OUTCOME BASED EDUCATION

Bachelor of Technology
Civil Engineering
GR20

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Outcome Based Education and Accreditation

1. **Introduction**

"Outcomes Based Education" (OBE) of Engineering qualifications gives recognition to graduates for the knowledge, skills and attitudes/behaviors they have acquired upon just completion of a program and after 4 to 5 years of graduation. This system is student centered instruction that focuses on measuring student performance i.e. outcomes of the Program and at the same time enabling students to develop new skills that prepare them to stand out with their global counterparts..

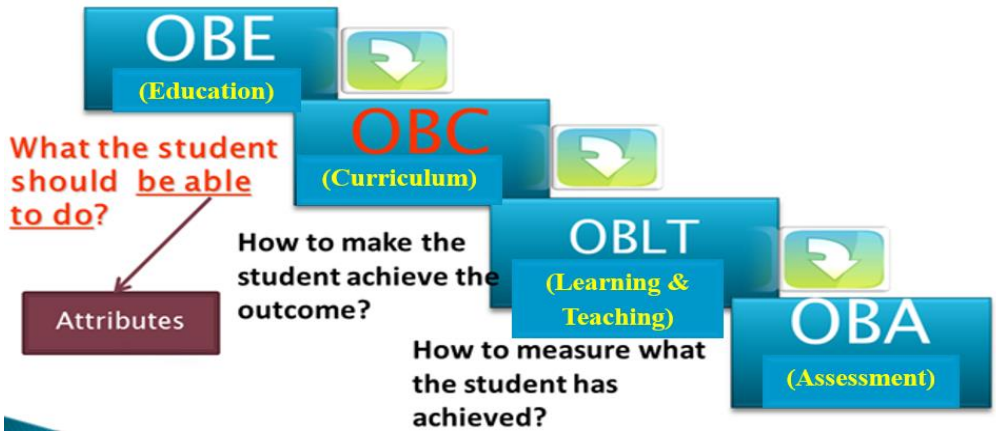
Outcome Based Accreditation (OBA) is an Assessment of the Performance of the Program/Institution as per the Accreditation Criteria defined in terms of Outcomes and other key Constituents.

Outcome Based Curriculum (OBC) is prepared keeping in mind that what the student should be able to do at end of the Program.

Outcome Based Learning &Teaching (OBLT) methods are developed to make the student achieve the Outcomes.

Outcome Based Assessments (OBA) methods are designed to measure what the student has achieved at end of the Program in terms of Knowledge, Skills, and Attitude/Behavior.

Key Constituents of OBE The Key Constituents of OBE are Vision, Mission, Program Educational Objectives (PEO), Program Outcomes (PO), Graduate Attributes (GA), Course Outcomes (CO), Assessments, Rubrics, Mapping, Evaluation and Grading.



Accreditation

It is a process of quality assurance and improvement, whereby a program in an approved Institution is critically appraised to verify that the Institution/program continues to meet and/or exceed the Norms and Standards prescribed by regulator from time to time. It is a kind of recognition which indicates that a program/Institution fulfills certain standards.

- It is a peer review process that assures the quality of post-secondary education students receive.
- Educational institutions or program volunteer to undergo this review periodically to determine if certain criteria are being met.
- It is important to understand that accreditation is not a ranking system. It is simply assurance that a program or institution meets established quality standards.

  There are two types of accreditation- Institution and Program.
- Institutional accreditation evaluates overall institutional quality. One form of institutional accreditation is accreditation of Colleges and Universities. (National Assessment & Accreditation Council-NAAC under UGC)
- Program accreditation examines specific program of study rather than institution as a whole. (National Board of Accreditation-NBA under AICTE)

Importance and Significance of Accreditation

- To make the institute/department/program aware of the weaknesses of the program offered by it and act on suggestions for improvement.
- To encourage the institute to move continuously towards the improvement of quality of its program, and the pursuit of excellence.
- To facilitate institutions for updating themselves in program curriculum, teaching and learning processes, faculty achievements students skills/abilities/knowledge.
- To improve student enrollment both in terms of quality and quantity.
- To facilitate receiving of grants from Government regulatory bodies and institutions/agencies.
- To attain international recognition of accredited degrees awarded.
- To facilitate the mobility of graduated students and professionals.
- To enhance employability of graduates.
- To create sound and challenging academic environment in the Institution, and contributes to social and economic development of the country by producing high quality technical manpower.

2. Washington Accord

The Washington Accord Agreement recognizes that

"Accreditation of engineering ac academic programs is a key foundation for the practice of engineering at the professional level in each of the countries or territories covered by the Accord."

The Washington Accord was sign in 1989.It is an agreement between the bodies responsible for accrediting professional engineering degree programs in each of the signatory countries. It recognizes the substantial equivalency of programs accredited by those bodies and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. The Washington Accord covers professional engineering undergraduate degrees. Postgraduate-level programs are not covered by the Accord. The Washington Accord Agreement applies only to accreditations conducted by the signatories within their respective national or territorial boundaries.

Agreements covering qualifications in engineering

There are three agreements covering mutual recognition in respect of qualification in engineering:
The Washington Accord signed in 1989 was the first -it recognizes substantial equivalence in the accreditation of qualifications in professional engineering, normally of four years duration.

The Sydney Accord signed in 2001 and recognizes substantial equivalence in the accreditation of qualifications in engineering technology, normally of three years duration.

The Dublin Accord signed in 2002 and recognizes substantial equivalence in the accreditation of qualifications in technician engineering, normally of two years duration.

The Washington Accord pertains to engineering programs accredited by its signatories within their respective jurisdiction starting in 1989. There are 15 Signatories to the Washington Accord as on today. Signatories to the Washington Accord are organizations responsible for accrediting engineering programs in Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States (1989); Hong Kong (1995), South Africa (1999), Japan (2005), Singapore (2006),
Korea, Chinese Taipei (2007), Malaysia (2009), Turkey (2011), Russia (2012). Signatories have full rights of participation in the Accord.

Washington Accord Agreement states:

- Accreditation criteria, policies and procedures of the signatories have been verified comparable
- Accreditation decisions made by one signatory are acceptable to the other signatories
- Recognition applies only to accreditations conducted within the signatory's national or territorial boundaries.

- Mutual recognition of accredited engineering programs
- Benchmarking standards for engineering education
- Graduate Attributes (GA) represent the generally agreed reference for accredited programs
- Bench marking accreditation policies and processes

The Signatories will identify and encourage the implementation best practice for the academic preparation of engineers.

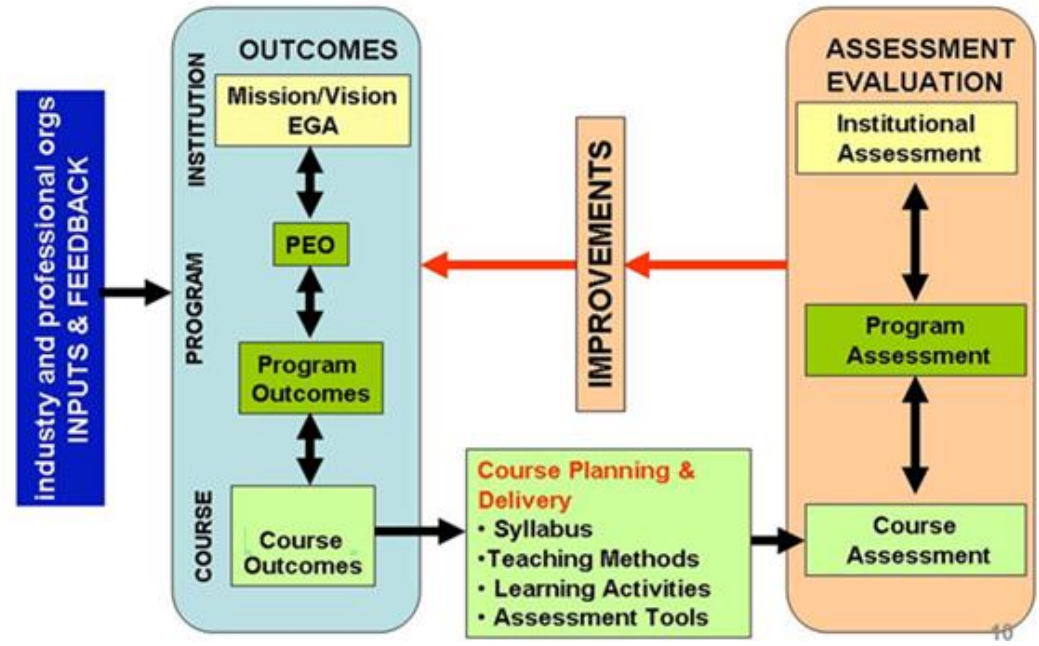
by mutual monitoring regular communication and sharing of information: accreditation criteria, systems, procedures, manuals, publications list of accredited programs; invitations to observe accreditation visits; and invitations to observe meetings of any boards.

