaluate, Create	Any Relevant PO
Test/Quiz	Understand, Apply, Analyse	Any relevant PO from 1 to 4
Students' Seminar	Understand, Apply, Analyse	Any PO from 1, 2, 8, 10
Case Study	Understand, Apply, Analyse	Any Relevant PO
Presentation/Oral	Understand	
Guest Lecture	Understand	
Visits	Understand	
Survey & Analysis	Apply & Analyse	
Workshop/Hands-on Training	Apply, Analyse, Evaluate	
Task	Evaluate, Create	
Minor Project	Create	

Note: Faculty/ department can conduct other than the mentioned activities with BTL, PO and proper justification.

### Activity Planning Guidelines (PO5 to PO12)

Sr. No.	Activity	Contact Hours	Minimum Assessment Tool	Mapping Level
1	Seminar Presentation	1 to 6 hrs	Feedback or Quiz or Rubric Based Assessment	1
	Case Study			
	Guest Lecture			
	Visits			
	Survey & Analysis			
2	Visits	7 to 20 Hrs	i) Feedback or Quiz	2
	Survey & Analysis		ii) Rubric Based Assessment for Report, Presentation etc.	
	Workshop / Hands -on Training			
	Task			
3	Workshop/Hands - on Training	More than 20 Hrs	i) Feedback or Quiz	3
	Task		ii) Rubric Based Assessment for each PO	
	Minor Project		iii) Impact analysis	

Note: Department may use other additional criteria and justify the mapping level.

## Contribution of Course Attainment in PO Attainment

### Illustration

Let us assume CO-PO mapping of a course

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	2	1	-	-	-	-	-	-	-	-	-	3	-	-
3	-	3	1	-	-	-	-	-	-	-	-	-	3	-	-
4	-	3	-	2	-	-	-	-	-	-	-	1	3	-	-
Average	3	3	1	2	-	-	-	-	-	-	-	1	3	-	-

Overall Attainment of CO is as below

CO	Direct Tool Attainment (A)	Indirect Tool Attainment (B)	Overall CO Attainment = 0.2x A + 0.8 x B
1	2	3	2.8
2	3	3	3
3	2	3	2.8
4	1	3	2.6

Hence, final contribution of CO attainment in PO attainment can be done using the below formula,  
CO Contribution = Overall CO attainment X (CO-PO Mapping weightage / 3)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	2.00	1.00	-	-	-	-	-	-	-	-	-	3.00	-	-
3	-	2.80	0.93	-	-	-	-	-	-	-	-	-	2.80	-	-
4	-	2.60	-	1.73	-	-	-	-	-	-	-	0.86	2.60	-	-
Average	2.80	2.50	0.96	1.73	-	-	-	-	-	-	-	0.86	2.80	-	-

### Sample calculations:

CO1- PO1 mapping attainment  $2.8 \times 3/3 = 2.80$  (up to 2 decimal places)

CO2- PO2 mapping attainment  $3 \times 2/3 = 2.00$

CO2- PO3 mapping attainment  $3 \times 1/3 = 1.00$

CO3- PO3 mapping attainment  $2.8 \times 1/3 = 0.93$

CO4- PO12 mapping attainment  $2.6 \times 1/3 = 0.86$

## Continuous Improvement

### A) Contribution of CO in PO attainment and Continuous Improvement (Faculty Level)

Outcome	Action to be taken by faculty
High attainment of all CO-PO (>2.5 out of 3)	Set new higher targets or attainment levels for next Academic Year (A.Y.).
Moderate attainment of all CO-PO (1.8 to 2.49 out of 3)	Record observations, Continue action plan of last A.Y. with plan for improvements.
Low attainment of all CO-PO (0.9 to 1.79 out of 3)	Record observations, assess the target set, revise/improve action plan of last A.Y. to achieve the attainment with plan for improvements.
CO-PO not attained, poor performance(<0.9 out of 3)	Record observations, Critical assessment of target with Program Assessment Committee (PAC), Revise action plan of last A.Y. at faculty/department level.

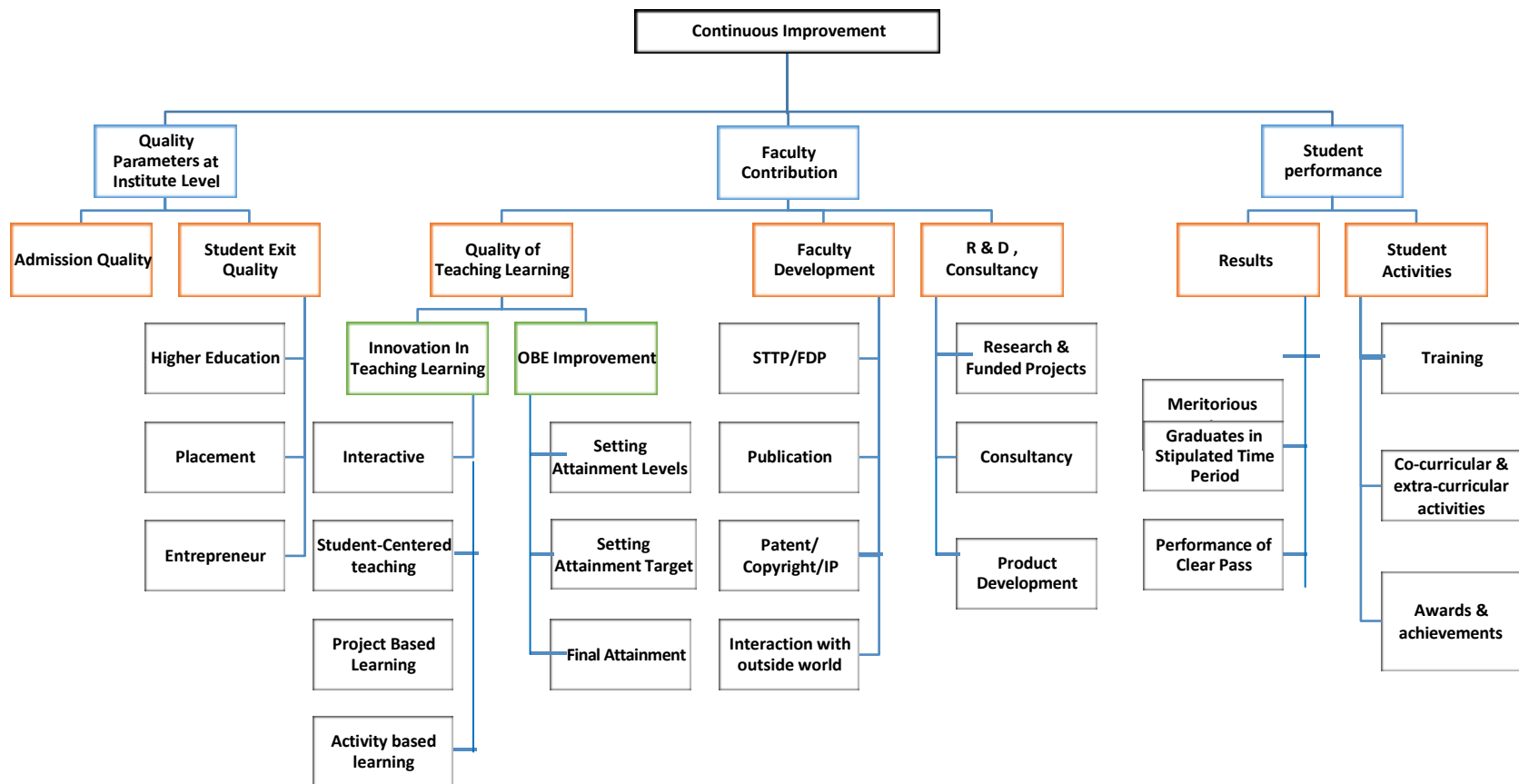
### B) PO attainment and Continuous Improvement (PC and HoD Level)

Category	Outcome	Action by PC and HoD
Course related	PO attained highly	Include activities with HOT.
	PO not attained highly	Identify concerned courses, plan for immediate improvements, guide, support and monitor its execution.
Activity related	Activities Conducted	Critical assessment, impact analysis to be done and revise as per the need for improvements.

### List of Documents

Sr.	Title	Details
1	Vision, Mission of Institute	Maintain at Dept. Level (PC & HoD)
2	Vision, Mission of Program	Maintain at Dept. Level (PC & HoD)
3	PEO of Program, PEO-PO/PSO Mapping	Maintain at Dept. Level (PC & HoD)
4	PO and PSO of Program	Maintain at Dept. Level (PC & HoD)
5	CO + PO/PSO + Mapping	Maintained by every faculty in Course File
6	Revised Bloom's Taxonomy Level and OBE Framework	Print to be maintained in Course File of Faculty & displayed in department all labs
7	Course List with Course Codes	Maintain at Dept. Level (PC & HoD)
8	List of PO Assessment Tools	Maintain at Dept. Level (PC & HoD)
9	List of CO Assessment Tools Used	Maintained by every faculty in Course File
10	Program Assessment Committee & DAB	Maintain at Dept. Level (PC & HoD)
11	Course and Module Coordinators	Maintain at Dept. Level (PC & HoD)
12	Course Plan	Along with delivery details and assessment tools by Faculty
13	Attainment Levels/ Targets of all courses of your program	Maintained by every faculty in Course File
14	Rubrics	Course wise rubrics to be maintained by every Faculty All activity rubrics to be maintained at Dept. Level (PC & HoD)
15	Record of all Assessment Details	Test Papers, Model Answers, Sample Answer Papers, Results, Sample Journals of students, Lab Manuals, Sample Seminar, Project Report & other record concerned with assessment to be maintained by Faculty
16	Slow-Advanced Learners	Identification, Action Taken Record to be maintained by Faculty
17	Course Exit Survey of every course	To be maintained by concerned Faculty
18	Program Exit Survey, Alumni Feedback, Employer Feedback	End of Final Year: Maintain at Dept. Level (PC & HoD)
19	CO Attainment	At End of Course: Maintained by Faculty and to be submitted to department
20	PO Attainment	At end of A.Y.: (Direct + Indirect) to be maintained by PC & HoD at Dept. Level
21	Impact Analysis and Continuous Improvement Related Documents	CO level documents to be maintained by concerned faculty. PO level documents to be maintained by PC and HoD.







## Vision

To develop dynamic and socially responsible engineers possessing wisdom, positive attitude, and an impeccable character.

## Mission

1. The college is devoted to serving society and the nation by providing quality education, and skill development programs thereby enabling the students to become skilled engineers with the right kind of knowledge.
2. Committed towards setting new benchmarks of excellence in engineering education with emphasis on research & development, innovation and services to society, industry, and the world.

## Quality Policy

We at Sanskrit School of Engineering endeavour to uphold excellence in all spheres by adopting best practices in effort and effect.

[www.instagram.com/sanskritigroup\\_ptp/](https://www.instagram.com/sanskritigroup_ptp/)

## CONTACT DETAILS



**SANSKRITHI SCHOOL  
OF ENGINEERING  
PUTTAPARTHI**

Official Website: [Sanskriti School of Engineering \(sseptp.org\)](https://www.sseptp.org)

Official Instagram : [https://www.instagram.com/sanskritigroup\\_ptp/](https://www.instagram.com/sanskritigroup_ptp/)

Official Twitter: [@SanskritiGroup](https://twitter.com/SanskritiGroup)

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## DEPARTMENT OF CIVIL ENGINEERING

### **Vision:**

To empower graduates to excel as competent professionals in the field of Design and Development, focusing on safe, healthy, sustainable, and eco-friendly infrastructure for the holistic development of society.

### **Mission:**

Our mission is to provide quality education through interdisciplinary research and innovative practices, with the aim of contributing to the betterment of human society through effective teaching and learning methodologies. We strive to develop creative solutions to a wide range of challenges in Civil Engineering by adopting modern tools and techniques.

### **Programme Educational Objectives (PEOs):**

**The B.E (CIVIL) programme aims to achieve the following Programme Educational Objectives:**

**PEO1:** Professional Competence: Graduates will demonstrate professional competence in their chosen careers by effectively utilizing appropriate techniques and modern engineering tools in the successful execution of projects.

**PEO2:** Problem Solving: Graduates will apply mathematical, scientific, and engineering principles to effectively solve complex problems in Civil Engineering, engaging in lifelong learning to keep abreast of advancements in the field.

**PEO3:** Multidisciplinary Collaboration: Graduates will actively participate in multidisciplinary projects, assuming professional and ethical responsibilities while working collaboratively with diverse teams.

### **Programme Outcomes (POs):**

**PO1:** Engineering Knowledge: Apply a profound understanding of mathematics, science, engineering fundamentals, and specialized knowledge to effectively solve complex engineering problems.

**PO2:** Problem Analysis: Identify, formulate, conduct comprehensive research, and analyze intricate engineering problems, drawing well-supported conclusions by utilizing first principles of mathematics, natural sciences, and engineering sciences, supported by relevant literature.

**PO3:** Design/Development of Solutions: Develop innovative solutions for complex engineering problems, designing system components or processes that meet specified needs while considering public health and safety, as well as cultural, societal, and environmental considerations.

**PO4:** Conduct Investigations of Complex Problems: Utilize research-based knowledge and research methods, including experimental design, data analysis, interpretation, and synthesis, to conduct rigorous investigations, resulting in valid and reliable conclusions.

**PO5:** Utilization of Modern Tools: Proficiently create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to effectively address complex engineering activities while demonstrating an understanding of their limitations.

**PO6:** Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues, recognizing the corresponding responsibilities relevant to professional engineering practice.

**PO7:** Environment and Sustainability: Comprehend the societal and environmental impact of professional engineering solutions, demonstrating knowledge of the importance of sustainable development.

**PO8:** Ethics: Apply ethical principles and adhere to professional ethics, responsibilities, and norms inherent in engineering practice.

**PO9:** Individual and Teamwork: Function effectively both as an individual and as a member or leader in diverse teams and multidisciplinary settings.

**PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and society at large. This includes the ability to comprehend and produce effective reports and design documentation, deliver impactful presentations, and provide and receive clear instructions.

**PO11:** Project Management and Finance: Demonstrate understanding of engineering and management principles, applying them to one's own work as a member and leader in a team to effectively manage projects in multidisciplinary environments.

**PO12:** Lifelong Learning: Recognize the necessity for and possess the preparation and ability to engage in independent and lifelong learning within the broadest context of technological change.