"Getting into Washington Accord is like getting into the UN Security Council,"

Organizations holding provisional status have been identified as having qualification accreditation or recognition procedures that are potentially suitable for the purposes of the Accord; those organizations are further developing those procedures with the goal of achieving signatory status in due course; qualifications accredited or recognized by organizations holding provisional status are not recognized by the signatories:

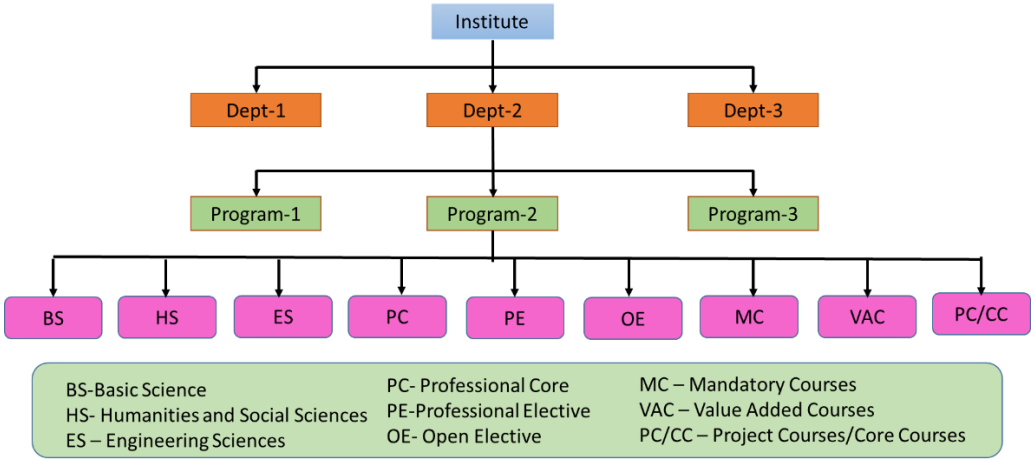
3. Outcome Based Education (OBE) Framework

The OBE Framework shown below presents a pictorial clarification of the hierarchical relationships among several different terminologies such as Vision, Mission, Program Educational Objectives, Program Outcomes, Course Outcomes etc. and also Assessment Plan.



Institute and Courses Relationship

An Institute may have several Departments such as Civil Engineering, Mechanical Engineering, Electrical & Electronics Engineering, Electronics& Communication Engineering, Computer Science Engineering, etc. Each Department may be conducting several Programs such as B.Tech in any Engineering, M.Tech in any Engineering, Diploma and Certificate programs. Each Program may have of several Courses such as shown in the flow diagram below. Each course has a syllabus with its contents.



4. Definitions

Vision and Mission

Vision

A vision statement is a mental big picture idea of what you want to accomplish or achieve. The vision statement should be concise and easy to remember. Because it is easy to remember, it is easy for everyone in the organization to focus on the vision. When people focus on the vision, their daily activities are automatically directed towards achieving the vision.

Mission

A statement of mission is a general statement of how you will achieve your vision

- There is a very close relationship between the vision and mission.
- The mission is an action statement that usually begins with the word "to". Once again it is a very simple and direct statement that is easy to understand and remember.
- Your mission statement should be simple. However, creating the statement is usually not easy. It may require several drafts. The statement needs to capture the very essence of what your business or organization will achieve and how you will achieve it.

Program Educational Objectives (PEOs)

Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Program Outcomes (POs)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

Course Outcomes (COs)

Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Assessment

Assessment is one or more processes, carried out by the institution, that identify, collect, andprepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.

Evaluation

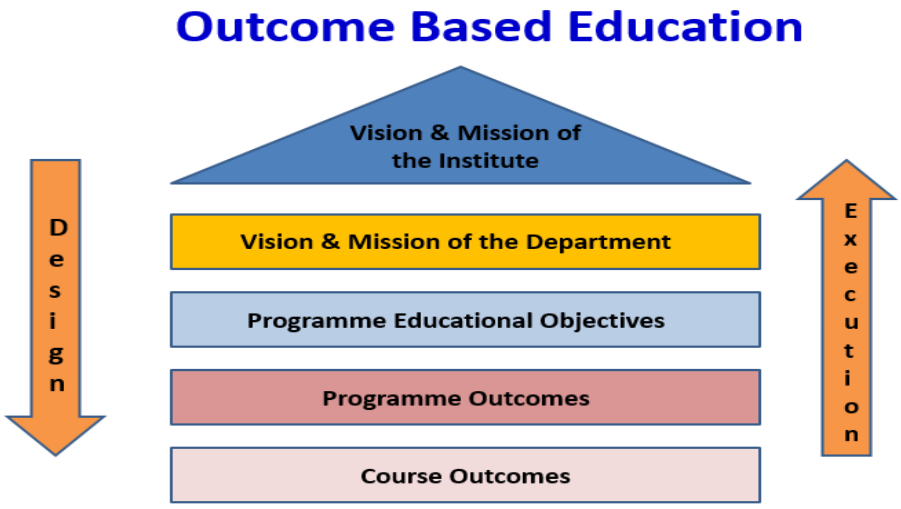
Evaluation is one or more processes, done by the evaluation team, for interpreting the dataand evidence accumulated through assessment practices. Evaluation determines the extent to whichProgram Educational Objectives or Program Outcomes are being achieved, and results in decisions andactions to improve the program.

Mapping

Mapping is the process of representing, preferably in matrix form, the correlation among the parameters. It may be done for one to many, many to one, and many to many parameters.

Rubrics

Rubrics provide a powerful tool for assessment and grading of student work. They can also serve as a transparent and inspiring guide to learning. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students your expectations in the assessment, and what you consider important.



5. Vision, Mission, PEOs, POs, PSOs and COs

Institute Vision

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Institute Mission

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Mission and Vision of the Department:

Vision of the Department

To become a pioneering centre in civil engineering and technology with attitude skills and knowledge.

Mission of the Department

- To produce well qualified and talented engineers by imparting quality education.
- To enhance the skills of entrepreneurship, innovativeness, management and life-long learning in young engineers.
- To inculcate professional ethics and make socially responsible engineers.

PEO/PO Mapping

Program Educational Objectives

PEOs are the expected achievements of graduates in their career. They are expected to perform and achieve during the first few years after graduation. Every programme is to prepare graduates to accomplish after 3 to 5 years of graduation. These must be realistic and attainable which addresses needs of the stakeholders.

B.Tech (Civil Engineering)

PEO1: Graduates of the program will be successful in technical and professional career of varied sectors of Civil Engineering.

PEO2: Graduates of the program will have proficiency to analyse and design real time Civil Engineering projects.

PEO3: Graduates of the program will exhibit management and leadership qualities with good communication skills facilitating to work in a multidisciplinary team.

PEO4: Graduates of the program will continue to engage in life-long learning with ethical and social responsibility.

Program Outcomes (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behavior that students acquire through the program. The POs essentially indicate what the students can do from subject-wise

knowledge acquired by them during the program. As such, POs define the professional profile of an engineering graduate. These should be in line with the Graduate Attributes(GA) as defined by the Washington Accord:

- **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- **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 health and safety, and the cultural, societal, and environmental considerations.
- **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 for complex problems:
    - That cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories and techniques;
    - That may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
    - That require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
    - Which need to be defined (modeled) within appropriate mathematical framework; and
    - That often requires use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter.
- **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.
- **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.
- **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.

- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **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.
- **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.
- **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required. These are the statements, which are specific to the particular program. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.

Program Outcomes B.Tech (Civil Engineering)

Graduates of the Civil Engineering programme will be able to

PO1: Apply knowledge of mathematics, science and fundamentals of Civil Engineering.

PO2: Analyse problems and interpret the data.

PO3: Design a system component, or process to meet desired needs in Civil Engineering within realistic constraints

PO4: Identify, formulate, analyse and interpret data to solve Civil Engineering problems.

PO5: Use modern engineering tools such as CAD and GIS for the Civil Engineering practice.

PO6: Understand the impact of engineering solutions in a global, economic and societal context.

PO7: Understand the effect of Civil Engineering solutions on environment and to demonstrate the need for sustainable development.

PO8: Understand the professional and ethical responsibility.

PO9: Work effectively as an individual or in a team and function with multi-disciplinary context.

PO10: Communicate effectively with engineering community and society.

PO11: Demonstrate the management principles in Civil Engineering projects.

PO12: Recognize the need for and an ability to engage in life-long learning.

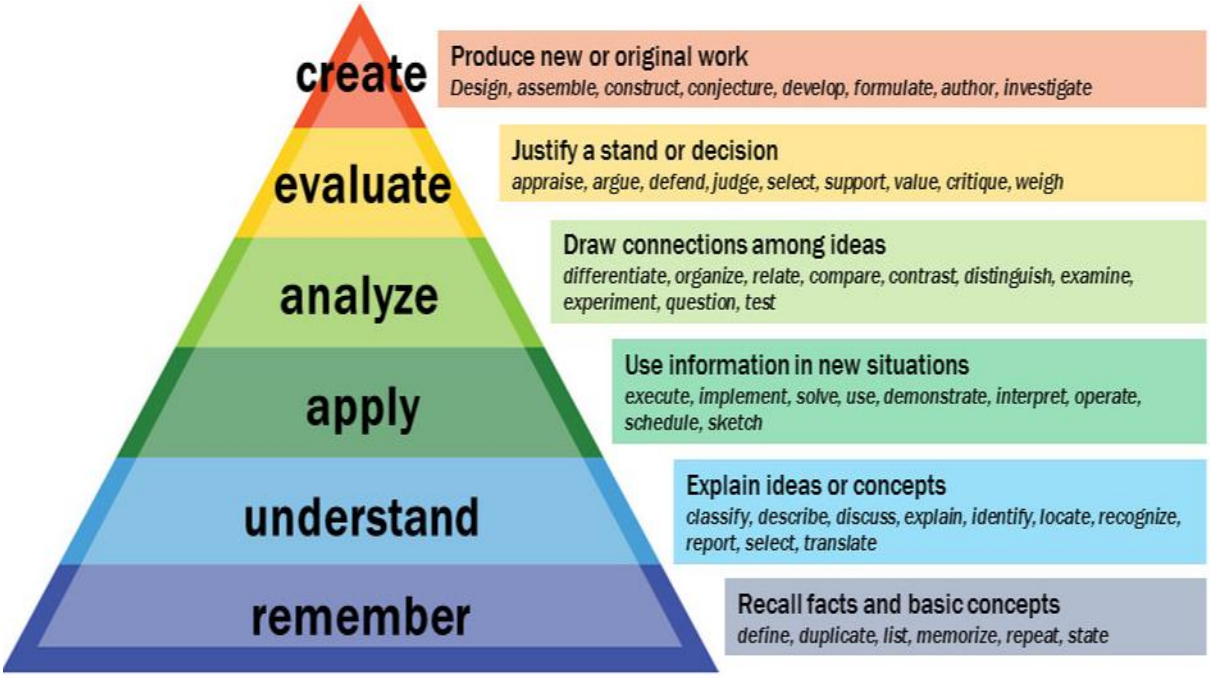
ROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Recognize the need for a sustainable environment and design smart infrastructure considering the global challenges.

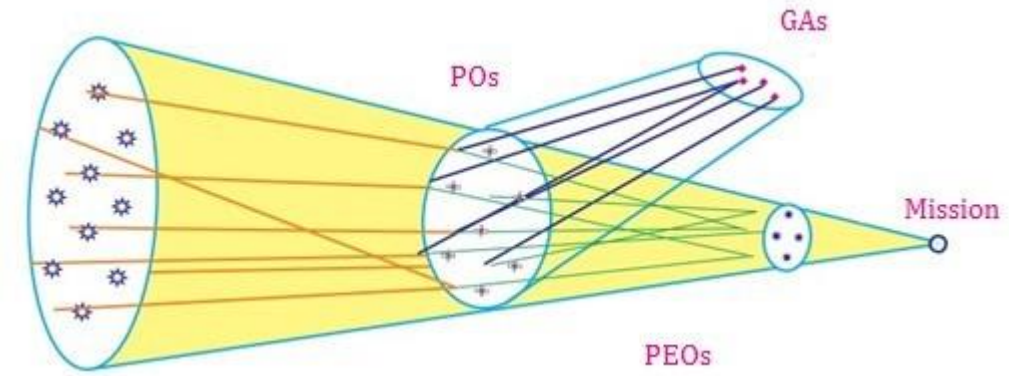
PSO2: Create and develop innovative designs with new era materials through research and development.

Course Outcomes (COs)

Course Outcomes describe what students are expected to know and be able to do at the time of completion of the course. These relate to the skills, knowledge, and behaviors/attitudes that the students / learners acquire as they progress through the course. These are specific and be measurable. For each course there would be 5 – 7 outcomes. These COs are written as per Blooms taxonomy



Relationship between PEOs, POs and COs



Program Educational Objectives (PEOs) are assessed a few years (3to5years)after Graduation.

Program Outcomes (POs) are assessed during and upon Graduation Course

Outcomes (COs) are assessed upon Course Completion.

6. Assessment Methods and Evaluation

Assessment

Assessment is one or more processes that identify, collect, use and prepare data to evaluate the attainment of student outcomes and program educational objectives. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods maybe used as part of an assessment process.

"Assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development."

Assessment Methods and Evaluation

Program Educational Objectives

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of students after they graduate from the program. Consequently, assessment and evaluation of the objectives requires assessment tools that can be applied after graduation. The PEO's assessment process and methods are tabulated.

S.No.	Method	Assessment Tool	Description
1	Direct	Oral & Written Exams	Objective, subjective, theory, practical, seminar and viva evaluation
2		Projects	Mini & Major project evaluation
3	Indirect	Student Exit Survey	Passing out students
4		Alumni Survey	Old batches of the students
5		Employer Survey	Industries which recruit our students
6		Industry Survey	Leading industry in the domain of programme

The continuous process of assignments, direct and indirect assessments and evaluation will lead to the revision and refinement of the PEOs.

Program Outcomes

The attainment of POs may be assessed by direct and indirect methods. Direct methods of assessment are essentially accomplished by the direct examination or observation of students' knowledge or skills against measurable performance indicators. On the other hand, indirect methods of assessment are based on ascertaining opinion or self-report. The results of assessment of each PO for two to three assessment years shall be indicated as they play a vital role in implementing the continuous improvement process of the program.