## **Programme Specific Outcomes (PSOs):**

### **Engineering graduates will have the ability to:**

**PSO1:** Project Planning and Execution: Plan, analyze, design, and execute cost-effective projects related to Civil Engineering structures, while emphasizing the conservation and protection of natural resources for sustainable growth.

**PSO2:** Diverse Career Paths: Pursue employment opportunities, establish new start-ups, engage in entrepreneurship, contribute to research and development, and become chartered Engineering professionals, all with a strong commitment to serving society with honesty and integrity.



## Civil Engineering

**Semester - 1 (Theory - 5, Lab - 4)**

Semester - 1 (Theory - 5, Lab - 4)					
S.No	Course No	Course Name	Category	L-T-P/D	Credits
1.	20A54101	Linear Algebra and Calculus	BS	3-0-0	3
2.	20A56101T	Engineering Physics	BS	3-0-0	3
3.	20A52101T	Communicative English	HS	3-0-0	3
4.	20A02101T	Basic Electrical & Electronics Engineering	ES	3-0-0	3
5.	20A03101T	Engineering Drawing	ES	1-0-0/2	2
6.	20A03101P	Engineering Graphics Lab	ES	0-0-2	1
7.	20A56101P	Engineering Physics Lab	BS	0-0-3	1.5
8.	20A52101P	Communicative English Lab	HS	0-0-3	1.5
9.	20A02101P	Basic Electrical & Electronics Engineering Lab	ES	0-0-2	1.5
Total					19.5

**Semester – 2 (Theory – 5, Lab – 5)**

Course No	Course Name	Category	L-T-P	Credits
20A54201	Differential Equations and Vector Calculus	BS	3-0-0	3
20A51201T	Engineering Chemistry	BS	3-0-0	3
20A05201T	C-Programming & Data Structures	ES	3-0-0	3
20A01201T	Strength of Materials	ES	3-0-0	3
20A03202	Engineering Workshop	ES	0-0-3	1.5
20A05202	IT Workshop	ES	0-0-3	1.5
20A05201P	C-Programming & Data Structures Lab	ES	0-0-3	1.5
20A51201P	Engineering Chemistry Lab	BS	0-0-3	1.5
20A01201P	Strength of Materials Lab	ES	0-0-3	1.5
20A99201	Environmental Science	MC	3-0-0	0.0
			<b>Total</b>	<b>19.5</b>

### SEMESTER - III

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54301	Probability and Statistics for Civil Engineering	BS	3	0	0	3
2.	20A01301	Advanced Strength of Materials	PC	3	0	0	3
3.	20A01302T	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3
4.	20A01303T	Surveying	PC	3	0	0	3
5.	20A52301	<b>Humanities Elective– I</b> Managerial Economics & Financial Analysis	HS	3	0	0	3
	20A52302	Organizational Behavior					
	20A52303	Business Environment					
6.	20A01304	Basic Civil Engineering Laboratory	PC	0	0	3	1.5
7.	20A01302P	Fluid Mechanics and Hydraulic Machines Lab	PC	0	0	3	1.5
8.	20A01303P	Surveying Lab	PC	0	0	3	1.5
9.	20A05305	<b>Skill oriented course - I</b> Application development with Python	SC	1	0	2	2
10.	20A52201	<b>Mandatory noncredit course – II</b> Universal Human Values	MC	3	0	0	0
11.	20A99301	NSS/NCC/NSO Activities	-	-	-	2	0
<b>Total</b>							<b>21.5</b>

SEMESTER - IV							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54401	Mathematical Modeling & Optimization Techniques	BS	3	0	0	3
2.	20A01401T	Engineering Geology	ES	3	0	0	3
3.	20A01402	Structural Analysis – I	PC	3	0	0	3
4.	20A01403T	Concrete Technology	PC	3	0	0	3
5.	20A01404T	Environmental Engineering - I	PC	3	0	0	3
6.	20A01401P	Engineering Geology Lab	ES	0	0	3	1.5
7.	20A01405	Concrete Materials Lab	PC	0	0	3	1.5
8.	20A01404P	Environmental Engineering Lab	PC	0	0	3	1.5
9.	20A52401	<b>Skill oriented course – II</b> Soft Skills	SC	1	0	2	2
10.	20A99401	<b>Mandatory non-credit course - III</b> Design Thinking for Innovation	MC	2	1	0	0
<b>Total</b>							<b>21.5</b>
Mandatory Community Service Internship for 6 weeks duration during Summer Vacation							

Semester–V							
S.No.	Course Code	Course Name	L	T	P	Credits	
1.	20A01501	Design of Reinforced Concrete Structures	3	0	0	3	
2.	20A01502T	Geotechnical Engineering	3	0	0	3	
3.	20A01503	Building Materials and Construction	3	0	0	3	
4.	20A01504a 20A01504b 20A01504c	<b>Professional Elective Course – I</b> Structural Analysis – II Open Channel Flow Building Construction Management	3	0	0	3	
5.		<b>Open Elective Course – I</b>	3	0	0	3	
6.	20A01506	Computer Aided Drafting Lab	0	0	3	1.5	
7.	20A01502P	Geotechnical Engineering Lab	0	0	3	1.5	
8.	20A01507	<b>Skill oriented course - III</b> Building Planning and Drawing	1	0	2	2	
9.	20A01508	Evaluation of Community Service Project				1.5	
<b>Total</b>							<b>21.5</b>

### Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	20A02505	Electric Vehicles	EEE
2	20A03505	3D Printing Technology	ME
3	20A04505	Digital Electronics	ECE
4	20A05505a	Java Programming	CSE & Allied/IT
5	20A05602T	Artificial Intelligence	
6	20A12502	Mobile Application Development using Android	
7	20A27505	Computer Applications in Food Processing	FT
8	20A54501	Optimization Techniques	Mathematics
9	20A56501	Materials Characterization Techniques	Physics
1	20A51501	Chemistry of Energy Materials	Chemistry

### Semester–VI



S.No	CourseCode	Course Name	L	T	P	Credits
1.	20A01601	Design of Steel Structures	3	0	0	3
2.	20A01602	Highway Engineering	3	0	0	3
3.	20A01603	Hydrology and Irrigation Engineering	3	0	0	3
4.	20A01604a 20A01604b 20A01604c	<b>Professional Elective Course– II</b> Experimental Stress Analysis Foundation Engineering Environmental Impact Assessment	3	0	0	3
5.		<b>Open Elective Course – II</b>	3	0	0	3
6.	20A01606	Design Studio Lab with STAAD Pro.	0	0	3	1.5
7.	20A01607	Highway Materials Lab	0	0	3	1.5
8.	20A01608	Concrete Technology Lab	0	0	3	1.5
9.	20A01609	<b>Skill oriented course - IV</b> BIM Fundamentals for Civil Engineers	1	0	2	2
10.	20A99601	<b>Noncredit mandatory Course</b> Intellectual Property Rights & Patents	2	0	0	0
<b>Total</b>						<b>21.5</b>
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

## Open Elective – II

S.No.	CourseCode	Course Name	Offered by the Dept.
1	20A02605	Smart Electric Grid	EEE
2	20A03605	Introduction to Robotics	ME
3	20A04605	Signal Processing	ECE
4	20A04701b	Introduction to Internet of Things	ECE/CSE
5	20A05605a	Principles of Operating Systems	CSE& Allied/IT
6	20A05605b	Foundations of Machine Learning	
7	20A05605c	Data Analytics Using R	
8	20A27605	Food Refrigeration and Cold Chain Management	FT
9	20A54701	Wavelet Transforms & its applications	Mathematics
10	20A56701	Physics Of Electronic Materials and Devices	Physics
11	20A51701	Chemistry of Polymers and its Applications	Chemistry

## Semester-VII

S.No.	Course Code	Course Name	L	T	P	Credits
1.	20A01701a 20A01701b 20A01701c	<b>Professional Elective Course– III</b> Finite Element Analysis Railways, Airport and Harbour Engineering Ground Improvement Techniques	3	0	0	3
2.	20A01702a 20A01702b 20A01702c	<b>Professional Elective Course– IV</b> Prestressed Concrete Hydraulic structures and WaterpowerEngineering Industrial Waste and Wastewater Management	3	0	0	3
3.	20A01703a 20A01703b 20A01703c	<b>Professional Elective Course– V</b> Remote Sensing and GIS Bridge Engineering Design and Drawing of Irrigation Structures	3	0	0	3

4.	20A52701a 20A52701b 20A52701c	<b>Humanities Elective – II</b> Entrepreneurship and Incubation Management Science Enterprise Resource Planning	3	0	0	3
5.		<b>Open Elective Course – III</b>	3	0	0	3
6.		<b>Open Elective Course – IV</b>	3	0	0	3
7.	20A01706	<b>Skill oriented course - V</b> Estimation, Costing and Valuation	1	0	2	2
8.	20A01707	Evaluation of Industry Internship				3
<b>Total</b>						<b>23</b>

### Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	20A02704	IOT Applications in Electrical Engineering	EEE
2	20A03704	Product Design & Development	ME
3	20A04704	Electronic Sensors	ECE
4	20A05704a	Web Technologies	CSE & Allied/IT
5	20A05704b	VR & AR for Engineers	
6	20A05704c	Software Engineering	
7	20A27704	Human Nutrition	FT
8	20A54702	Numerical Methods for Engineers	Mathematics
9	20A56702	Sensors And Actuators for Engineering Applications	Physics
10	20A51702	Chemistry of Nanomaterials and Applications	Chemistry

### Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	20A02705	Renewable Energy Systems	EEE
2	20A03705	Introduction to Composite Materials	ME
3	20A04705	Microcontrollers and Applications	ECE
4	20A05705a	Cyber Security	CSE & Allied/IT
5	20A05705b	Introduction to Full Stack Development	
6	20A05705c	Industrial IoT	
7	20A27705	Waste and Effluent Management	FT
8	20A54703	Number theory & its applications	Mathematics
9	20A56703	Smart Materials and Devices	Physics
10	20A51703	Green Chemistry and Catalysis for Sustainable Environment	Chemistry

### Semester-VIII

Course Name	Category	L	T	P	Credits
Full Internship & Project work	PR				12
<b>Total</b>					<b>12</b>

Course Code	Linear Algebra and Calculus	L	T	P	C
20A54101		3	0	0	3
Pre-requisite	Linear Algebra and Calculus	Semester	I		

<b>UNIT -1</b>
<b>Matrices</b>
Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non- homogeneous equations linear equations. Eigen values and Eigenvectors and their properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.
<b>UNIT -2</b>
<b>Mean Value Theorems</b>
Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.
<b>UNIT -3</b>
<b>Multivariable Calculus</b>
Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.
<b>UNIT -4</b>
<b>Multiple Integrals</b>
Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.
<b>UNIT -5</b>
<b>Beta and Gamma functions</b>
Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

## Course Outcomes:

At the end of the course, the student will be able to

<ul style="list-style-type: none"> <li>• <b>Develop</b> the use of matrix algebra techniques that is needed by engineers for practical applications (L6)</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Utilize</b> mean value theorems to real life problems (L3)</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Familiarize</b> with functions of several variables which is useful in optimization (L3)</li> </ul>
<ul style="list-style-type: none"> <li>• Students will also learn important tools of <b>calculus</b> in higher dimensions. Students will become <b>familiar</b> with 2- dimensional coordinate systems (L5)</li> </ul>
<ul style="list-style-type: none"> <li>• Students will become <b>familiar</b> with 3- dimensional coordinate systems and also learn the utilization of special functions</li> </ul>

**Text Books:**

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

**Reference Books:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
5. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education
9. H. k Das, Er. RajnishVerma, Higher Engineering Mathematics, S. Chand.
10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

<b>Course Code</b>	<b>APPLIED PHYSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A56201T</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	<b>APPLIED PHYSICS</b>	<b>Semester I</b>			

## UNIT-I

### Wave Optics

**Interference-** Principle of superposition – Interference of light – Conditions for sustained interference

– Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings- Determination of wavelength and refractive index.

**Diffraction-** Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to singleslit, double slit and N-slits (qualitative) – Grating spectrum.

**Polarization-** Introduction – Types of polarization – Polarization by reflection, refraction and double refraction – Nicol's Prism – Half wave and Quarter wave plates with applications.

## UNIT-II

**Lasers and Fiber optics** Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

**Fiber optics-** Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (Qualitative) – Applications.

## UNIT III

**Engineering Materials** **Dielectric Materials-** Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarization (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

**Magnetic Materials-** Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

**Nanomaterials-** Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

## UNIT-IV

**Acoustics and Ultrasonics** **Acoustics-** Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method ) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

**Ultrasonics-** Introduction – Properties – Production by magnetostriction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Pulse echo system through transmission and reflection modes – Applications.

## UNIT-V

### Crystallography and X-ray diffraction

**Crystallography-** Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC & FCC – Miller indices – Separation between successive (hkl) planes.

**X-Ray Diffraction-** Bragg's law – Bragg's X-ray diffractometer – Crystal structure determination by Powder method.

## Course Outcomes

<b>1.Study</b> the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
<b>2Identify</b> the wave properties of light and the interaction of energy with the matter(L3).
<b>Asses</b> the electromagnetic wave propagation and its power in different media (L5).
3.Understands the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3)
<b>4.Elucidates</b> the importance of nano materials along with their engineering applications. (L5)
5.Explain the basic concepts of acoustics and ultrasonics. (L2) Apply the concept of NDT to material testing. (L3)
<b>6.Study</b> the important properties of crystals like the presence of long-range order, periodicity and structure determination using X-ray diffraction technique. (L5)

## Prescribed Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.

## Reference Books:

1. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
4. Engineering Physics – M.R. Srinivasan, New Age Publications

Course Code	COMMUNICATIVE ENGLISH		L	T	P	C
20A52101T			3	0	0	3
Pre-requisite	COMMUNICATIVE ENGLISH	Semester	I			

## UNIT -1

### Lesson: On the Conduct of Life: William Hazlitt

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh- questions; word order in sentences.