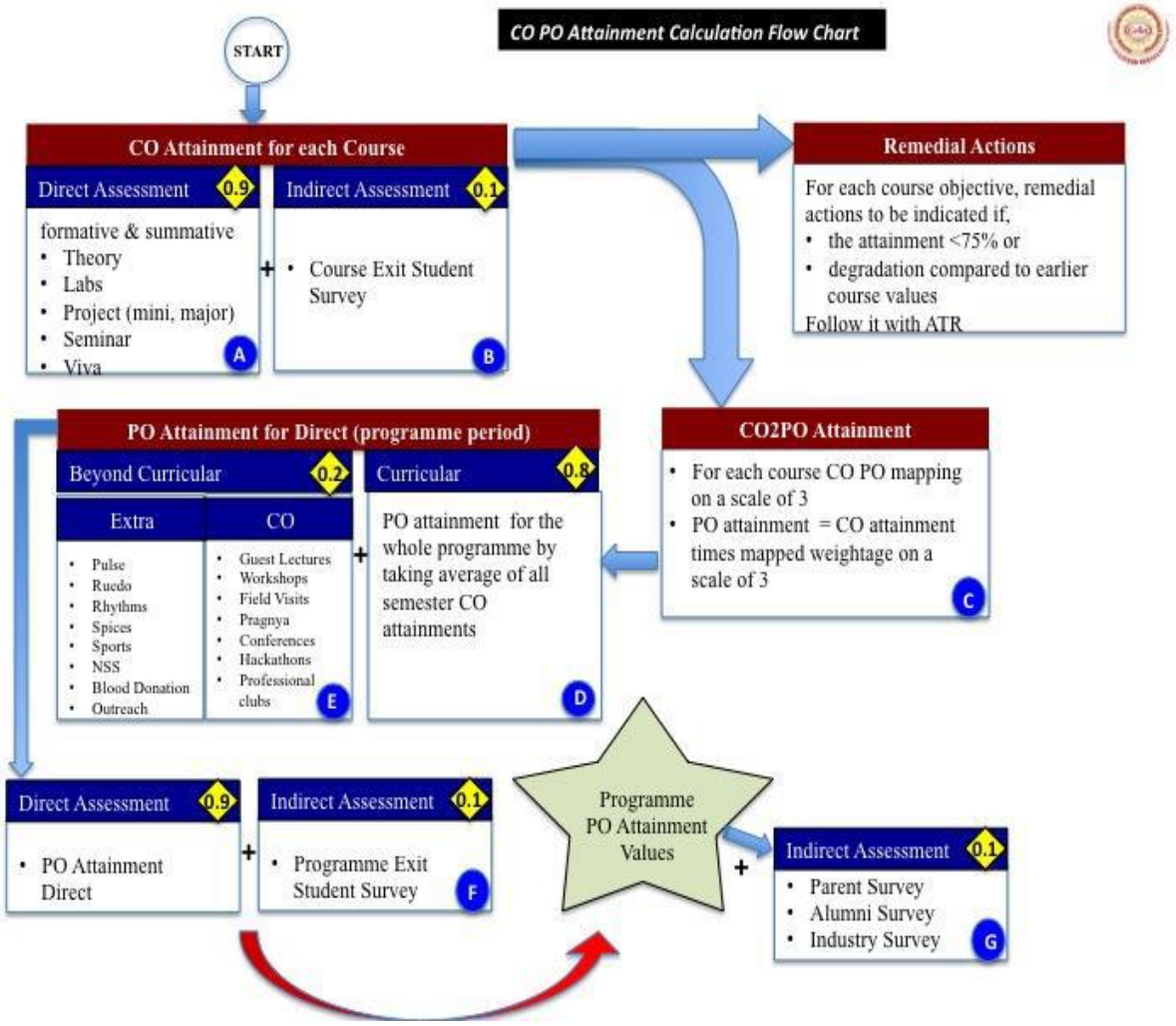
7. Mapping

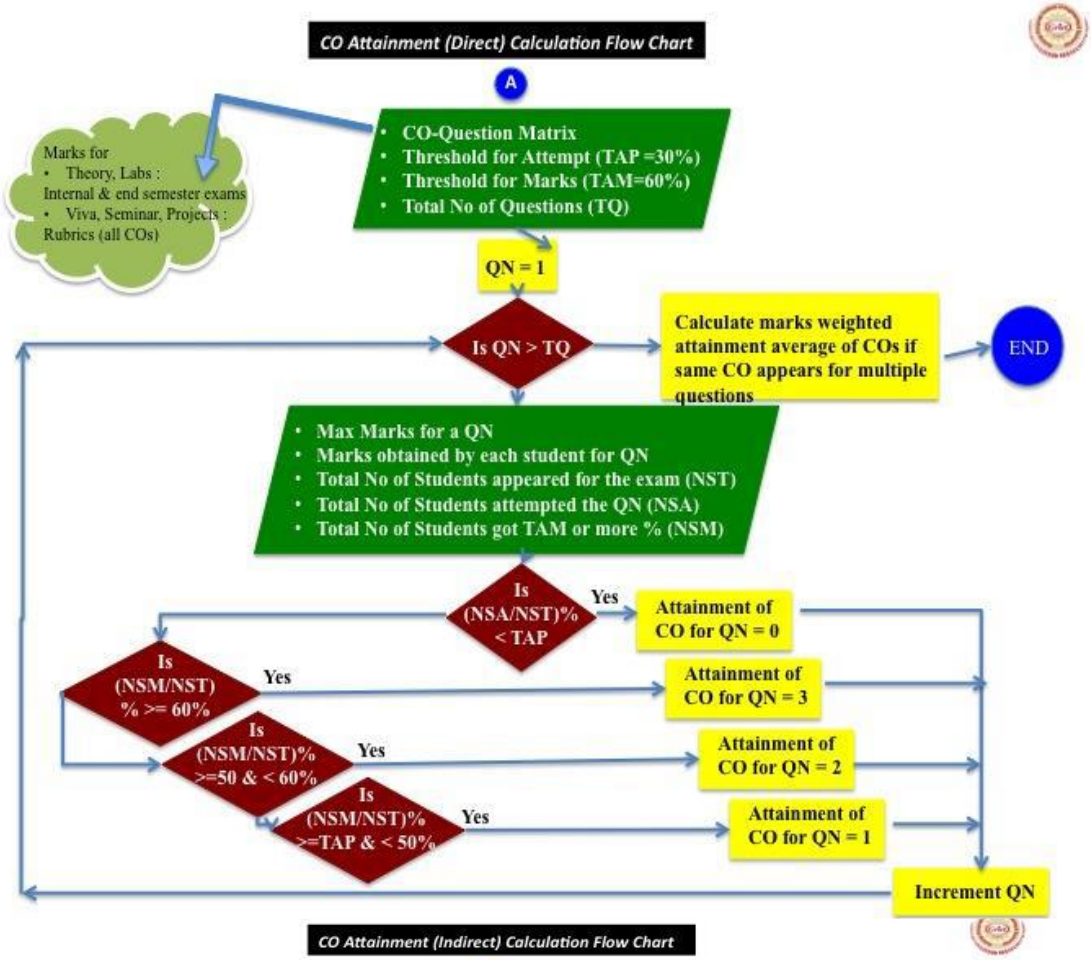
Program Articulation Matrix

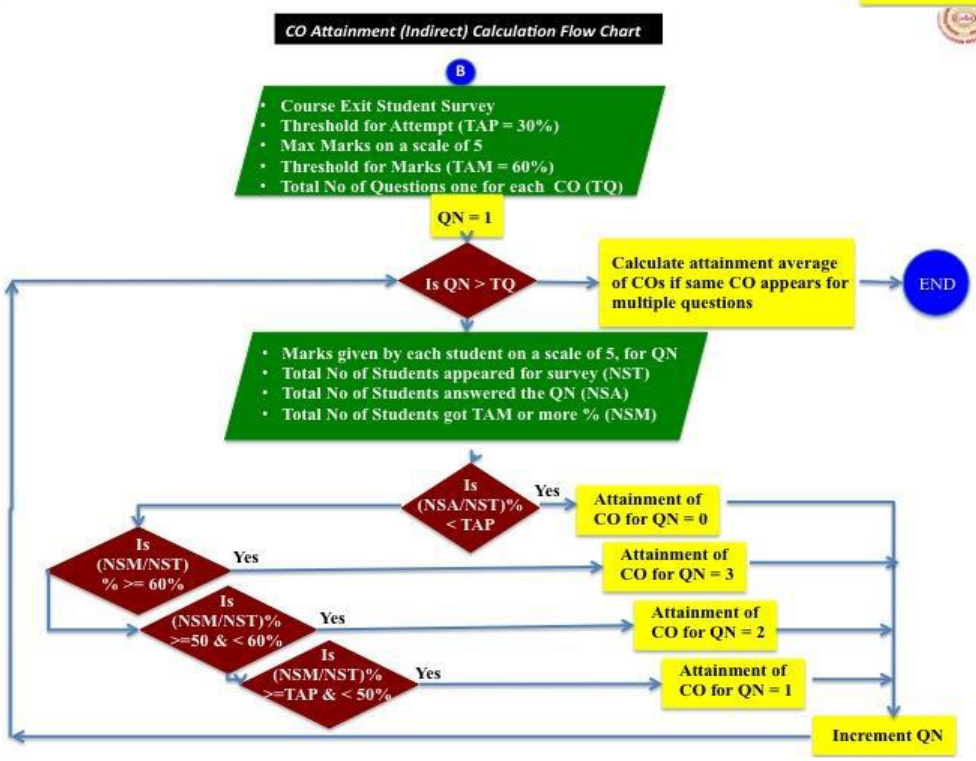
Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C101														
C202														
C303														
….														
….														
C4..														