## UNIT -2

**Lesson: The Brook: Alfred Tennyson** **Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices;

mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:**

## UNIT -3

### Lesson: The Death Trap: Saki



**Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. **Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing, Paragraph Writing **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

## UNIT-4

### Lesson: Innovation: Muhammad Yunus

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

## UNIT -5

### Lesson: Politics and the English Language: George Orwell

**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts - identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

### Course Outcomes

1. <b>Retrieve</b> the knowledge of basic grammatical concepts
2. <b>Understand</b> the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
3. <b>Apply</b> grammatical structures to formulate sentences and correct word forms
4. <b>Analyze</b> discourse markers to speak clearly on a specific topic in informal discussions CO5 Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
5. <b>Create</b> a coherent paragraph interpreting a figure/graph/chart/table

### Text Book:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

### Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12<sup>th</sup> Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

<b>Course Code</b>	<b>Basic Electrical &amp; Electronics Engineering</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
20A02101T			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	Basic Electrical Engineering	<b>Semester</b>	<b>I</b>			

## UNIT -1

## DC & AC Circuits:

Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

## UNIT -2

### DC & AC Machines:

Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC tests on transformer - Principle and operation of 3-phase AC machines [ Elementary treatment only ]

## UNIT -3

## Basics of Power Systems:

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

### Course Outcomes:

The student should be able to

● <b>Apply</b> concepts of KVL/KCL in solving DC circuits
● <b>Understand</b> and choose correct rating of a transformer for a specific application
● <b>Illustrate</b> working principles of DC Motor
● <b>Identify</b> type of electrical machine based on their operation
● <b>Understand</b> the basics of Power generation, Transmission and Distribution

**Text Books:**

1. D. P. Kothari and I. J. Nagrath - “Basic Electrical Engineering” - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, “Principles of Power System” – S.Chand – 2018.

### References:

1. L. S. Bobrow - “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.
3. C.L. Wadhwa – “Generation Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International Publications.

<b>Course Code</b>	<b>Basic Electrical &amp; Electronics Engineering</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
20A02101T			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	Electronics Engineering	<b>Semester</b>	<b>I</b>			
<b>Unit-1:</b>						
<b>Diodes and Applications:</b> Semiconductor Diode, Diode as a Switch & Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.						



**Transistor Characteristics:** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point,

Biassing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Unit-2:

**Operational Amplifiers and Applications:** Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non- Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

**Unit-3:**

**Digital Electronics:** Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters. Introduction to Microcontrollers and their applications (Block diagram approach only).

### Text Books:

1. R.L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2007.
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4<sup>th</sup> Edition, Pearson, 2017.
3. R. P. Jain, Modern Digital Electronics, 3<sup>rd</sup> Edition, Tata Mcgraw Hill, 2003.
4. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2<sup>nd</sup> Edition, Pearson, 2012.

### (20A03101T) Engineering Drawing (Common to All Branches of Engineering)

Course Code	Engineering Drawing	L	T	P	C
20A03101T		1	0	0	2
Pre-requisite	Engineering Drawing	Semester	I		

### Unit: I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance–Conventions in drawing–lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid c) Involute

### Unit: II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

### Unit: III

**Projections of solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

### Unit: IV

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

### Unit: V

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

**Course Outcomes:**

After completing the course, the student will be able to

• <b>draw</b> various curves applied in engineering. (L2)
• <b>show</b> projections of solids and sections graphically. (L2)
• <b>draw</b> the development of surfaces of solids. (L3)

**Text Books:**

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

**Reference Books:**

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

**Additional Sources**

Youtube: <http://sewor.carleton.ca/gkardos/88403/drawings.html> conic sections-online, red woods.edu

<b>Course Code</b>	<b>Engineering Graphics Lab</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A03101P</b>			<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Pre-requisite</b>	Engineering Drawing	<b>Semester</b>	<b>I</b>			

<b>Computer Aided Drafting:</b>
<b>Introduction to AutoCAD:</b> Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.
Dimensioning principles and conventional representations.
<b>Orthographic Projections:</b> Systems of projections, conventions and application to orthographic projections - simple objects.
<b>Isometric Projections:</b> Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

### Course Outcomes:

After completing the course, the student will be able to

<ul style="list-style-type: none"> <li>• Use computers as a drafting tool. (L2)</li> </ul>
<ul style="list-style-type: none"> <li>• Draw isometric and orthographic drawings using CAD packages. (L3)</li> </ul>

### Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

### Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

### Additional Sources

1. Youtube: [http://sewor,Carleton.ca/g\\_kardos/88403/drawings.html](http://sewor.Carleton.ca/g_kardos/88403/drawings.html) conic sections-online, red woods.edu

<b>Course Code</b>	Engineering Physics Lab		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A56101P</b>			<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Pre-requisite</b>	Engineering Physics Lab	<b>Semester</b>	<b>I</b>			

## List Of Topics

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
8. Determination of dielectric constant by charging and discharging method.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
10. Measurement of magnetic susceptibility by Gouy's method
11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
12. Determination of ultrasonic velocity in liquid (Acoustic grating)
13. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
14. Sonometer: Verification of the three laws of stretched strings
15. Determination of spring constant of springs using Coupled Oscillator

## Course Outcomes:

After completing the course, the student will be able to

• <b>Operate</b> various optical instruments (L2)
• <b>estimate</b> wavelength of laser and particles size using laser(L2)
• <b>evaluate</b> the acceptance angle of an optical fiber and numerical aperture (L3)
• <b>estimate</b> the susceptibility and related magnetic parameters of magnetic materials (L2)
• <b>plot</b> the intensity of the magnetic field of circular coil carrying current with distance (L3)
• <b>determine</b> magnetic susceptibility of the material and its losses by B-H curve (L3)
• <b>apply</b> the concepts of ultrasonics by acoustic grating (L2)

## References:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University

<b>Course Code</b>	<b>COMMUNICATIVE ENGLISH LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A52101P</b>		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Pre-requisite</b>	<b>COMMUNICATIVE ENGLISH LAB</b>	<b>Semester</b>		<b>I</b>	

## List of Topics

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

## COURSE OUTCOMES:

After completing the course, the student will be able to

• <b>Listening</b> and repeating the sounds of English Language
• <b>Understand</b> the different aspects of the English language
• <b>proficiency</b> with emphasis on LSRW skills
• <b>Apply</b> communication skills through various language learning activities
• <b>Analyze</b> the English speech sounds, stress, rhythm, intonation and syllable
• <b>Division</b> for better listening and speaking comprehension.
• <b>Evaluate</b> and exhibit acceptable etiquette essential in social and professional settings
• <b>Create</b> awareness on mother tongue influence and neutralize it in order to
• <b>Improve</b> fluency in spoken English.

## Suggested Software

Orel, Walden Infotech, Young India Films

## Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

<b>Course Code</b>	Basic Electrical & Electronics Engineering Lab		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
20A02101P			<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Pre-requisite</b>	Electrical Engineering Lab	<b>Semester</b>	<b>I</b>			

## List of experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

## Course Outcomes:

After completing the course, the student will be able to

• <b>Understand</b> Kirchoff's Laws & Superposition theorem.
• <b>Analyze</b> the various characteristics on DC Machines by conducting various tests.
• <b>Analyze</b> I – V Characteristics of PV Cell
• <b>Apply</b> the knowledge to perform various tests on 1-phase transformer

## Part B: Electronics Engineering Lab

### List Of Experiments:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

**Tools / Equipment Required:** DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.



## Course outcomes:

<ul style="list-style-type: none"> <li>• <b>Learn</b> the characteristics of basic electronic devices like PN junction diode, Zener diode &amp; BJT.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Construct</b> the given circuit in the lab</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Analyze</b> the application of diode as rectifiers, clippers and clampers and other circuits.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Design</b> simple electronic circuits and verify its functioning</li> </ul>

Course Code	Differential Equations and Vector Calculus		L	T	P	C
20A54201			3	0	0	3
Pre-requisite	Differential Equations and Vector Calculus	Semester	II			

## UNIT -1

### Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

## UNIT 2:

### Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

## UNIT -3

### Applications of Partial Differential Equations

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

## UNIT -5

### Vector integration

### Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without UNIT-4

### Vector differentiation

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

## Course Outcomes:

At the end of the course, the student will be able to

<ul style="list-style-type: none"> <li>• <b>Solve</b> the differential equations related to various engineering fields (L6)</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Identify</b> solution methods for partial differential equations that model physical processes (L3)</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Interpret</b> the physical meaning of different operators such as gradient, curl and divergence (L5)</li> </ul>
Estimate the work done against a field, circulation and flux using vector calculus (L6)

## Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**Reference Books:**

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Michael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I & II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
11. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CE)– II Sem

L T P C

### (20A51201T) Engineering Chemistry (Civil and Mechanical)

Course Code	Engineering Chemistry		L	T	P	C
20A51201T			0	0	3	1.5
Pre-requisite	Engineering Chemistry	Semester	II			
<b>UNIT -1</b>						
<b>Water Technology</b>						
Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment						
– specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.						
<b>UNIT -2</b>						
<b>Electrochemistry and Applications:</b>						
Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.						
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.						
Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, <b>Factors affecting the corrosion</b> , cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).						
<b>UNIT -3</b>						
<b>Polymers and Fuel Chemistry:</b>						
Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization.						
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC and Bakelite						
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol						
Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio-fuels						
<b>UNIT-4</b>						
<b>Advanced Engineering Materials</b>						
Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforcedcomposites, properties and Engineering applications						
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils –Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications. Building materials- Portland Cement, constituents, phases and reactivity of clinker, Setting andHardening of cement.						

## UNIT -5

### Surface Chemistry and Applications:

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid- gas interface, solid-liquid interface, adsorption isotherm, BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors.

### Course Outcomes:

At the end of the course, the students will be able to

• <b>Demonstrate</b> the corrosion prevention methods and factors affecting corrosion (L2)
• <b>Explain</b> the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers. (L2)
• <b>Explain</b> calorific values, octane number, refining of petroleum and cracking of oils (L2)
• <b>Explain</b> the setting and hardening of cement and concrete phase (L2)
• <b>Summarize</b> the concepts of colloids, micelle and nanomaterials (L2).

### Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

### Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
4. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heinemann, 1992.

Course Code	C-Programming & Data Structures		L	T	P	C
(20A05201T)			0	0	3	1 5
Pre-requisite	C-Programming & Data Structures	Semester	II			

## UNIT-1

**Introduction to C Language** - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays

## UNIT – 2

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures,

## UNIT-3

**Data Structures**, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

## UNIT – 4

**Linked Lists** – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

## UNIT-5

**Trees** - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

### Course Outcomes:

- **Analyse** the basic concepts of C Programming language. (L4)
- **Design** applications in C, using functions, arrays, pointers and structures. (L6)
- **Apply** the concepts of Stacks and Queues in solving the problems. (L3)
- **Explore** various operations on Linked lists. (L5)
- **Demonstrate** various tree traversals and graph traversal techniques. (L2)
- **Design** searching and sorting methods (L3)

### Text Books:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R. Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
4. B.A. Forouzan and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

### Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, “C and Data Structures”, 4<sup>th</sup> Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, “Problem Solving Using C”, PHI, 2<sup>nd</sup> Edition 2009.

Course Code	STRENGTH OF MATERIALS		L	T	P	C
(20A01201T)			3	0	0	3
Pre-requisite	STRENGTH OF MATERIALS	Semester	II			

## UNIT-I

**Introduction to Mechanics:** Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial systems-

**Center of Gravity and moment of inertia:** Introduction – Centroids of rectangular, circular, I, L and T sections - Centroids of built up sections.

**Area moment of Inertia:** Introduction – Definition of Moment of Inertia of rectangular, circular, I, L and T sections - Radius of gyration. Moments of Inertia of Composite sections.

## UNIT – II

### Simple Stresses and Strains:

Types of stresses and strains – Hooke's law – Stress – strain diagram for mild steel – working stress – Factor of safety – lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of Varying section – Composite bars – Temperature stresses. Strain energy – Resilience – Gradual, Sudden, impact and shock loadings – simple applications.

## UNIT – III

### Shear Force and Bending Moment:

Definition of beam – types of beams – Concept of Shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and over hanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – point of contra flexure – Relation between S.F, B.M and rate of loading at section of a beam.

## UNIT – IV

### Flexural Stresses:

Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/Y = E/R$  – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel Sections – Design of simple beam sections.

## UNIT – V

### Shear Stresses:

Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Combined bending and shear.

**Analysis of trusses** by Method of Joints & Sections.

### Course Outcomes:

On completion of the course, the student will be able to:

- **Understand** the different types of couples and force systems
- **Determine** the centroid and moment of inertia for different cross-sections
- **Understand** the concepts of stress, strain, generalized Hooke's law, elastic moduli and strain energy.
- **Develop** shear force and bending moment diagrams for different load cases.
- **Compute** the flexural stresses and shear stresses for different loading cases and different cross-sections.

**Text Books:**

1. S. Timoshenko, D.H. Young and J.V. Rao, “Engineering Mechanics”, Tata McGraw-Hill Company.
2. Sadhu Singh, “Strength of Materials”, 11th edition 2015, Khanna Publishers.

**References:**

1. S.S.Bhavikatti, “Strength of materials”, Vikas publishing house Pvt. Ltd.
2. R. Subramanian, “Strength of Materials”, Oxford University Press.
3. R. K. Bansal, “Strength of Materials”, Lakshmi Publications House Pvt. Ltd.
4. Advanced Mechanics of Materials – Seely F.B and Smith J.O. John wiley & Sons inc., New York.

Course Code	Engineering Workshop		L	T	P	C
(20A03202)			0	0	3	1.5
Pre-requisite	Engineering Workshop	Semester	II			
<b>List of Topics Wood Working:</b>						
Familiarity with different types of woods and tools used in wood working and make following joints						
a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint						
<b>Sheet Metal Working:</b>						
Familiarity with different types of tools used in sheet metal working, Developments of following sheetmetal job from GI sheets						
a) Tapered tray                      b) Conical funnel    c) Elbow pipe              d) Brazing						
<b>Fitting:</b>						
Familiarity with different types of tools used in fitting and do the following fitting exercises						
a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two wheeler tyre						
<b>Electrical Wiring:</b>						
Familiarities with different types of basic electrical circuits and make the following connections						
a) Parallel and series b) Two way switch    c) Godown lighting						
d) Tube light                                      e) Three phase motor f) Soldering of wires						

### Course Outcomes:

After completion of this lab the student will be able to

• <b>Apply</b> wood working skills in real world applications. (13)
• <b>Build</b> different objects with metal sheets in real world applications. (13)
• <b>Apply</b> fitting operations in various applications. (13)
• <b>Apply</b> different types of basic electric circuit connections. (13)
• <b>Use</b> soldering and brazing techniques. (12)

Course Code	IT Workshop		L	T	P	C
(20A05202)			0	0	3	1.5
Pre-requisite	IT Workshop	Semester	II			
<b>Computer Task 1:</b>						
<b>Learn about Computer:</b> Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.						