Course Articulation Matrix

Course	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1															
CO2															
CO3															
CO4															
CO5															




CO Attainment (Direct) Calculation Flow Chart
A
Marks for
• Theory, Labs : Internal & end semester exams
• Viva, Seminar, Projects : Rubrics (all COs)
• CO-Question Matrix
• Threshold for Attempt (TAP =30%)
• Threshold for Marks (TAM=60%)
• Total No of Questions (TQ)
QN = 1
Is QN > TQ
Calculate marks weighted attainment average of COs if same CO appears for multiple questions
END
• Max Marks for a QN
• Marks obtained by each student for QN
• Total No of Students appeared for the exam (NST)
• Total No of Students attempted the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN


CO Attainment (Indirect) Calculation Flow Chart
B
• Course Exit Student Survey
• Threshold for Attempt (TAP = 30%)
• Max Marks on a scale of 5
• Threshold for Marks (TAM = 60%)
• Total No of Questions one for each CO (TQ)
QN = 1
Is QN > TQ
Calculate attainment average of COs if same CO appears for multiple questions
END
• Marks given by each student on a scale of 5, for QN
• Total No of Students appeared for survey (NST)
• Total No of Students answered the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN

8. Rubrics

Rubric is a tool that helps to make subjective measurements as objective, clear, and consistent as possible by defining the criteria on which performance should be judged.

A tool often shaped like a matrix, with criteria on one side and levels of achievement across the top used to score products or performances. Rubrics describe the characteristics of different levels of performance, often from exemplary to unacceptable. The criteria are ideally explicit, objective, and consistent with expectations for student performance.

Rubrics may be used by an individual or multiple raters to judge student work.

Rubrics are meaningful and useful when shared with students before their work is judged so they better understand the expectations for their performance.

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
1.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates To the topic.	Collects a great deal of Informatio n all relates to the topic.	2
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	2
		Share Equally	Always relies on others to do the work.	Rarely does the assigned work-- often need reminding.	Usually does the assigned work-- rarely needs reminding	Always does the assigned Work without having to be reminded	2
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking-- Rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		2.5

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
2.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates To the topic.	Collects a great deal of Information on all relates to the topic.	4
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	2
		Share Equally	Always relies on others to Do the work.	Rarely does the assigned work--often needs reminding.	Usually does the assigned work--rarely needs reminding	Always does the assigned Work without having to be reminded	4
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking--Rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		4

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
3.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates To the topic.	Collects a great deal of Informatio n all relates to the topic.	5
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	5
		Share Equally	Always relies	Rarely	Usually	Always	4
			on others to Do the work.	does the Assigned work-- often needs reminding.	does the assigned work-- rarely needs reminding	does the assigned Work without having to Be reminded	
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking-- Rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	5
					Average		4.5

9. Accreditation Criteria

The assessment and evaluation process of accreditation of an engineering program is based on 10 broad criteria developed through a participatory process involving experts from reputed national-level technical institutions, industries, R&D organizations and professional bodies. Each criterion relates to a major feature of institutional activity and its effectiveness. The criteria have been formulated in terms of parameters, including quantitative measurements that have been designed for maximal objective assessment of each feature. An engineering programme to be accredited or re- accredited has to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the programme and seek to improve the standards and quality continually, and address deficiencies if any aspect falls short of the standards set by the accreditation criteria. During the full term of accreditation, the institutions are required to submit their annual self-assessment report toNBA.

Program Level Criteria

Criteria-1: Vision, Mission and Program Educational Objectives

Criteria-2: Program Curriculum and Teaching – Learning Processes

Criteria-3: Course Outcomes and Program outcomes

Criteria-4: Students' Performance

Criteria-5: Faculty Information and Contributions

Criteria-6: Facilities and Technical Support

Criteria-7: Continuous Improvement

Institute Level Criteria

Criteria-8: First Year Academics

Criteria-9: Student Support Systems

Criteria-10: Governance, Institutional Support and Financial Resources

10. Program Structure

I B.Tech(CE) - I Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR20A1001	Linear Algebra and Differential Calculus	3	1	0	4	3	1	0	4	30	70	100
2	Physics	BS	GR20A1004	Engineering Physics	3	1	0	4	3	1	0	4	30	70	100
3	English	HS	GR20A1006	English	2	0	0	2	2	0	0	2	30	70	100
4	CSE	ES	GR20A1007	Programming for Problem Solving	2	1	0	3	2	1	0	3	30	70	100
5	Mechanical	ES	GR20A1010	Engineering Graphics	1	0	2	3	1	0	4	5	30	70	100
6	Physics	BS	GR20A1013	Engineering Physics Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
7	CSE	ES	GR20A1016	Programming for Problem Solving Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	English	HS	GR20A1015	English Language and Communication Skills Lab	0	0	1	1	0	0	2	2	30	70	100
		TOTAL			11	3	6	20	11	3	12	26	240	560	800
9	Humanities	BS	GR20A1020	Design Thinking	1	0	0	1	2	0	0	2	30	70	100

I B.Tech(CE) - II Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR20A1002	Differential equations and Vector Calculus	3	1	0	4	3	1	0	4	30	70	100
2	Chemistry	BS	GR20A1005	Engineering Chemistry	3	1	0	4	3	1	0	4	30	70	100
3	Mechanical	ES	GR20A1009	Engineering Mechanics	3	1	0	4	3	1	0	4	30	70	100
4	CSE	ES	GR20A1011	Data structures	2	1	0	3	2	1	0	3	30	70	100
5	Chemistry	BS	GR20A1014	Engineering Chemistry Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
6	CSE	ES	GR20A1018	Data Structures Lab	0	0	1	1	0	0	2	2	30	70	100
7	Mechanical	ES	GR20A1019	Engineering Workshop	1	0	1.5	2.5	1	0	3	4	30	70	100
		TOTAL			**12**	**4**	**4**	**20**	**12**	**4**	**09**	**25**	**210**	**490**	**700**
8	Humanities	BS	GR20A1021	Life skills and Personality development	1	**0**	0	1	**2**	**0**	0	2	30	70	100

II B.Tech (CE) - I Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR20A2009	Building Materials and Construction Planning	2	0	0	2	2	0	0	2	30	70	100
2	CE	PC	GR20A2010	Engineering Geology	2	0	0	2	2	0	0	2	30	70	100
3	CE	PC	GR20A2011	Solid Mechanics – I	2	1	0	3	2	1	0	3	30	70	100
4	Maths	BS	GR20A2008	Computational Mathematics for Engineers	3	0	0	3	3	0	0	3	30	70	100
5	CE	PC	GR20A2012	Introduction to Fluid Mechanics	3	0	0	3	3	0	0	3	30	70	100
6	CE	PC	GR20A2013	Surveying & Geomatics	3	0	0	3	3	0	0	3	30	70	100
7	CE	PC	GR20A2014	Engineering Geology lab	0	0	2	2	0	0	4	4	30	70	100
8	CE	PC	GR20A2015	Solid Mechanics Lab	0	0	2	2	0	0	4	4	30	70	100
TOTAL					**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**240**	**560**	**800**
9	BS	MC	GR20A2002	Value Ethics and Gender Culture	2	0	0	2	2	0	0	2	30	70	100
10	BS	MC	GR20A2001	Environmental Science	2	0	0	2	2	0	0	2	30	70	100

II B.Tech (CE) – II Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	**CE**	PC	GR20A2016	Solid Mechanics – II	2	1	0	3	2	1	0	3	30	70	100
2	**EEE**	ES	GR20A2017	Basic Electrical and Electronics Engineering	3	0	0	3	3	0	0	3	30	70	100
3	**CE**	PC	GR20A2018	Structural Analysis I	3	0	0	3	3	0	0	3	30	70	100
4	**Mgmt**	HS	GR20A2004	Economics & Accounting for Engineers	3	0	0	3	3	0	0	3	30	70	100
5	**CE**	PC	GR20A2019	Hydraulic Engineering	2	0	0	2	2	0	0	2	30	70	100
6	**CE**	PC	GR20A2020	Surveying Lab	0	0	2	2	0	0	4	4	30	70	100
7	**CE**	PC	GR20A2021	Computer Aided Design Lab	0	0	2	2	0	0	4	4	30	70	100
8	**CE**	PC	GR20A2022	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	2	0	0	4	4	30	70	100
		TOTAL			**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**240**	**560**	**800**