<b>Task 2:</b>
<b>Assembling a Computer:</b> Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods
<b>Task 3:</b>



**Install Operating system:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

## Task 4:

**Operating system features:** Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

## Networking and Internet

### Task 5:

**Networking:** Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc. should be done by the student. The entire process has to be documented.

### Task 6:

**Browsing Internet:** Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e- mail account.

### Task 7:

**Antivirus:** Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

## Productivity tools

### Task 8:

**Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

### Task 9:

**Presentations:** creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

### Task 10:

**Spreadsheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

## Task 11:

**LaTeX:** Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references)

## Course Outcomes:

• <b>Disassemble</b> and Assemble a Personal Computer and prepare the computer ready to use.
• <b>Prepare</b> the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LaTeX.
• <b>Prepare</b> Slide presentations using the presentation tool.
• <b>Interconnect</b> two or more computers for information sharing.
<b>Access</b> the Internet and Browse it to obtain the required information

## References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.



<b>Course Code</b> (20A05201P)	<b>C-Programming &amp; Data Structures Lab</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
			<b>3</b>	<b>0</b>	<b>0</b>	<b>1.5</b>
<b>Pre-requisite</b>	<b>C-Programming &amp; Data Structures Lab</b>	<b>Semester</b>	<b>II</b>			

<b>Week 1</b>
Write C programs that use both recursive and non-recursive functions
i) To find the factorial of a given integer.
ii) To find the GCD (greatest common divisor) of two given integers.
iii) To solve Towers of Hanoi problem.
<b>Week 2</b>
a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices
<b>Week 3</b>
a) Write a C program that uses functions to perform the following operations:
i) To insert a sub-string in to a given main string from a given position.
ii) To delete n characters from a given position in a given string.
<b>Week 4</b>
a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
b) Write a C program to count the lines, words and characters in a given text.
<b>Week 5</b>
a) Write a C Program to perform various arithmetic operations on pointer variables.
b) Write a C Program to demonstrate the following parameter passing mechanisms:
i) call-by-value ii) call-by-reference
<b>Week 6</b>
Write a C program that uses functions to perform the following operations:
i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers (Note: represent complex number using a structure.)
<b>Week 7</b>
Write C programs that implement stack (its operations) using
i) Arrays
ii) Pointers
<b>Week 8</b>
Write C programs that implement Queue (its operations) using
i) Arrays
ii) Pointers

<b>Week 9</b>
Write a C program that uses Stack operations to perform the following:
i) Converting infix expression into postfix expression
ii) Evaluating the postfix expression
<b>Week 10</b>
Write a C program that uses functions to perform the following operations on singly linked list.
i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
<b>Week 11</b>
Write a C program that uses functions to perform the following operations on Doubly linkedlist.
i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
<b>Week 12</b>
Write a C program that uses functions to perform the following operations on circular linkedlist.
<b>Week 13</b>
Write a C program that uses functions to perform the following:
i) Creating a Binary Tree of integers
ii) Traversing the above binary tree in preorder, inorder and postorder.
<b>Week 14</b>
Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:
i) Linear search
ii) Binary search
<b>Week 15</b>
Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
i) Bubble sort
ii) Selection sort
iii) Insertion sort

## Course Outcomes

• <b>Demonstrate</b> basic concepts of C programming language. (L2)
• <b>Develop</b> C programs using functions, arrays, structures and pointers. (L6)
• <b>Illustrate</b> the concepts Stacks and Queues. (L2)
• <b>Design</b> operations on Linked lists. (L6)
• <b>Apply</b> various Binary tree traversal techniques. (L3)
• <b>Develop</b> searching and sorting methods. (L6)

## Text Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

## Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4<sup>th</sup> Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2<sup>nd</sup> Edition 2009.



# SANSKRITHI SCHOOL OF ENGINEERING

Behind SSSS Hospital, Beedupalli knowledge park, Prasanthigram, Puttaparthi - 515134  
Affiliated by JNTUA & Approved by All India Council for Technical Education (AICTE), www.sseptp.org

Course Code	Engineering Chemistry Lab	L	T	P	C
((20A51201P))		0	0	3	1.5
Pre-requisite	Engineering Chemistry Lab	Semester	II		

## List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of percentage of Iron in Cement sample by colorimetry
8. Estimation of Calcium in port land Cement
9. Preparation of nanomaterials by precipitation.
10. Adsorption of acetic acid by charcoal
11. Determination of percentage Moisture content in a coal sample
12. Determination of Viscosity of lubricating oil by Redwood Viscometer 1 &2
13. Determination of Calorific value of gases by Junker's gas Calorimeter

## Course Outcomes:

At the end of the course, the students will be able to

• <b>Determine</b> the cell constant and conductance of solutions (L3)
• <b>Prepare</b> advanced polymer materials (L2)
• <b>Determine</b> the physical properties like surface tension, adsorption and viscosity (L3)
• <b>Estimate</b> the Iron and Calcium in cement (L3)
• <b>Calculate</b> the hardness of water (L4)

## (20A01201P) STRENGTH OF MATERIALS LAB

Course Code	STRENGTH OF MATERIALS LAB	L	T	P	C
(20A01201P)		0	0	3	1.5
Pre-requisite	STRENGTH OF MATERIALS LAB	Semester	II		

## List of Experiments

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test.
5. Hardness test.
6. Compression test on Open coiled springs
7. Tension test on Closely coiled springs
8. Compression test on wood/ concrete
9. Izod / Charpy Impact test on metals
10. Shear test on metals
11. Use of electrical resistance strain gauges.
12. Continuous beam – deflection test.

### Course Outcomes:

- By **performing** the various tests in this laboratory the student will be able to know the structural behavior various structural elements when subjected to external loads

Course Code	Probability and Statistics for Civil Engineering		L	T	P	C
20A54301			3	0	0	3
Pre-requisite	NIL	Semester	III			
<b>UNIT - II</b>	<b>Elementary Statistics</b>		<b>9 Hrs</b>			
Introduction to statistics- definition-advantages-limitations-frequency distribution tables-Arithmetic mean, median, mode for grouped and ungrouped data-variance, standard deviation, co-efficient of variation. Correlation –properties, correlation co-efficient-Regression-properties-Regression co-efficient- relation between correlation co-efficient and Regression co-efficient.						
<b>UNIT - I</b>	<b>Probability Theory</b>		<b>8 Hrs</b>			
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.						
<b>UNIT - III</b>	<b>Random variables &amp; Distributions</b>		<b>8 Hrs</b>			
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution						
<b>UNIT - IV</b>	<b>Testing of Hypothesis</b>		<b>9 Hrs</b>			
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in onesample and two sample problems						
<b>UNIT - V</b>	<b>Testing of significance &amp; Curve fitting</b>		<b>9 Hrs</b>			
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi^2$ - test for goodness of fit, $\chi^2$ - test for independence of attributes . Curve Fitting: Fitting of Linear, Quadratic, Exponential curves, Least squares method						
<b>Course outcomes</b>						
<b>At the end of the course, student will be able to</b>						
<ul style="list-style-type: none"> <li>• <b>Understand</b> the concepts of probability, sampling distributions, test of hypothesis and Curvefitting.</li> <li>• Explain the characteristics through correlation and regression tools.</li> <li>• Apply Probability theory to find the chances of happening of events.</li> <li>• <b>Understand</b> various probability distributions and calculate their statistical moments.</li> </ul>						
Solve the problems on testing of hypothesis on large samples and small samples and fitting of the curves.						
<b>Textbooks:</b>						
1. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, SultanChand & Sons.						

2. Vijay K Rohatgi, Statistical Inference, Aug 2003, Dover Publications Inc.

### Reference Books:

1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons. 2. M.K.Jain, S.R.K.Iyengar and R.K.Jain,
2. Numerical Methods for Science and Engineering Computation, 6th Edition, New Age International Publishers.

### Online Learning Resources:

<http://nptel.ac.in/courses/111105090>/<http://nptel.ac.in/courses/111106112>

<b>Course Code</b>	<b>Advanced Strength of Materials</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A01301</b>			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	<b>Engineering Mechanics</b>	<b>Semester</b>	<b>III</b>			
<b>UNIT - I</b>	<b>Deflection of Beams</b>					
Uniform bending – slope, deflection and radius of curvature – Differential equation for elastic line of a beam – Double integration and Macaulay’s methods. Determination of slope and deflection for cantilever and simply supported beams under point loads, U.D.L. uniformly varying load-Mohr’s theorems – Moment area method – application to simply supported and overhanging beams- analysis of propped cantilever beams under UDL and point loads.						
<b>UNIT - II</b>	<b>Torsion</b>					
Torsion: Theory of pure torsion – Assumptions and Derivation of Torsion formula for circular shaft – Torsional moment of resistance – Polar section modulus – power transmission through shafts – Combined bending and torsion –. Springs -Types of springs – deflection of close coiled helical springs under axial pull and axial couple – Carriage or leaf springs.						
<b>UNIT – III</b>	<b>Columns and Struts</b>					
Introduction – classification of columns – Axially loaded compression members – Euler’s crippling load theory – derivation of Euler’s critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler’s critical stress – Limitations of Euler’s theory – Rankine – Gordon formula – eccentric loading and Secant formula – Prof. Perry’s formula.						
<b>UNIT - IV</b>	<b>Springs</b>					
Axial load and torque on helical springs - stresses and deformations - strain energy - compound springs - leaf springs.						
<b>UNIT - V</b>	<b>Thin and Thick Cylinders</b>					
Introduction - Thin Cylindrical shells - hoop stress - longitudinal stresses - Lamé’s theory - Design of thin & thick cylindrical shells- Wire wound thin cylinders - Compound cylinders - Shrink fit - compound cylinders						
<b>Course outcomes:</b> <ul style="list-style-type: none"> <li>• <b>Determine</b> deflection at any point on a beam under simple and combined loads</li> <li>• <b>Apply</b> energy theorems for analysis of indeterminate structures</li> <li>• <b>Analyze</b> indeterminate structures with yielding of supports</li> <li>• <b>Analyze</b> beams and portal frames using slope deflection and moment distribution methods</li> <li>• <b>Analyze</b> bending moment, normal thrust and radial shear in the arches</li> </ul>						







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Varied FlowDynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification - Elements and characteristics- Energy dissipation.	
UNIT - V	Hydraulic Machines
Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory - characteristic curves of hydraulic turbines - Cavitation - Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies – Introduction to Reciprocating Pump.	
<b>Course outcomes:</b> <ul style="list-style-type: none"> <li>• <b>Familiarize</b> basic terms used in fluid mechanics</li> <li>• <b>Understand</b> the principles of fluid statics, kinematics and dynamics</li> <li>• <b>Understand</b> flow characteristics and classify the flows and estimate various losses in flowthrough channels</li> <li>• <b>Analyze</b> characteristics for uniform and non-uniform flows in open channels.</li> </ul> Design different types of turbines, centrifugal and multistage pumps.	
<b>Textbooks:</b>	
1. P. M. Modi and S. M. Seth, “Hydraulics and Fluid Mechanics”, Standard Book House 2. K. Subrahmanya, “Theory and Applications of Fluid Mechanics”, Tata McGraw Hill	
<b>Reference Books:</b>	
1. R. K. Bansal, A text of “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications (P) Ltd., New Delhi. 2. K. Subramanya, Open channel Flow, Tata McGraw Hill. 3. N. Narayana Pillai, Principles of “Fluid Mechanics and Fluid Machines”, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009. 4. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, “Fluid Mechanics and Machinery”, Oxford University Press, 2010. 5. Banga& Sharma, “Hydraulic Machines”, Khanna Publishers.	





UNIT - V	Construction surveys
Introduction-staking out buildings-pipelines and sewers-highwaysculverts. Bridge surveys-determining the length of a bridge-locating centres of piers- surface surveys and tunnel alignment-underground surveys-connection of surface and underground surveys-levelling in tunnels.	
<b>Course outcomes:</b> At the end of the course, the student will be able to: <ul style="list-style-type: none"> <li>• <b>Calculate</b> angles, distances and levels</li> <li>• <b>Identify</b> data collection methods and prepare field notes</li> <li>• <b>Understand</b> the working principles of survey instruments</li> <li>• <b>Estimate</b> the volumes of earth work</li> </ul> Able to use modern survey instruments.	
<b>Textbooks:</b> <ol style="list-style-type: none"> <li>1. C.Venkatramaiah, "Text book of surveying", 2nd edition, Universities press, 2018.</li> <li>2. Arora K R "Surveying" Vol 1, 2 &amp; 3, Standard Book House, Delhi, 2004.</li> </ol>	
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. S K Duggal, "Surveying" (Vol – 1 &amp; 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.</li> <li>2. R. Subramanian, "Surveying and leveling" Oxford university press, New Delhi.</li> <li>3. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Surveying" (Vol – 1, 2 &amp; 3), - Laxmi Publications (P) ltd., New Delhi.</li> <li>4. R. Agor Khanna Publishers 2015 "Surveying and leveling".</li> <li>5. Arthur R Benton and Philip J Taety, "Elements of Plane Surveying", McGraw Hill – 2000.</li> </ol>	

	<b>Managerial econamivs and financial management (Common to All branches of Engineering)</b>				
<b>Pre-requisite</b>	<b>NIL</b>	<b>Semester</b>	<b>III</b>		
UNIT - I	<b>Managerial Economics</b>				
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.					
UNIT - II	<b>Production and Cost Analysis</b>				
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.					
UNIT - III	<b>Business Organizations and Markets</b>				
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies					
UNIT - IV	<b>Capital Budgeting</b>				
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)					

Unit-V	<b>Financial accounts</b>
<p>Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). <b>Financial Analysis</b> - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.</p>	
<p><b>Course outcomes:</b></p> <ul style="list-style-type: none"> <li>• <b>Define</b> the concepts related to Managerial Economics, financial accounting and management.</li> <li>• <b>Understand</b> the fundamentals of Economics viz., Demand, Production, cost, revenue and markets</li> <li>• <b>Apply</b> the Concept of Production cost and revenues for effective Business decision</li> <li>• <b>Analyze</b> how to invest their capital and maximize returns</li> <li>• <b>Evaluate</b> the capital budgeting techniques</li> </ul> <p>Develop the accounting statements and evaluate the financial performance of business entity</p>	
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Varshney &amp; Maheswari: Managerial Economics, Sultan Chand, 2013.</li> <li>2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019</li> </ol>	
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Ahuja H I Managerial economics Schand, 3/e, 2013</li> <li>2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.</li> <li>3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.</li> <li>4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.</li> </ol>	