III B.Tech (CE) – I Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR20A3001	Geotechnical Engineering	2	0	0	2	2	0	0	2	30	70	100
2	CE	PC	GR20A3002	Concrete Technology	2	0	0	2	2	0	0	2	30	70	100
3	CE	PC	GR20A3003	Hydrology & Water Resources Engineering	3	0	0	3	3	0	0	3	30	70	100
4	CE	PC	GR20A3004	Design of Reinforced Concrete Structures	2	1	0	3	2	1	0	3	30	70	100
5	CE	PE		Professional Elective I	3	0	0	3	3	0	0	3	30	70	100
6	CE	OE		Open Elective I	3	0	0	3	3	0	0	3	30	70	100
7	CE	PC	GR20A3010	Geotechnical Engineering Lab	0	0	2	2	0	0	4	4	30	70	100
8	CE	PC	GR20A3011	Concrete Technology Lab	0	0	2	2	0	0	4	4	30	70	100
		TOTAL			**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**240**	**560**	**800**
9	Mgmt	MC	GR20A2003	Constitution of India	2	0	0	2	2	0	0	2	30	70	100

Professional Elective I			
S.No	**BOS**	**Course code**	**COURSE**
1	CE	GR20A3005	Structural Analysis - II
2	CE	GR20A3006	Traffic Engineering and Management
3	CE	GR20A3007	Groundwater
4	CE	GR20A3008	Irrigation Management

Open Elective I			
S.No	**BOS**	**Course code**	**COURSE**
1	CE	GR20A3009	Engineering Materials for Sustainability

III B.Tech (CE) – II Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR20A3081	Design of Steel Structures	2	1	0	3	2	1	0	3	30	70	100
2	CE	PC	GR20A3082	Foundation Engineering	3	0	0	3	3	0	0	3	30	70	100
3	CE	PC	GR20A3083	Environmental Engineering	2	0	0	2	2	0	0	2	30	70	100
4	CE	PE		Professional Elective II	3	0	0	3	3	0	0	3	30	70	100
5	CE	OE		Open Elective II	3	0	0	3	3	0	0	3	30	70	100
6	CE	PC	GR20A3089	Environmental Engineering Lab	0	0	2	2	0	0	4	4	30	70	100
7	CE	PC	GR20A3090	GIS Lab	0	0	2	2	0	0	4	4	30	70	100
8	CE	PW	GR20A3141	Mini Project with Seminar	0	0	2	2	0	0	4	4	30	70	100
		TOTAL			**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**240**	**560**	**800**
Summer Internship					-	-	-	-	-	-	-	-	-	-	-

Professional Elective II			
S.No	**BOS**	**Course Code**	**Course**
1	CE	GR20A3084	Masonry Structures
2	CE	GR20A3085	Rock Mechanics
3	CE	GR20A3086	Open Channel Flow

Open Elective II			
S.No	**BOS**	**Course Code**	**COURSE**
1	CE	GR20A3088	Geographic Information Systems and Science

IV B.Tech (CE) – I Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR20A4001	Estimation & Costing	2	1	0	3	2	1	0	3	30	70	100
2	CE	PC	GR20A4002	Transportation Engineering	3	0	0	3	3	0	0	3	30	70	100
3	CE	PE		Professional Elective III	3	0	0	3	3	0	0	3	30	70	100
4	CE	PE		Professional Elective IV	3	0	0	3	3	0	0	3	30	70	100
5	CE	OE		Open Elective III	3	0	0	3	3	0	0	3	30	70	100
6	CE	PC	GR20A4012	Transportation Engineering Lab	0	0	2	2	0	0	4	4	30	70	100
7	CE	PC	GR20A4013	Computer Applications in Structural Engineering Lab	0	0	2	2	0	0	4	4	30	70	100
8	CE	PW	GR20A4129	Project work (Phase I)	0	0	6	6	0	0	12	12	30	70	100
TOTAL					**14**	**1**	**10**	**25**	**14**	**1**	**20**	**35**	**240**	**560**	**800**

Professional Elective III			
S.No.	**BOS**	**Course Code**	**COURSE**
1	**CE**	GR20A4003	Bridge Engineering
2	**CE**	GR20A4004	Ground Improvement Techniques
3	**CE**	GR20A4005	Surface Hydrology
4	**CE**	GR20A4006	Tall Buildings

Open Elective III			
S.No.	**BOS**	**CourseCode**	**COURSE**
1	CE	GR20A4011	Environmental Impact Assessment and Life Cycle Analyses

Professional Elective IV			
S.No.	**BOS**	**CourseCode**	**COURSE**
1	CE	GR20A4007	Industrial Structures
2	CE	GR20A4008	Geometric Design of Highways
3	CE	GR20A4009	Physico-Chemical Processes for Water and Wastewater Treatment
4	CE	GR20A4010	Rehabilitation and Retrofitting of Structures

IV B.Tech (CE) – II Semester

S.No	BOS	Group	Course code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PE		Professional Elective V	3	0	0	3	3	0	0	3	30	70	100
2	CE	PE		Professional Elective VI	3	0	0	3	3	0	0	3	30	70	100
3	Mgmt	HS	GR20A4091	Entrepreneurship and Project management	2	1	0	3	2	1	0	3	30	70	100
4	CE	PW	GR20A4130	Project work (Phase II)	0	0	6	6	0	0	12	12	30	70	100
TOTAL					**8**	**1**	**6**	**15**	**8**	**1**	**12**	**21**	**120**	**280**	**400**

Professional Elective V

S.No.	BOS	Course Code	COURSE
1	CE	GR20A4083	Prestressed Concrete
2	CE	GR20A4084	Pavement Design
3	CE	GR20A4085	Design of Hydraulic Structures
4	CE	GR20A4086	Construction Project Planning and Systems

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Professional Elective VI

S.No.	BOS	Course Code	COURSE
1	CE	GR20A4087	Earthquake Engineering
2	CE	GR20A4088	Urban Transportation and Planning
3	CE	GR20A4089	Green Building Technology
4	CE	GR20A4090	Pavement Materials

PROFESSIONAL ELECTIVES - 4 THREADS

S.No.	Structural Engineering	Geotechnical and Transportation Engineering	Environmental and Hydrology Engineering	Construction Techology& Management
1	Structural Analysis II	Traffic Engineering and Management	Groundwater	Irrigation Management
2	Masonry Structures	Rock Mechanics	Open Channel flow	Construction Equipment & Automation
3	Bridge Engineering	Ground Improvement Techniques	Surface Hydrology	Tall Buildings
4	Industrial Structures	Geometric Design of Highways	Physico-Chemical Processes for Water and Wastewater Treatment	Rehabilitation and Retrofitting of Structures
5	Prestressed Concrete	Pavement Design	Design of hydraulic structures	Construction Project Planning & Systems
6	Earthquake Engineering	Urban Transportation and Planning	Green Building Technology	Pavement Materials

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication. 2. Human Resource Development and Organizational Behavior. 3. Cyber Law and Ethics 4. EconomicPolicies inIndia	1. Principles of E-Commerce 2. Business Analytics 3. Augmented Reality & Virtual Reality	CSE
	1. Internet of Things 2. Augmented Reality & Virtual Reality 3. Human Computer Interaction	CSE (AIML)
	1. Augmented Reality & Virtual Reality 2. Internet of Things 3. Human Computer Interaction	CSE (DS)
	1. Services Science and Service Operational Management 2. IT Project Management 3. Marketing Research and Marketing Management	CSBS
	1. Artificial Intelligence 2. Human Computer Interaction 3. Data Science	IT
	1. Non-Conventional Energy Sources 2. Machine Learning 3. Artificial Intelligence Techniques	EEE
	1. Artificial Neural Networks 2. Software Defined Radio and Cognitive Radio 3. Fundamentals of Mimo Wireless Communications	ECE
	1. Operations Research 2. Robotics 3. Mechatronic Systems	ME
	1. Engineering Materials for Sustainability 2. Geographic Information Systems and Science 3. Environmental Impact Assessment and Life Cycle Analyses	CE

11. PO Vs Courses

PO		Contributing Courses
1	GR20A1001	Linear Algebra and Differential Calculus
	GR20A1004	Engineering Physics
	GR20A1002	Differential equations and Vector Calculus
	GR20A1009	Engineering Mechanics
	GR20A2008	Computational Mathematics for Engineers
	GR20A2011	Solid Mechanics – I
	GR20A1013	Engineering Physics Lab
	GR20A2016	Solid Mechanics – II
	GR20A3004	Design of Reinforced Concrete Structures
	GR20A3081	Design of Steel Structures
	GR20A4002	Transportation Engineering
	GR20A4012	Transportation Engineering Lab
2	GR20A1010	Engineering Graphics
	GR20A1002	Differential equations and Vector Calculus
	GR20A1011	Data structures
	GR20A1018	Data Structures Lab
	GR20A2013	Surveying & Geomatics
	GR20A2019	Hydraulic Engineering
	GR20A2020	Surveying Lab
	GR20A3001	Geotechnical Engineering
	GR20A3003	Hydrology & Water Resources Engineering
	GR20A3010	Geotechnical Engineering Lab
	GR20A3141	Mini Project with Seminar
	GR20A3088	Geographic Information Systems and Science
	GR20A4008	Geometric Design of Highways
	GR20A4130	Project work (Phase II)
3	GR20A1019	Engineering Workshop
	GR20A2018	Structural Analysis I
	GR20A2019	Hydraulic Engineering
	GR20A3005	Structural Analysis - II
	GR20A3004	Design of Reinforced Concrete Structures

	GR20A3002	Concrete Technology
	GR20A3011	Concrete Technology Lab
	GR20A3081	Design of Steel Structures
	GR20A4084	Pavement Design
	GR20A4085	Design of Hydraulic Structures
	GR20A4003	Bridge Engineering
4	GR20A1007	Programming for Problem Solving
	GR20A2010	Engineering Geology
	GR20A2021	Computer Aided Design Lab
	GR20A3007	Groundwater
	GR20A3083	Environmental Engineering
	GR20A3089	Environmental Engineering Lab
	GR20A3141	Mini Project with Seminar
	GR20A4004	Ground Improvement Techniques
	GR20A4010	Rehabilitation and Retrofitting of Structures
	GR20A4083	Prestressed Concrete
	GR20A4087	Earthquake Engineering
5	GR20A1019	Engineering Workshop
	GR20A2020	Surveying Lab
	GR20A2021	Computer Aided Design Lab
	GR20A3088	Geographic Information Systems and Science
	GR20A3090	GIS Lab
6	GR20A1020	Design Thinking
	GR20A2004	Economics & Accounting for Engineers
	GR20A2003	Constitution of India
	GR20A3009	Engineering Materials for Sustainability
	GR20A4007	Industrial Structures
	GR20A4091	Entrepreneurship and Project management
7	GR20A2001	Environmental Science
	GR20A3003	Hydrology & Water Resources Engineering
	GR20A3007	Groundwater
	GR20A3008	Irrigation Management
	GR20A3009	Engineering Materials for Sustainability
	GR20A3083	Environmental Engineering
	GR20A3089	Environmental Engineering Lab
	GR20A4004	Ground Improvement Techniques

	GR20A4005	Surface Hydrology
	GR20A4011	Environmental Impact Assessment and Life Cycle Analyses
	GR20A4009	Physico-Chemical Processes for Water and Wastewater Treatment
	GR20A4010	Rehabilitation and Retrofitting of Structures
	GR20A4089	Green Building Technology
8	GR20A1021	Life skills and Personality development
	GR20A2002	Value Ethics and Gender Culture
	GR20A2003	Constitution of India
	GR20A3141	Mini Project with Seminar
	GR20A4129	Project work (Phase I)
	GR20A4130	Project work (Phase II)
9	GR20A1015	English Language and Communication Skills Lab
	GR20A1006	English
	GR20A1021	Life skills and Personality development
	GR20A2017	Basic Electrical and Electronics Engineering
	GR20A2003	Constitution of India
	GR20A3141	Mini Project with Seminar
10	GR20A1015	English Language and Communication Skills Lab
	GR20A1006	English
	GR20A1021	Life skills and Personality development
	GR20A3141	Mini Project with Seminar
11	GR20A2004	Economics & Accounting for Engineers
	GR20A4001	Estimation & Costing
	GR20A4091	Entrepreneurship and Project management
	GR20A4086	Construction Project Planning and Systems
12	GR20A1006	English
	GR20A1015	English Language and Communication Skills Lab
	GR20A1020	Design Thinking
	GR20A2021	Computer Aided Design Lab
	GR20A3090	GIS Lab

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Department of Civil Engineering

12. COURSE OUTCOMES

I B.Tech – I SEM

LINEAR ALGEBRA AND DIFFERENTIAL CALCULUS

CourseCode:GR20A1001 **L/T/P/C:3/1/0/4**

Course Outcomes

1. Compile the rank of a matrix to determine the existence of solutions of a linear algebraic system.
2. Determine the eigen values and eigenvectors of a square matrix which arise in several engineering applications
3. Determine approximate solution of over determined systems using the pseudo inverse.
4. Develop the skill of determining optimal values of multivariable functions using classical methods.
5. Apply the definite integral concept for various computational problems in geometry.

ENGINEERING PHYSICS

Course Code:GR20A1004 **L/T/P/C:3/1/0/4**

Course Outcomes: At the completion of this course, students will be able to:

1. Apply the principles of interference and diffraction of light in engineering applications.
2. Analyze the properties of Laser and its propagation in different types of optical fibers.
3. Classify materials based on the theory of Kronig Penny model.
4. Understand the nature and characterization of nano-materials and its applications.
5. Comprehend the concepts of Acoustics and Non-destructive testing in solving engineering problems.

ENGLISH

Course Code:GR20A1006 **L/T/P/C:2/0/0/2**

Course Outcomes:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully, respect others point of view.

PROGRAMMING FOR PROBLEM SOLVING

Course Code:GR20A1007 **L/T/P/C:2/1/0/3**

Course Outcomes:

1. To write algorithms and to draw flow charts and remember and reuse the fundamentals of C language.
2. To apply decision making statements and arrays to solve problems.
3. To illustrate the need for strings and functions in problem solving.
4. To implement pointers and structures in writing programs.
5. To illustrate working with files and pre-processor directives inc.

ENGINEERING GRAPHICS

Course Code: GR20A1010 **L/T/P/C:1/0/4/3**

Course Outcomes:

1. Familiarize with BIS standards and conventions used in engineering graphics.
2. Drawvariousengineeringcurvese.g.,ellipse,parabola,cycloidsandinvolutesetcand construct various reduced scales e.g., plain, diagonal and Vernier scales.
3. Differentiate between first angle and third angle methods of projection and distinguish parallel and perspective projection.
4. Visualize different views like elevation and plan for a given line, plane figures or solid objects.
5. Apply drafting techniques and use 2D software e.g., AutoCAD to sketch 2D plane figures.

ENGINEERING PHYSICS LAB

Course Code:GR20A1013 **L/T/P/C: 0/0/3/1.5**

Course Outcomes: At the completion of this course, students will be able to:

1. Evaluate the frequency of tuning for k, spring constant through coupled oscillation and analyze the resonance phenomena in LCR circuit.
2. Compare the rigidity modulus of wires of different materials using Torsional pendulum.
3. Interpret the properties of light like interference and diffraction through experimentation.
4. Asses the characteristics of Lasers and infer the losses in optical fibers.
5. Identify the type of semiconductor by measuring energy gap.

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR20A1007 **L/T/P/C: 0/0/3/1.5**

Course Outcomes:

1. Formulate the algorithms for simple problems and translate algorithms to a working and correct program.
2. Identify, analyse and correct syntax and logical errors encountered during coding.
3. Interpret and implement programs using branching and looping statements.
4. Represent and manipulate data with arrays, strings and structures and use pointers.
5. Create, read and write to and from simple text and binary files and modularize the code with functions so that they can be reused

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course Code:GR20A1015 **L/T/P/C:0/0/2/1**

Course Outcomes: Students will be able to

1. Interpret the role and importance of various forms of communication skills.
2. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professional responsibilities.
5. Evaluate and use a neutral and correct form of English.