<b>Course Code</b>	<b>ORGANISATIONAL BEHAVIOUR</b> <b>(Common to All branches of Engineering)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
20A52302			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	<b>NIL</b>	<b>Semester</b>	<b>III</b>			
<b>UNIT - I</b>	<b>Introduction to Organizational Behavior</b>					
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.						
<b>UNIT - II</b>	<b>Motivation and Leading</b>					
Theories of Motivation- Maslow’s Hierarchy of Needs - Hertzberg’s Two Factor Theory - Vroom’s theory of expectancy – Mc Clelland’s theory of needs–Mc Gregor’s theory X and theory Y– Adam’s equity theory – Locke’s goal setting theory– Alderfer’s ERG theory .						
<b>UNIT - III</b>	<b>Organizational Culture</b>					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.						
<b>UNIT - IV</b>	<b>Group Dynamics</b>					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution						
<b>UNIT - V</b>	<b>Organizational Change and Development</b>					
Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization’s change and development						



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<b>Course outcomes:</b> <ul style="list-style-type: none"> <li>• <b>Define</b> the Organizational Behaviour, its nature and scope.</li> <li>• <b>Understand</b> the nature and concept of Organizational behaviour</li> <li>• <b>Apply</b> theories of motivation to analyse the performance problems</li> <li>• <b>Analyse</b> the different theories of leadership</li> <li>• <b>Evaluate</b> group dynamics</li> </ul>
Develop as powerful leader
<b>Textbooks:</b> <ol style="list-style-type: none"> <li>1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011</li> <li>2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017</li> </ol>
<b>Reference Books:</b> <ul style="list-style-type: none"> <li>▪ McShane, Organizational Behaviour, TMH 2009</li> <li>▪ Nelson, Organisational Behaviour, Thomson, 2009.</li> <li>▪ Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.</li> <li>▪ Aswathappa, Organisational Behaviour, Himalaya, 2009</li> </ul>

Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	NIL		Semester		III	
UNIT - I	Overview of Business Environment					
Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis& Characteristics of business.						
UNIT - II	Fiscal & Monetary Policy					
Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.						
UNIT - III	India’s Trade Policy					
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.						
UNIT - IV	World Trade Organization					
Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.						
UNIT - V	Money Markets and Capital Markets					
Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.						
<b>Course outcomes:</b> <ul style="list-style-type: none"><li>• Define Business Environment and its Importance.</li><li>• Understand various types of business environment.</li><li>• <b>Apply</b> the knowledge of Money markets in future investment</li><li>• <b>Analyse</b> India’s Trade Policy</li><li>• <b>Evaluate</b> fiscal and monitory policy</li></ul>						
Develop a personal synthesis and approach for identifying business opportunities						



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## Reference Books:

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Course Code	Basic Civil Engineering Laboratory		L	T	P	C
20A01304			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

## List of Experiments:

1. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
4. Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
5. Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.
6. Installation of plumbing and fixtures like Tap, T-Joint, Elbow, Bend, Threading etc;
7. Plastering and Finishing of wall
8. Application of wall putty and painting a wall
9. Application of base coat and laying of Tile flooring of one square meter
10. Preparation of soil cement blocks for masonry and testing for compressive strength
11. Casting and testing of Fly ash Blocks
12. Preparation of cover blocks for providing cover to reinforcement

## Course outcomes:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- **Select** proper tools for a particular operation.  
Select materials and tools to make a job as per given specification/drawing.

## References:

1. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
2. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
3. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
4. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
5. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
6. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.









**Modules and Packages:** Standard modules-Importing own module as well as external modules  
Understanding Packages Powerful Lamda function in python Programming using functions, modules  
and external packages

**Working with Data in Python:** Printing on screen- Reading data from keyboard- Opening and closing  
file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

### 1. OPERATORS

- Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
- Read your name and age and write a program to display the year in which you will turn 100 years old.
- Read radius and height of a cone and write a program to find the volume of a cone.
- Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

### 2. CONTROL STRUCTURES

- Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if...elif...else statement.
- Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
- Write a Program to find the sum of a Series  $1/1! + 2/2! + 3/3! + 4/4! + \dots + n/n!$ . (Input :n = 5, Output : 2.70833)
- In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

### 3: LIST

- Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
- Read a list of numbers and print the sum of odd integers and even integers from the list. (Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
- Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
- Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

### 4: TUPLE

- Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test\_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
- Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test\_list = [("GFG", "IS", "BEST"), ("GFg", "AVERAGE"), ("GfG", ), ("Gfg", "CS")], Output : [(„GFG“, „IS“, „BEST“)]).
- Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

### 5: SET

- Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x\*x).
- Write a program to perform union, intersection and difference using Set A and Set B.

## 6: DICTIONARY

- a. Write a program to do the following operations:
  - i. Create a empty dictionary with dict() method
  - ii. Add elements one at a time
  - iii. Update existing key's value
  - iv. Access an element using a key and also get() method
  - v. Deleting a key value using del() method
- b. Write a program to create a dictionary and apply the following methods:
  - i. pop() method
  - ii. popitem() method
  - iii. clear() method
- c. Given a dictionary, write a program to find the sum of all items in the dictionary.
- d. Write a program to merge two dictionaries using update() method.

## 7: STRINGS

- a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
- b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
- c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
- d. Write a program to read a string and count how many times each letter appears. (Histogram).

## 8: USER DEFINED FUNCTIONS

- a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
- b. Write a function merge\_dict(dict1, dict2) to merge two Python dictionaries.
- c. Write a fact() function to compute the factorial of a given positive number.
- d. Given a list of n elements, write a linear\_search() function to search a given element x in a list.

## 9: BUILT-IN FUNCTIONS

- a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
- b. Write a program to demonstrate the working of built-in trigonometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
- c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
- d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

## 10. CLASS AND OBJECTS

- a. Write a program to create a BankAccount class. Your class should support the following methods for
  - i) Deposit
  - ii) Withdraw

iii) GetBalance

iv) PinChange

- b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
- c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee\_info() method and also using dictionary (\_dict\_).
- d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

## 11. FILE HANDLING

- a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
- Count the sentences in the file.
  - Count the words in the file.
  - Count the characters in the file.
- b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
- c. Write a Python program to store N student's records containing name, roll number and branch. Print the given branch student's details only.

### Course outcomes:

Students should be able to

- **Identify** the issues in software requirements specification and enable to write SRS documents for software development problems
- **Explore** the use of Object oriented concepts to solve Real-life problems
- **Design** database for any real-world problem
- **Solve** mathematical problems using Python programming language

### References:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
3. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
4. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, 2018

<b>Course Code</b>	<b>Universal Human Values</b> (Common to all branches)		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A52201</b>			<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Pre-requisite</b>	<b>NIL</b>	<b>Semester</b>	<b>III</b>			
<b>UNIT - I</b>						<b>8 Hrs</b>
<b>Need, Basic Guidelines, Content and Process for Value Education</b>						
<ul style="list-style-type: none"> <li>Purpose and motivation for the course, recapitulation from Universal Human Values-I</li> <li>Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration</li> <li>Continuous Happiness and Prosperity- A look at basic Human Aspirations</li> <li>Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority</li> <li>Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario</li> <li>Method to fulfil the above human aspirations: understanding and living in harmony at various levels.</li> </ul>						
Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking						
<b>UNIT - II</b>						<b>8 Hrs</b>
<b>Understanding Harmony in the Human Being - Harmony in Myself!</b>						
<ul style="list-style-type: none"> <li><b>Understanding</b> human being as a co-existence of the sentient ‘I’ and the material ‘Body’</li> <li><b>Understanding</b> the needs of Self (‘I’) and ‘Body’ - happiness and physical facility</li> <li><b>Understanding</b> the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)</li> <li><b>Understanding</b> the characteristics and activities of ‘I’ and harmony in ‘I’</li> <li><b>Understanding</b> the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail</li> <li>Programs to <b>ensure</b> Sanyam and Health.</li> </ul>						
Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease						

<b>Unit-III</b>	
<b>Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship</b> <ul style="list-style-type: none"> <li>• Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship</li> <li>• Understanding the meaning of Trust; Difference between intention and competence</li> <li>• Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship</li> <li>• Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals</li> <li>• Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.</li> </ul> <p>Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>	
<b>UNIT - IV</b>	<b>8 Hrs</b>
<b>Understanding Harmony in the Nature and Existence - Whole existence as Coexistence</b> <ul style="list-style-type: none"> <li>• Understanding the harmony in the Nature</li> <li>• Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature</li> <li>• Understanding Existence as Co-existence of mutually interacting units in all- pervasive space</li> <li>• Holistic perception of harmony at all levels of existence.</li> </ul> <p>Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.</p>	
<b>UNIT - V</b>	<b>10 Hrs</b>
<b>Implications of the above Holistic Understanding of Harmony on Professional Ethics</b> <ul style="list-style-type: none"> <li>• Natural acceptance of human values</li> <li>• Definitiveness of Ethical Human Conduct</li> <li>• Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order</li> <li>• Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.</li> <li>• Case studies of typical holistic technologies, management models and production systems</li> <li>• Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations</li> <li>• Sum up.</li> </ul> <p>Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.</p>	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1</li> <li>2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2</li> </ol>	
<b>Course outcomes:</b> By the end of the course, <ul style="list-style-type: none"> <li>• Students are expected to become more aware of themselves, and their surroundings (family, society, nature)</li> <li>• They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.</li> <li>• They would have better critical ability.</li> </ul>	

- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

**Reference Books:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantal, 1999.
  2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
  3. The Story of Stuff (Book).
  4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
  5. E. F. Schumacher. "Small is Beautiful"
  6. Slow is Beautiful – Cecile Andrews
  7. J C Kumarappa "Economy of Permanence"
  8. Pandit Sunderlal "Bharat Mein Angreji Raj"
  9. Dharampal, "Rediscovering India"
  10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
  11. India Wins Freedom - Maulana Abdul Kalam Azad
  12. Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)





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Course Code	Mathematical Modeling & Optimization Techniques		L	T	P	C
20A54401			3	0	0	3
Pre-requisite	NIL	Semester	IV			
<b>UNIT - I</b>	<b>Introduction to Modelling, Building Models, Studying Models</b>		<b>8 Hrs</b>			
What is mathematical modelling? What objectives can modelling achieve? Classifications of models Stages of modelling . Systems analysis- Making assumptions- Flow diagrams- Choosing mathematical equations.						
<b>UNIT - II</b>	<b>Studying Models</b>		<b>8 Hrs</b>			
Equations from the literature- Analogies from physics-Data exploration, Dimensionless form - Asymptotic behaviour- Sensitivity analysis - Modelling model output						
<b>UNIT - III</b>	<b>Linear programming problems(LPP)</b>		<b>9 Hrs</b>			
Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.						
<b>UNIT - IV</b>	<b>Transportation&amp;Assignment Problem</b>		<b>11 Hrs</b>			
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Travelling salesman problem.						
<b>UNIT - V</b>	<b>Game Theory</b>		<b>11 Hrs</b>			
Formulation of games, Two person-Zero sum game, Mini max and Max min Principle, games with and without saddle point, Rules of dominance, Solving a 2/2 game using graphical method.						
<b>Course outcomes:</b> After the completion of Course, students will be able to 1. <b>Know</b> about the classifications and stages of mathematical modeling 2. <b>Understand</b> building of mathematical models 3. <b>Study</b> the behavior of mathematical models 4. <b>formulate</b> a linear programming problem and solve it by various methods give an optimal solution in assignment jobs, give transportation of items from sources to destinations.						
<b>Textbooks:</b> 1. Mathematical Modeling: by Majid Jaber-Douraki and Seyed M. Moghadas 2. Operations Research , S.D. Sharma.						
<b>Reference Books:</b> 1. Mathematical Models in Applied Mechanics A.B. Tayler 2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.						



Course Code	Engineering Geology		L	T	P	C
20A01401T			3	0	0	3
Pre-requisite	NIL	Semester	IV			
UNIT - I	PHYSICAL GEOLOGY		Lecture Hrs			
Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.						
UNIT - II	MINEROLOGY		Lecture Hrs			
Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals - Ore minerals - Iron ores; pyrite; Chlorite						
UNIT - III	PETROLOGY		Lecture Hrs			
Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.						
UNIT - IV	STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS		Lecture Hrs			
Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Electrical resistivity methods, and seismic refraction methods.						
UNIT - V	APPLICATION OF GEOLOGICAL INVESTIGATIONS		Lecture Hrs			
Remote sensing for civil engineering applications; site selection for dams and tunnels – Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation.						
<b>Course outcomes:</b> At the end of the course student will be able to						
<ul style="list-style-type: none"> <li>• <b>Gain</b> basic knowledge on characteristics of rocks and</li> <li>• <b>Gain</b> basic knowledge on characteristics of minerals.</li> <li>• <b>Identify</b> and differentiate rocks using geological classification.</li> <li>• <b>Carry out</b> geo physical investigations for infrastructural projects.</li> </ul>						
Apply concepts of structural geology for civil engineering structures.						
Textbooks:						
<ol style="list-style-type: none"> <li>1. N. ChennaKesavulu, “Text Book of Engineering Geology”, 2nd Edition (2009), Macmillan Publishers India.</li> <li>2. Vasudev Kanithi, “Engineering Geology”, Universities Press Pvt Ltd, Hyderabad. 2012.</li> </ol>						





## Textbooks:

1. A. M. Neville, "Properties of Concrete", Pearson Publication – 4th Edition
2. M.S. Shetty, A. K. Jain, "Concrete Technology Theory and Practice", S. Chand and Company Limited, New Delhi

## Reference Books:

1. M. L. Gambhir, “Concrete Technology”, Tata Mc. Graw Hill Publishers, New Delhi
2. N. Krishna Raju, “Design of Concrete Mixes”, CBS Publishers.
3. P. K. Mehta And J. M. Monteiro, “Concrete: Micro Structure, Properties and Materials” Mc-Graw Hill Publishers
4. J. Prasad, C.G.K. Nair, “Non-Destructive Test and Evaluation of Materials”, Tata Mcgraw Hill Publishers, New Delhi
5. Newman, John & Choo, Ban Sang. “ADVANCED CONCRETE TECHNOLOGY- Constituent Materials” Elsevier 2003.

<b>Course Code</b>	<b>Environmental Engineering - I</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>20A01404T</b>			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Pre-requisite</b>	<b>NIL</b>	<b>Semester</b>	<b>IV</b>			
<b>UNIT - I</b>	<b>Water quality and treatment:</b>					
Water quality: Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes						
<b>UNIT – II</b>	<b>Sewage and Treatment</b>					
Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment – COD & BOD- aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.						
<b>UNIT - III</b>	<b>Air Pollution</b>					
Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations.						
<b>UNIT - IV</b>	<b>Solid Waste Management</b>					
Municipal solid waste-Composition - chemical and physical parameters - Collection, transport, treatment and disposal. waste from commercial establishments and other urban zonesconstruction activities - biomedical wastes, Effects of solid waste on environment. Disposal of solid waste- Disposal methods- Integrated solid waste management.						

UNIT - V	Domestic Plumbing
Types of home plumbing systems for water supply and waste water disposal, high rise building plumbing-Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings. Role of Government authorities in water supply, sewerage disposal	
<b>Course outcomes:</b> At the end of the course, the student will be able to: <ul style="list-style-type: none"> <li>• <b>Understand</b> about quality of water and purification process</li> <li>• <b>Select</b> appropriate technique for treatment of wastewater.</li> <li>• <b>Assess</b> the impact of air pollution</li> <li>• <b>Understand</b> consequences of solid waste and its management</li> </ul> Design domestic plumbing systems	
<b>Textbooks:</b> <ol style="list-style-type: none"> <li>1. G. S. Birdi, "Water supply and sanitary Engineering", Dhanpat Rai &amp; Sons Publishers.</li> <li>2. Peavy, H.S, Rowe, D. R. Tchobanoglous, "Environmental Engineering", Mc-Graw – Hill International Editions, New York 1985.</li> </ol>	
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. B.C. Punmia, Ashok Jain &amp; Arun Jain, "Water Supply Engineering", Vol. 1, Waste water Engineering, Vol. II, Laxmi Publications Pvt. Ltd, New Delhi.</li> <li>2. MetCalf and Eddy, "Wastewater Engineering", Treatment, Disposal and Reuse, Tata McGraw- Hill, New Delhi.</li> <li>3. S. M. Patil, "Plumbing Engineering Theory, Design and Practice", 1999.</li> <li>4. K. N. Duggal, "Elements of Environmental Engineering", S. Chand Publishers.</li> </ol>	











Behind SSSS Hospital, Beedupalli knowledge park, Prasanthigram, Puttaparthi - 515134

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Course Code	ENVIRONMENTAL ENGINEERING LAB		L	T	P	C
20A01404P			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			
<b>List of Experiments:</b>						
<ol style="list-style-type: none"> <li>1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.</li> <li>2. Determination and estimation of Total Hardness–Calcium &amp; Magnesium.</li> <li>3. Determination of Alkalinity/Acidity</li> <li>4. Determination of Chlorides in water and soil</li> <li>5. Determination and Estimation of total solids, organic solids and inorganic solids and settleable solids by Imhoff Cone.</li> <li>6. Determination of Iron.</li> <li>7. Determination of Dissolved Oxygen with D.O. Meter &amp; Wrinklers Method and B.O.D.</li> <li>8. Determination of N, P, K values in solid waste</li> <li>9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.</li> <li>10. Determination of C.O.D.</li> <li>11. Determination of Optimum coagulant dose.</li> <li>12. Determination of Chlorine demand.</li> <li>13. Presumptive Coliform test.</li> </ol>						
<b>Course Outcomes (CO):</b>						
At the end of the course, the student will be able to <b>Understand</b> about quality of water standards						
<b>References:</b>						
1.G. S. Birdi “Water supply and sanitary Engineering”, Dhanpat Rai & Sons Publishers. 2.Peavy, H.S, Rowe, D. R. Tchobanoglous, “Environmental Engineering”, Mc-Graw –Hill International Editions, New York 1985						

Course Code	DESIGN OF REINFORCED CONCRETE STRUCTURES		L	T	P	C
20A01404P			3	0	0	3
Pre-requisite	NIL	Semester	V			

## UNIT I Introduction

Concepts of Reinforced concrete Design – Introduction to Working Stress Method - Limit State method – Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456:2000.

**Beams:** Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections

## UNIT II Shear and Torsion

Limit state analysis and design of section for shear and torsion – Concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing;

## UNIT III Columns

Short and Long columns – Under axial loads, Uniaxial bending and biaxial bending – I S Code provisions.

## UNIT IV Footings

Different types of footings – Design of isolated, square, rectangular, circular footings

## UNIT V Slabs & Staircase

Design of one-way slab, Two-way slabs and continuous slab using I.S. Coefficients, Limit state design for serviceability for deflection, cracking and IS code provision. Design of doglegged staircase.

**Codes/Tables:** IS 456-2000 and relevant sheets (Pertaining to columns) of SP 16 Code books to be permitted into the examinations Hall.

### Course outcomes:

• <b>Classify</b> the basic concepts of reinforced concrete analysis and design.
• <b>Classify</b> the behavior and various modes of failure of reinforced concrete members.
• <b>Analyze</b> and design various reinforced concrete members such as beams, columns, footings and slabs.
• <b>Draw</b> the section and reinforcement details for columns using IS code provisions,
Draw the section and reinforcement details for the footings and stair cases.

### Textbooks:

1. Limit state design of reinforced concrete by P. C. Varghese, Prentice Hall of India, New Delhi
2. Structural Design and Drawing: Reinforced Concrete and Steel, Fourth Edition, N Krishna Raju, Universities Press, 2022

### Reference Books:

1. Limit State Design of Reinforced Concrete by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, , Laxmi, Publications Pvt. Ltd., New Delhi
2. Fundamentals of reinforced concrete by N. C. Sinha and S. K Roy, S. Chand publishers
3. Design of Reinforced concrete structures by N. Subramanian, Oxford university press.
4. IS 456- 2000 Code of practice for Reinforced Concrete Structures.

Course Code	GEOTECHNICAL ENGINEERING		L	T	P	C
20A01502T			3	0	0	3
Pre-requisite	NIL	Semester	V			

## UNIT I

**INTRODUCTION:** Soil formation – Soil structure – Adsorbed water – Mass- Volume relationship – Relative density. Index Properties Of Soils: Moisture Content, Specific Gravity, In-situ density, Grain size analysis – Sieve and Hydrometer methods – Consistency limits and indices – I.S. Classification of soils.

## UNIT II

**PERMEABILITY:** Soil water – Capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting – Laboratory determination of coefficient of permeability – Permeability of layered systems.

**SEEPAGE THROUGH SOILS:** Total, neutral and effective stresses –Quick sand condition –Seepage through soils – Flow nets: Characteristics and Uses.

## UNIT III

**STRESS DISTRIBUTION IN SOILS:** Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart. Compaction: Mechanism of compaction – Factors affecting – effects of compaction on soil properties. – Field compaction Equipment – Compaction control.

## UNIT IV

**CONSOLIDATION:** Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - Stress history of clay; e-p and e-log p curves – normally consolidated soil, over consolidated soil and under consolidated soil – pre-consolidation pressure and its determination – Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods.

## UNIT V

**SHEAR STRENGTH OF SOILS:** Importance of shear strength – Mohr's– Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelopes – Critical void ratio –Liquefaction.

### Course Outcomes:

• <b>Carry out</b> soil classification
• <b>Solve</b> any practical problems related to soil stresses permeability and seepage
• <b>Estimate</b> the stresses under any system of foundation loads
• <b>Solve</b> practical problems related to consolidation settlement and time rate of settlement
Determine the shear strength of soil

### Textbooks:

1. Soil Mechanics and Foundation Engg. By K.R. Arora, Standard Publishers and Distributors Delhi 7<sup>th</sup> edition 2009
2. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, ( 2002).

### Reference Books:

1. Soil Mechanics and Foundation by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain,

- Laxmi, publications Pvt. Ltd., New Delhi 17<sup>th</sup> edition 2017
- Geotechnical Engineering by Iqbal H.Khan, PHI publishers 4<sup>th</sup> edition.
  - Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt . Ltd, New Delhi 3<sup>rd</sup> edition 2016

Course Code	BUILDING MATERIALS AND CONSTRUCTION		L	T	P	C
20A01503			3	0	0	3
Pre-requisite	NIL	Semester	V			

## UNIT I

### INTRODUCTION TO BUILDING MATERIALS:

Traditional & Organic Building Materials – Stone – Dressing of Stones – Modern Building Materials – Bricks – Manufacturing process – Ceramic Products – Manufacturing Process – Building Materials for Low Cost Housing – Utilisation of Wastes for Alternative Building Materials – Sustainable Materials in Construction, Concepts of energy efficient building envelopes as per ECBC – National Standards.

## UNIT II

**GLASS:** Introduction to Fenestration - Functions of Glass in Buildings – Constituents and Classification of Glass – Manufacturing Process – Properties of Glass – Common Types of Glass – Special Glass – Advantages and Disadvantages of Glass – National Standards such as ECBC. **PLASTIC:** Introduction – Polymerisation – Classification of Plastics – Commonly Used Plastics – Moulding and Fabricating for Plastic Products – Applications – Advantages – Disadvantages – Intelligent Use of Plastics in Buildings – National Standards such as ECBC.

## UNIT III

**INSULATING MATERIALS:** Thermal Insulating Materials: Introduction – Thermal Insulation – Heat Transfer Fundamentals – Thermal Properties of Insulating Materials – Selection of Insulating Materials – Classification of Insulation materials – Reflective Insulation Systems – Commonly Used Building Insulation Materials – Insulation that Should not be Used – National Standards such as ECBC. Sound Insulating Materials: Introduction – Basics of Acoustics – Sound Absorption or Insulation – Green Insulation – Cool Roof, Green Roof, Power Roof – National Standards such as ECBC.

## UNIT IV

**STRUCTURAL COMPONENTS:** Foundations – classification of Foundations – consideration in selection of foundation types – Masonry – Brick and block walls – Cavity walls – Damp-proof courses and membranes – Mortars – Arches and openings – Windows – Glass and glazing – Doors – Stairs – Types and Applications – Cladding to external walls – Flat roofs – Dormer windows – Formwork & Scaffolding – Precast concrete frames – Portal frames – Types – components – Framed structures – components – construction Procedure – Panel walls – National Standards such as ECBC

## UNIT V

**INTERNAL CONSTRUCTION AND FINISHES:** Internal elements – Internal walls – Construction joints – Internal walls, fire protection – separating walls – Partitions – Plasters and plastering – Domestic floors and finishes – Sound insulation – Timber, concrete and metal stairs – Internal doors – Door sets – Fire resisting doors – Plasterboard ceilings – Suspended ceilings – Paints and painting – Components of Paints – Types of Paint – Considerations in Selecting Paints – Cement Paints – Oil Paints – Emulsion Paints – Whitewash and Colourwash – Application of Paints – Distempers – Varnishes – Safety – Joinery production – Composite boarding – National Standards such as ECBC

### Course Outcomes:

• <b>Identify</b> the alternate waste and sustainable materials for low-cost housing construction as per appropriate standards
• <b>Understand</b> the properties and utilisation of glass and plastic materials in building construction
• <b>Evaluate</b> various types of thermal and acoustic insulation materials
• <b>Identify</b> various structural components and their functions
• <b>Understand</b> the finishing works meant for flooring, roofs and walls

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#### Text books:

1. Building Materials by M.L.Gambhir, TMH Publishers 2017 edition
2. Building material by S K Duggal – New Age International Publishers; Fifth Edition
3. Building Construction by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi 11<sup>th</sup> edition
4. A Textbook on building construction by S.K.Sharma, S.Chand Publishers 2016 edition

### Reference Books:

1. Building construction by W.B.Mckay, Vol. I, II, III & IV Pearson Publications, 2013 edition.
2. Building materials by S.C.Rangawala, Charotar Publishing House, Anand- India.
3. Building Construction by S.C.Rangawala, Charotar Publishing House, Anand- India
4. Building Construction by P.C. Varghese, Prentice-Hall of India private Ltd, New Delhi.
5. ECBC (Energy Conservation Building Code).BEE (Bureau of Energy Efficiency) Manuals on Energy efficient building envelope concepts.

Course Code	BUILDING CONSTRUCTION MANAGEMENT		L	T	P	C
20A01504c			3	0	0	3
Pre-requisite	NIL	Semester	V			

## UNIT I

**FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY:** Definitions and Discussion – Construction Activities – Construction Processes – Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

### PREPARATORY WORK AND IMPLEMENTATION:

Site layout – Infrastructure Development – Construction Methods – Construction Materials – Deployment of Construction Equipment – Prefabrication in Construction – Falsework and Temporary Works.

## UNIT II

**EARTHWORK:** Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging. Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

## UNIT III

**PROJECT MANAGEMENT AND BAR CHARTS AND MILESTONE CHARTS:** Introduction – Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts – Development of PERT network problems.

#### UNIT IV

**ELEMENTS OF NETWORK AND DEVELOPMENT OF NETWORK:** Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems – Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies – Illustrative examples – Problems

#### UNIT V

**PERT AND CPM: TIME COMPUTATIONS & NETWORK ANALYSIS:** Introduction – Uncertainties : Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time Problems -Earliest expected time – Formulation for  $T_E$  - Latest allowable occurrence time – Formulation for  $T_L$  - Combined tabular computations for  $T_E$  and  $T_L$  problems. Introduction - Slack – Critical path – Illustrative examples – Probability of meeting scheduled date Problems – CPM : process – CPM : Networks – Activity time estimate – Earliest event time – Latest allowable occurrence time – Combined tabular computations for  $T_E$  and  $T_L$  - Start and finish times of activity – Float – Critical activities and critical path – Illustrative examples Problems.

#### Textbooks:

1. Construction project management by Jha ,Pearson publications, New Delhi 2<sup>nd</sup> Edition 2015
2. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher Education- Univ. Press, Delhi 2008 edition
3. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 edition

#### Course outcomes:

<ul style="list-style-type: none"> <li>• <b>Identify</b> the various construction activities like preparing construction schedule and main documents and records of those activities</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Understand</b> the concepts and techniques involved in earthwork activities</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Understand</b> the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Understand</b> the various elements of a network diagram like event, activity and dummy</li> </ul>

#### Reference Books:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by : P.K.JOY- Mac Millan Publishers India Limited.

#### Online Learning Resources:

<https://nptel.ac.in/courses/105104161>



Course Code	COMPUTER AIDED DRAFTING LAB		L	T	P	C
20A01506			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

**LIST OF EXPERIMENTS:**

1. Introduction to computer aided drafting
2. Software for CAD – Introduction to different software's
3. Practice exercises on CAD software
4. Detailing of Building Components using CAD Software.
5. Drawing of Line diagram of Residential Building Using CAD software.
6. Drawing of Plan, Section & Elevation for Residential Buildings Using CAD Software.
7. Drawing Line diagram for Multi Storey Residential Buildings.
8. Drawing of Plan, Section & Elevation for Residential Multi Storey Buildings Using CAD Software.
9. Drawing of Plan, Section & Elevation for Hospital Building Using CAD Software.
10. Drawing of Plan, Section & Elevation for Industrial Buildings Using CAD Software.

**Course outcomes:**

- **Achieve** skill sets to prepare computer aided engineering drawings
- **Utilize** the power and precision of AutoCAD as a drafting and design tool
- **Apply** basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions
- A student will **know** what is plan and how it should be drawn in auto CAD software.

**Textbooks:**

Engineering graphics with Auto CAD - R.B. Choudary , Anuradha Publishes



Course Code	GEOTECHNICAL ENGINEERING LAB		L	T	P	C
20A01502P			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

### LABORATORY EXPERIMENTS

1. Specific gravity
2. Grain size analysis by sieving
3. Field density-Core cutter and Sand replacement methods
4. Atterberg's Limits.
5. Proctor Compaction test
6. Permeability of soil - Constant and Variable head tests
7. CBR Test
8. Direct Shear test
9. Unconfined Compression test
10. Triaxial Compression test (UU Test)
11. Differential free swell (DFS)
12. Hydrometer Analysis Test (Demonstration)
13. Consolidation test (Demonstration)
14. Vane Shear test

### Course outcomes:

At the end of the course, the student must be able to:

- **Identify** various soils based on their characteristics.
- **Evaluate** permeability and seepage of soils.
- **Determine** plasticity characteristics of various soils.
- tests to determine shear strength

Understand the consolidation process and thereby predicting the settlement of soils.

### Textbooks:

1. Soil Mechanics and Foundation Engg by K. R. Arora, Standard Publishers and Distributors, Delhi 7<sup>th</sup> edition 2009.
2. Geotechnical Engineering by C. Venkataramiah, New age International Pvt . Ltd, (2002).

### Reference Books:

1. Soil Mechanics and Foundation by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications Pvt. Ltd., New Delhi 17<sup>th</sup> edition 2017.
2. Basic and Applied Soil Mechanics by Gopal Ranjan & A. S. R. Rao, New age International Pvt . Ltd, New Delhi 3<sup>rd</sup> edition 2016.
3. Principles of Geotechnical Engineering by Braja M. Das Cengage Learning

Course Code	BUILDING PLANNING AND DRAWING		L	T	P	C
20A01507			1	0	2	2
Pre-requisite	NIL	Semester	V			

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### **LIST OF EXERCISES**

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows.
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

#### **Course outcomes:**

- To **impart** the practical knowledge in detailing and drawing of various components of building and Different types of Buildings.
- **Interpret** the symbols, signs and conventions from the given drawing.
- The student should be able to **distinguish** the relation between the plan, elevation and crosssection and identify the form and functions among the buildings.
- The student is expected to learn the skills of drawing building elements and plan various types of buildings as per requirements.

Student should be able to plan various buildings as per the building by-laws

#### **Textbooks:**

1. Planning and Designing and Scheduling – Gurucharan Singh and Jagadish Singh- Standard publishers 2020 edition
2. Building Planning and Design – N.Kumara Swamy and A.Kameswara Rao. Charotar publications 9<sup>th</sup> edition 2019

#### **Reference Books:**

1. Building by laws by state and Central Governments and Municipal corporations. National Building Code
2. Building drawing with an integrated approach to building environment - M.G.Saha, G.M.Kale, S.Y.patki-Tata Mc Graw Hill

Course Code	DESIGN AND DRAWING OF STEEL STRUCTURES		L	T	P	C
20A01601			3	0	0	3
Pre-requisite	NIL	Semester	VI			

### UNIT I

Concepts of Plasticity, Yield strength of steel. Loads and combinations, wind loads on roof trusses, Concept of limit State Design of steel structures – Different Limit States as per IS 800 -2007 – Design Strengths- Deflection limits – Serviceability - Bolted connections – Welded connections – Design Strength – Efficiency of joint – Prying action Types of Welded joints - Design of Tension members

### UNIT II

Design of Steel Compression members – Buckling class – slenderness ratio / strength design – Laced – Battered columns – Design of Column bases – Slab base only.

### UNIT III

Design of Beams – Plastic moment – Bending and shear strength, design of laterally supported beams – Built up sections – Large plates Web buckling, Crippling and Deflection of beams

### UNIT IV

Design of eccentric connections with brackets, Beam end connections – Web angle – Un-stiffened and stiffened seated connections (bolted and Welded types) Design of truss joints

### UNIT V

Plate Girder: Design consideration – I S Code recommendations - Design of welded plate girder – Curtailment of flange plates- stiffeners.

#### Course outcomes:

- **Learn** the basic elements of a steel structure
- **Learn** the fundamentals of structural steel fasteners
- Able to **design** basic elements of steel structure like tension members, compression members, beams and beam-columns
- Able to **design** column splices and bases.

Able to design the various steel structures.

#### Textbooks:

1. Limit state design of Steel Structures by Subramanyam.N, Oxford University press, New Delhi 2<sup>nd</sup> edition 2018
2. Limit State Design of steel structures by S.K. Duggal, Tata Mcgraw Hill, New Delhi 3<sup>rd</sup> edition 2019

#### Reference Books:

1. Structural Design and Drawing by N.Krishna Raju, University Press, Hyderabad 3<sup>rd</sup> edition 2009
2. Structural design in steel by Sarwar Alam Raz, New Age International Publishers, New Delhi
3. Design of Steel Structures by Edwin Gaylord, Charles Gaylord, James Stallmeyer, Tata Mc.Graw-Hill, New Delhi.

#### Codes/Tables: IS Codes:

- 1) IS -800 – 2007
- 2) IS – 875 – Part III
- 3) Steel Tables.
- 4) Railway Design Standards Code and steel tables to be permitted into the examination hall.

Course Code	HIGHWAY ENGINEERING		L	T	P	C
20A01602			3	0	0	3
Pre-requisite	NIL	Semester	VI			

## UNIT I

### HIGHWAY DEVELOPMENT AND PLANNING

Highway development in India – Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

## UNIT II

### HIGHWAY GEOMETRIC DESIGN

Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

## UNIT III

### TRAFFIC ENGINEERING STUDIES

Basic Parameters of Traffic-Volume, Speed and Density – Definitions and their inter relation – Highway capacity and level of service concept – factors affecting capacity and level of service - Traffic Volume Studies- Data Collection and Presentation-Speed studies- Data Collection and Presentation- Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams.

### TRAFFIC REGULATION AND MANAGEMENT:

Road Traffic Signs – Types and Specifications – Road markings-Need for Road Markings-Types of Road Markings- Specifications - Design of Traffic Signals –Webster Method –Saturation flow – phasing and timing diagrams – Numerical problems.

## UNIT IV INTERSECTION

### DESIGN

Conflicts at Intersections- Channelization: Objectives –Traffic Islands and Design criteria- Types of At-Grade Intersections – Types of Grade Separated Intersections- Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersection.

## UNIT V

### PAVEMENT DESIGN

Types of pavements – Difference between flexible and rigid pavements – Pavement Components – Sub grade, Sub base, base and wearing course – Functions of pavement components – Design Factors – Flexible pavement Design methods – G.I method, CBR Method, (as per IRC 37-2002) – Design of Rigid pavements – Critical load positions - Westergaard's stress equations – computing Radius of Relative stiffness and equivalent radius of resisting section – stresses in rigid pavements – Design of Expansion and contraction joints in CC pavements. Design of Dowel bars and Tie bars.

#### Course outcomes:

- **Understand** the importance of Highway Development in Social and Economic Development of a Nation
- **Understand** the concepts of Geometric Design of various Highway Infrastructure elements like Superelevation, Sight Distances, Radius of Curve, Extra widening etc
- **Understanding** Basic Traffic Parameters and Surveys needed for Collecting Data about them
- **Understand** the need for Management of Traffic in Urban areas and the measures available

Familiar with types of Road Intersections and their design elements

#### Textbooks:

1. Highway Engineering – S.K.Khanna & C.E.G. Justo, Nemchand & Bros., 7<sup>th</sup> edition (2000).
2. Traffic Engineering and Transportation Planning by L.R. Kadiyali and Lal- Khanna Publications 9<sup>th</sup> edition

**Reference Books:**

1. Transportation Engineering, R Srinivas Kumar, Universities Press, 2020
2. Highway Engineering – Dr.S.K.Sharma, S.Chand Publishers 2014 edition
3. Transportation Engineering, Volume I, C Venkatramaiah, Universities Press, 2015
4. Pavement Design, R Srinivasa Kumar, Universities Press, 2013

Course Code	HYDROLOGY AND IRRIGATION ENGINEERING		L	T	P	C
20A01603			3	0	0	3
Pre-requisite	NIL	Semester	VI			

**UNIT I**

**INTRODUCTION TO HYDROLOGY:** Engineering hydrology and its applications; Hydrologic cycle; precipitation- Types and forms, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, presentation and interpretation of rainfall data.

**DESCRIPTIVE HYDROLOGY:**Evaporation- Factors affecting evaporation, measurement of evaporation; Infiltration- Factors affecting infiltration, measurement of infiltration, infiltration indices; Run off- Factors affecting run- off, Computation of run-off; Design Flood; Estimation of maximum rate of run-off; separation of base flow.

**UNIT II**

**HYDROGRAPH ANALYSIS:** Hydrograph; Unit Hydrograph- Construction and limitations of Unit hydrograph, Application of the unit hydrograph to the construction of a flood hydrograph resulting from rainfall of unit duration; S-hydrograph.

**GROUND WATER:** Introduction; Aquifer; Aquiclude; Aquifuge; aquifer parameters- porosity, Specific yield, Specific retention; Divisions of sub-surface water; Water table; Types of aquifers; storage coefficient-coefficient of permeability and transmissibility

**UNIT III**

**IRRIGATION:** Introduction; Necessity and Importance of Irrigation; advantages and ill effects of Irrigation; types of Irrigation; methods of application of Irrigation water; quality for Irrigation water. Duty and delta; duty at various places; relation between duty and delta; factors affecting duty; methods of improving duty.

**WATER REQUIREMENT OF CROPS:** Types of soils, Indian agricultural soils, preparation of land for Irrigation; soil fertility; Soil-water-plant relationship; vertical distribution of soil moisture; soil moisture tension; soil moisture stress; various soil moisture constants; Limiting soil moisture conditions; Depth and frequency of irrigation; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; crop seasons and crop rotation; Irrigation efficiencies; Determination of irrigation requirements of crops; Assessment of Irrigation water. Consumptive use of water-factors affecting consumptive use, direct measurement and determination by use of equations (theory only)

**UNIT IV**

**CHANNELS – SILT THEORIES:** Classification; Canal alignment; Inundation canals; Cross– section of an irrigation channel; Balancing depth; Borrow pit; Spoil bank; Land width; Silt theories– Kennedy's theory, Kennedy's method of channel design; Drawbacks in Kennedy's theory; Lacey's regime theory- Lacey's theory applied to channel design; Defects in Lacey's theory; Comparison of Kennedy's and Lacey's theory.

**WATER LOGGING AND CANAL LINING:** Water logging; Effects of water logging; Causes of water logging; Remedial measures; Saline and alkaline soils and their reclamation; Losses in canal; Lining of irrigation channels – Necessity, advantages and disadvantages; Types of lining; Design of lined canal.

**UNIT V**

**DIVERSION HEAD WORKS:** Types of diversion head works; Diversion and Storage head works; weirs and barrages; Layouts of diversion head works; components; Causes and failure of hydraulic structures on permeable foundations; Blighs creep theory; Khoslas theory; Determination of uplift pressure, impervious floors using Blighs and Khoslas theory; Exit gradient.

**Course outcomes:**

- **Design** various channel systems
- **Design** head and cross regulator structures and also Identify various types of reservoir and their design aspects.
- By the Establishes the **understanding** of cross drainage works and its design.
- Students **understood** all type of dams and reservoirs and their designs

Students understood Spillways, Gates & Energy dissipaters

**Textbooks:**

1. Irrigation and water power engineering by Punmia& Lal, Laxmi publications pvt. Ltd., New Delhi 17<sup>th</sup> edition 2021
2. Engineering Hydrology by K. Subramanya, The Tata Mcgraw Hill Company, Delhi 5<sup>th</sup> edition 2020

**Reference Books:**

1. Irrigation Engineering and Hydraulic structures by S. K. Garg; Khanna Publishers, Delhi 36<sup>th</sup> edition
2. Engineering Hydrology by Jayarami Reddy, Laxmi publications pvt. Ltd., New Delhi 3<sup>rd</sup> edition 2016
3. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House 6<sup>th</sup> edition 2020

Course Code	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
20A01604C		3	0	0	3
Pre-requisite	NIL	Semester		VI	

### UNIT I Concepts and methodologies of EIA

Initial environmental Examination, Elements of EIA, - Factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

### UNIT II Impact of Developmental Activities and Land Use

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

### UNIT III Assessment of Impact on Vegetation, Wildlife and Risk Assessment

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment

### UNIT IV Environmental Audit

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

### UNIT V Environmental Acts and Notifications

The Environmental protection Act, The water preservation Act, The Air (Prevention & Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

#### Course outcomes:

- To **prepare** EMP, EIS, and EIA report.
- To **identify** the risks and impacts of a project.
- To **choose** an appropriate EIA methodology.
- To **evaluation** the EIA report.

To Estimate the cost benefit ratio of a project.

#### Textbooks:

1. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2<sup>nd</sup> edition 2011

#### Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G. McGraw Hill International Editions, New York 1985
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers
3. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania & Sons Publication, ND



Course Code	DESIGN STUDIO LAB WITH STAAD PRO		L	T	P	C
20A01606			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

#### LIST OF EXERCISES

1. Analysis & Design of 2D Frame under pure Vertical loading using Staad Pro Software.
2. Analysis & Design of 2D Frame under both Vertical & Horizontal loading using Staad Pro Software.
3. Analysis & Design of 2D Truss using Staad Pro Software.
4. Analysis & Design of 3D Frames using Staad Pro Software.
5. Analysis & Design of Different types of Beams Using Staad Pro Software.
6. Analysis & Design of Rectangular & Circular Columns Using Staad Pro Software.
7. Analysis & Design of Isolated Footings Using Staad Pro Software.
8. Analysis & Design of Retaining Walls Using Staad Pro Software.
9. Analysis & Design of One Way and Two Way Slabs Using Staad Pro Software.
10. Analysis & Design of Simple Tower by Using Staad Pro Software.

**TEXT BOOKS:** Staad Pro V8i for Beginners:With Indian Examples by T.S.Sarma, Notion Press Media

Course Code	HIGHWAY MATERIALS LAB		L	T	P	C
20A01607			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

#### LIST OF EXPERIMENTS

##### TESTS ON ROAD AGGREGATES:

- Aggregate Crushing value Test.
- Aggregate Impact Test.
- Abrasion Test.
- Shape tests

##### Course Outcomes:

By the end of this course the student will be able to

- **Categorize** the test on materials used Civil Engineering Building & Pavement constructions
- **Identify** engineering properties of aggregate.
- **Identify** the grade & properties of bitumen.
- **Examine** the tests performed for Bitumen mixes.

The students will be able to select the most appropriate materials for highway construction based on material characteristics, engineering properties, design requirements, cost, availability, and expected service

##### TESTS ON BITUMINOUS MATERIALS:

- Penetration Test.
- Ductility Test.
- Softening Point Test.
- Flash and fire point tests

## Demo on Marshall Stability Test on Bituminous Mixes

### Course Outcomes:

By the end of this course the student will be able to

• <b>Categorize</b> the test on materials used Civil Engineering Building & Pavement constructions
• <b>Identify</b> engineering properties of aggregate.
• <b>Identify</b> the grade & properties of bitumen.
• <b>Examine</b> the tests performed for Bitumen mixes.

### Textbooks:

Highway Material Testing and Quality Control (English, Paperback, G. Venkatappa Rao, K.Ramachandra Rao, Kausik Pahari, D.V. Bhavanna Rao) Dreamtech Press

Course Code	CONCRETE TECHNOLOGY LAB		L	T	P	C
20A01608			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

### LIST OF EXPERIMENTS

1. Determine the workability of Fresh Conventional Concrete by using Flow Table Test
2. Determine the Density, Yield and Air Content of Fresh Conventional concrete
3. Determine the Modulus of Elasticity for Conventional Concrete
4. Determine the Filling Ability of Fresh Self Compacting Concrete by using Slump Flow Test
5. Determine the Flowability of Fresh Self Compacting Concrete by using V- Funnel Test
6. Determine the Flowability of Fresh Self Compacting Concrete by using L - Box Test
7. Determine the Resistance of Fresh Self Compacting Concrete to segregation
8. Determine the Compressive Strength for Self-Compacting Concrete
9. Determine the Split Tensile Strength for Self-Compacting Concrete
10. Determine the Modulus of Elasticity for Self-Compacting Concrete

### COURSE OUTCOMES:

• To <b>determine</b> the consistency and fineness of cement.
• To <b>understand</b> the non-destructive testing procedure on concrete.
• To <b>determine</b> the workability of cement concrete by compaction factor, slump and Vee-Beete
• <b>Ability</b> to know the setting times of cement.

To determine the specific gravity of fine aggregate and coarse aggregate.

### LIST OF EQUIPMENT

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers.
4. Los angles Abrasion test machine
5. Vicat's apparatus
6. Specific gravity bottle.
7. Lechatlier's apparatus.
8. Slump and compaction factor setups
9. Longitudinal compressor meter and l
10. Rebound hammer, Pulse velocity machine.
11. Relevant IS Codes

#### Reference Books

1. Concrete Manual by M.L.Gambhir, DhanpatRai&co., Fourth edition.
2. Building construction and materials (Lab Manual) by Gambhir , TMH publishers 2017 edition

Course Code	BIM FUNDAMENTALS FOR CIVIL ENGINEERS		L	T	P	C
20A01609			1	0	2	2
Pre-requisite	NIL	Semester	VI			

#### UNIT IBIM in Design Coordination

Develop an advanced understanding of BIM approaches for retrieving, analysing and integrating information to aid decision-making, and using appropriate BIM tools.

#### UNIT IIBIM in Construction Operations

Looks at a range of BIM approaches and applications for construction planning and operations, including simulating construction schedules and logistics, buildability forecasting and clashdetection.

#### UNIT IIIBIM in Business and Practice

The opportunity to pursue a case study closely related to a company's interests, and how they useBIM approaches and protocols. You will help the company with a BIM organisational strategic and implementation plan to ensure it's aligned with their business strategy.

#### UNIT IVBIM in Operation and Maintenance

Examine the role of BIM for building and asset operation and maintenance, and the challenges of BIM-Facilities Management (FM) integration

#### UNIT VLow/Zero-Impact Buildings

Assesses the role of BIM in designing and operating comfortable buildings that significantly reduce or eliminate energy use. You will evaluate low or zero-carbon and renewable technologies, apply BIM to evaluate buildings' environmental performance and explore the impact of Part L, BREEAM, LEED and EPC ratings.

**COURSE OUTCOMES:**

- **Simulate** construction schedules and logistics using BIM to communicate and evaluate project activities
- **Apply** BIM for buildability scenario forecasting, including interference management and clash detection
- **Assess** low/zero-carbon and renewable technologies
- **Apply** BIM and low/zero carbon technology to evaluate building environmental performance

The course provides a comprehensive overview of the main BIM applications currently in use, in order to develop a critical approach to these techniques

**Textbooks:**

1. BIM Handbook: A Guide to Building Information Modeling - Chuck Eastman, et al.
2. Building Information Modeling: A Strategic Implementation Guide - Dana K. Smith and Michael Tardif
3. Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations - Willem Kymmell
4. BIM & Construction Management: Proven Tools, Methods, & Workflows -Brad Hardin

Course Code	GROUND IMPROVEMENT TECHNIQUES		L	T	P	C
(20A01701c)			3	0	0	3
Pre-requisite	NIL	Semester	VII			

**UNIT I**

**DEWATERING:** Methods of de-watering- Sumps and interceptor ditches- Single, multi stage well points - Vacuum well points- Horizontal wells-foundation drains-blanket drains - Criteria for selection of fill material around drains –Electro-osmosis .

**GROUTING:** Objectives of grouting- Grouts and their properties- Grouting methods- ascending, descending and stage grouting- hydraulic fracturing in soils and rocks- Post grout test.

**UNIT II****DENSIFICATION METHODS IN GRANULAR SOILS:-**

In – situ densification methods in granular Soils:- Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.

**DENSIFICATION METHODS IN COHESIVE SOILS:-**

In – situ densification methods in Cohesive soils:- Preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

**UNIT III**

**STABILISATION:** Methods of stabilization-mechanical-cement- Lime-bituminous-Chemical stabilization with calcium chloride, sodium silicate and gypsum

**UNIT IV**

**REINFORCED EARTH:** Principles – Components of reinforced earth – Factors governing design of reinforced earth walls – Design principles of reinforced earth walls.

**GEOSYNTHETICS:** Geotextiles- Types, Functions and applications – Geogrids and geomembranes – Functions and applications.

#### UNIT V

**EXPANSIVE SOILS:** Problems of expansive soils – Tests for identification – Methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – Under reamed piles.

#### COURSE OUTCOMES:

- Given solution to **solve** various problems.
- **Use** effectively the various methods of ground improvement techniques.
- The locally available technique for ground improvement so that the **design** of foundation.
- **Identify** different types of function & application & geo member.

Be able to anticipate & subject the soils test for identification method of determination of swell pressure.

#### Textbooks:

1. Engineering Principles of Ground Modification, Haussmann M.R. , McGraw-Hill International Edition(1990).
2. Ground Improvement Techniques, Dr.P.Purushotham Raj. Laxmi Publications, New Delhi / University science press, New Delhi 2<sup>nd</sup> edition 2016
3. Ground Improvement Techniques, NiharRanajanPatraVikas Publications, New Delhi

#### Reference Books:

- Ground Control and Improvement, Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994)  
John Wiley and Sons, New York, USA.
- Designing with Geosynthetics, Robert M. Koerner, Prentice Hall New Jersey, USA

Course Code	INDUSTRIAL WASTE AND WASTEWATER MANAGEMENT		L	T	P	C
20A01702c			3	0	0	3
Pre-requisite	NIL	Semester	VII			

#### UNIT I

Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastes - Difference between industrial & municipal waste waters - Effects of industrial effluents on sewers and Natural water Bodies.

#### UNIT II

Pre & Primary Treatment - Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction.

#### UNIT III

Waste Treatment Methods - Nitrification and De-nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process - Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water.

#### UNIT IV

Characteristics and Composition of waste water and Manufacturing Processes of Industries like Sugar, Characteristics and Composition of Industries like Food processing Industries, Steel, and Petroleum Refineries.

#### UNIT V

Characteristics and Composition of Industries like Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries – Joint Treatment of Raw Industries waste water and Domestic Sewage – Common Effluent Treatment Plants(CETP) – Location, Design, Operation and Maintenance Problems – Economical aspects.

#### COURSE OUTCOMES:

- To **understand** the fundamental concepts of wastewater treatment.
- To **conduct** experiments and the ability to analyze the data, interpret results and draw conclusions.
- To **design** a component, system or process to meet desired needs and imposed constraints.
- To **Identify**, formulate and solve civil engineering problems

To understand the modern techniques skills and tools including computer applications, necessary for engineering practice.

#### Textbooks:

1. Wastewater engineering Treatment disposal reuse by Metcalf & Eddy, Tata McGraw Hill.
2. Industrial Water Pollution Control by Eckenfelder, W.W., McGraw-Hill

#### Reference Books:

1. Industrial Waste by M.N. Rao and Dutta CBS Publishers and Distributors Pvt Ltd; 3rd edition (January 30, 2018)
2. Water & Wastewater Technology by Mark J. Hammer, Mark J. Hammer, Jr., Prentice Hall of India.
3. Theories and practices of Industrial Waste Engineering by N.L. Nemerow Addison-Wesley publishers

**Online Learning Resources:** <https://nptelvideos.com/video.php?id=1118>

Course Code	ESTIMATION, COSTING AND VALUATION		L	T	P	C
(20A01706)			1	0	2	2
Pre-requisite	NIL	Semester	VII			

#### LIST OF EXPERIMENTS

1. Activity based learning on methods and types of estimates
2. Preparation of Detailed estimate for a single storey residential building using wall to wall method
3. Preparation of Detailed estimate for a single storey residential building using centre line method for Earthwork, foundations, Super structure, Fittings including sanitary and electrical fittings & Paintings.
4. Preparation of Detailed estimate for a two storey residential building using centre line method for Earthwork, foundations, Super structure, Fittings including sanitary and electrical fittings & Paintings.
5. Activity based learning of Estimate Data and Rate Analysis
6. Preparation of Abstract Estimate for the detailed estimate in Exercise No.3
7. Preparation of Abstract Estimate for the detailed estimate in Exercise No.4
8. Writing of Measurement book and Bill preparation as per AP State Govt Procedure for detailed estimate in No. 3 and abstract estimate of No. 6
9. Writing of detailed specifications for various items of estimate and preparing a model Tender document for the work Listed in No. 3 and 6
10. Activity based learning for Valuation of Buildings, Cost escalation procedures and Value Analysis for any one work

**COURSE OUTCOMES:**

- **Understand** basics on methods and types of estimation.
- **Formulate** specifications and write tender documents.
- **Prepare** Detailed and Abstract Estimates
- **Determine** rate analysis of different items.

Valuation of buildings.

**Textbooks:**

1. Estimating and Costing in Civil Engineering (Theory & Practice) by Dutta, B. N., UBS Publishers, 28<sup>th</sup> edition 2021
2. Civil Engineering Contracts and Estimates”, by B. S. Patil, Universities Press Pvt Ltd, Hyderabad. 4<sup>th</sup> Edition 2015.

**Reference Books:**

1. Estimation, Costing and Specifications by M. Chakraborti, Laxmi publications 24<sup>th</sup> edition
2. A Textbook of Estimating and Costing(Civil) by D. D. Kohli & R. C. Kohli, S. Chand and Company Limited, New Delhi
3. Standard Schedule of rates and standard data book by public works department.
4. I. S. 1200 (Parts I to XXV, “Method of Measurement of Building and Civil Engineering works – B.I.S.)” 1974

Course Code	3D PRINTING TECHNOLOGY		L	T	P	C
(20A01707)			3	0	0	3
Pre-requisite	NIL	Semester	VII			

<b>.UNIT I</b>
Introduction to 3D Printing Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.
<b>UNIT II</b>
<b>Solid and Liquid Based RP Systems</b>
Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).
<b>UNIT III</b>
<b>Powder Based &amp; Other RP Systems</b>
<b>Powder Based RP Systems:</b> Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).
<b>Other RP Systems:</b> Working Principle, Materials, Advantages, Limitations and



<b>UNIT IV</b>
<b>Rapid Tooling &amp; Reverse Engineering</b>
<b>Rapid Tooling:</b> Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.
<b>Reverse Engineering (RE):</b> Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.
<b>UNIT V</b>
<b>Errors in 3D Printing and Applications:</b>
Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. <b>Software:</b> Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. <b>Applications:</b> Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.
<b>Course Outcomes:</b>
<ul style="list-style-type: none"> <li>• <b>Use</b> techniques for processing of CAD models for rapid prototyping.</li> <li>• <b>Understand</b> and apply fundamentals of rapid prototyping techniques.</li> <li>• <b>Use</b> appropriate tooling for rapid prototyping process.</li> <li>• <b>Use</b> rapid prototyping techniques for reverse engineering.</li> </ul>
Identify Various Pre – Processing, Processing and Post Processing errors in RP processes

#### Textbooks:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.