DESIGN THINKING

CourseCode:GR20A1020 **L/T/P/C:2/0/0/1**

Course Outcomes

1. Students will be able to identify an Opportunity from a Problem
2. Students will be able to frame a Product/Service Idea
3. Students will be able to empathize with the customers
4. Students will be able to design and develop a Prototype
5. Students will be able to pitch their idea

IFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code:GR20A1002 **L/T/P/C:3/1/0/4**

Course Outcomes: After learning the contents of this paper the student must be able to

1. Classify the differential equations of first order and solve them analytically by suggested methods
2. Solve linear differential equations of higher order under various forcing functions
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics
4. Apply vector differential operators on scalar and vector fields and apply them to solve some field related problems
5. Applyclassicalvectorintegraltheoremsforfastevaluationofworkdonearoundclosedcurvesand flux across closed surfaces

ENGINEERING CHEMISTRY

Course Code:GR20A1005 **L/T/P/C:3/1/0/4**

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces.
2. Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.
3. Recognize various problems related to electro chemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in engineering.
4. Know the origin of different types of engineering materials used in modern technology and Interpret different problems involved in industrial utilization of water.
5. Understand the processing of fossil fuels for the effective utilization of chemical energy.

ENGINEERING MECHANICS

Course Code: GR20A1009 **L/T/P/C:3/1/0/4**

Course Outcomes: At the end of the course students will be able to

1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Determine the forces in the members of the trusses
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion of rigid bodies.

DATA STRUCTURES

Course Code:GR20A1011 **L/T/P/C:2/1/0/3**

Course Outcomes: After completion of the course, the student will be able to

1. Analyze basic concepts of data structures, computation complexity and implement various searching and sorting techniques.
2. Apply various operations on linear data structures Stack and Queue and their applications.
3. Develop algorithms for operations on linked lists and convert them to programs.
4. Apply various operations on non-linear data structure tree.
5. Implement various graph traversals techniques and idea of hashing.

ENGINEERING CHEMISTRY LAB

Course Code: GR20A1014 **L/T/P/C: 0/0/3/1.5**

Course Outcomes:

1. Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
2. Determinationofparameterslikehardnessandchloridecontentinwater,measurementofredox potentials and conductance.
3. Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.
4. Synthesizeadrugmoleculeasanexampleoforganicsynthesismethodswidelyusedinindustry.
5. Determination of physical properties like adsorption and viscosity.

DATA STRUCTURES LAB

Course Code:GR20A1018 **L/T/P/C: 0/0/2/1**

Course Outcomes:

1. Formulate the algorithms for sorting problems and translate algorithms to a working and correct program.
2. Implement stack and queue data structures and their applications.
3. Interpret linked list concept to produce executable codes.
4. Develop working procedure on trees using structures, pointers and recursion.
5. Implements graph traversal techniques
6.

ENGINEERING WORKSHOP

Course Code:GR20A1019 **L/T/P/C: 1/0/3/2.5**

Course Outcomes: At the end of the course students will be able to

1. Develop various trades applicable to industries / Manufacturing practices.
2. Create Hands on experience for common trades.
3. Improve to fabricate components with their own hands.

4. Developpracticalknowledgeonthedimensionalaccuraciesanddimensionaltolerancesposs iblewith various manufacturing processes.
5. To build the requirement of quality of work life on safety and organizational needs.

LIFE SKILLS AND PERSONALITY DEVELOPMENT (LSPD)

Course Code:GR20A1021 **L/T/P/C:2/0/0/1**

Course Outcomes: At the end of the course, student should be able to

1. Apply the concept of Time Management to his own day to day life. They will also learn to cope with Information Overload, which has become a serious problem for the digital generation. They will be in a position to with stand harmful peer pressure, and steer themselves towards attaining their own objectives in the four years time they spend in the college.
2. Apart from understanding the importance of English language skills in a globalized world, they will leant the methodologies as to how they can master English Language skills. They will become familiar with the communication skills and etiquette, body language, non-verbal communication and they will start applying these concepts in their day to day life. This will help them to become thorough professionals in their career.
3. Largenumberofstudentsareignorantabouttheneedforpersonalhealthmanagementandtheneed to stay away from addictions. After this course, they will get a complete understanding of the biological basis behind these concepts. This will help them to maintain a robust health trough out their life and it will also keep them away from addictions like drug addiction, alcohol addiction & video games addiction. They will learn the techniques of stress management as well.
4. They would start cultivating some good hobbies which will help them to maintain ideal work-life balance throughout their life. The students would start discarding bad habits & will start picking up good habits. Further, they will learn the techniques of holding difficult conversations and negotiations, which is an important skill set in the 21st century world.
5. They will develop the aptitude for finding creative solutions to problems and they will come to realize the importance of continuous and lifelong learning in a fast changing technological landscape. They will appreciate why collaboration and team working skills are important for success in a modern world.

II YEAR I SEMESTER

BUILDING MATERIALS AND CONSTRUCTION PLANNING

Course Code: GR20A2009 **L/T/P/C:2/0/0/2**

Course Outcomes: At the end of the course, the student will be able to

1. Distinguish between various types of building stones, bricks and tiles and their structural requirements.
2. Recognize the need and process of manufacture of cement and lime.
3. Identify function of various materials like wood, glass, paints and building components.
4. Find the importance of masonry, finishing and form woks.
5. Assess various building services and principles of building planning

ENGINEERING GEOLOGY

Course Code: GR20A2010 **L/T/P/C:2/0/0/2**

Course outcomes: At the end of the course, the student will be able to

1. Identify the weathering effects and various deposits.
2. Recognize the minerals and its importance from civil engineering point of view.
3. Distinguish features of igneous, sedimentary and metamorphic rocks.
4. Recognizevariousgeologicalstructuresandthefailuresofdams,reservoirsandtunnels due to geological reasons
5. Relate water table and the failures of earthquake and landslides

SOLID MECHANICS - I

Course Code: GR20A2011 **L/T/P/C:2/1/0/3**

Prerequisite: Mathematics, Engineering Mechanics.

Course outcomes: At the end of course, the student will be able to

1. Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types of loading.
2. Analyze the principal stresses and strains in different planes by using analytical and graphical methods
3. Determine the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams with different loading.
4. Formulate the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members.
5. Evaluate the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

Course code: GR20A2008 **L/T/P/C:3/0/0/3**

Course outcomes: At the end of the course, the student will be able to

1. Apply well known techniques to find real roots of an equation and linear algebraic systems by iterative methods.
2. Utilize interpolation techniques for univariate and bivariate data using Gaussian and cubic spline methods.
3. Apply numerical techniques to find eigen values and corresponding eigenvectors of a matrix.
4. Make use of numerical techniques in differentiation and integration.
5. Model finite differences method to solve IVP in ODE and PDE.

INTRODUCTION TO FLUID MECHANICS

Course Code: GR20A2012 **L/T/P/C:3/0/0/3**

Pre Requisite: Mathematics, Physics.

Course Outcomes: At the end of course, the student will be able to

1. Comprehend the various fluid properties and fluid statics.
2. Understand the broad principles of hydrostatic forces on submerged planes
3. Analyzing fluid dynamics and kinematics.
4. classify concept of boundary layer and predict the laminar and turbulent flows
5. Predict the losses in pipes flows and able to calculate discharge measurement.

SURVEYING AND GEOMATICS

Course Code: GR20A2013 **L/T/P/C:3/0/0/3**

Course Outcomes: At the end of the course, the student will be able to

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to Engineering and surveying activities.
2. Tobeabletocalculate,designandlayoutofhorizontalandverticalcurves,Understand, interpret, and prepare plan, profile, and cross-section drawings.
3. Understand the advantages of electronic surveying over conventional surveying methods.
4. Acquireknowledgeaboutphotogrammetryprinciples,methodsand.productgenerat on strategies in both Analytical and digital Photo grammetry system.
5. Acquire knowledge about the principles and physics of Remote sensing and data acquisition and getting familiarized with various data analysis techniques

ENGINEERING GEOLOGY LAB

Course Code: GR20A2014 **L/T/P/C:0/0/2/2**

Course Outcomes: At the end of the course, the student will be able to

1. Identify various minerals and their properties.
2. Identify various rocks and their properties.
3. Understand various rocks and minerals used in the industries.

4. Prepare and interpret various sections of geological maps showing structures like faults, folds and Unconformities etc.
5. Resolve simple structural Geology problems.

SOLID MECHANICS LAB

Course Code: GR20A2015 **L/T/P/C:0/0/2/2**

Prerequisites: Engineering Mechanics, Mathematics and Physics.

Course Outcomes: At the end of course, the student will be able to

1. Determine the important mechanical properties of materials.
2. Identify the stiffness of an elastic isotropic material.
3. Evaluate the Reciprocal theorem.
4. Measure any substance's resistance to uniform compression.
5. Resistance of various materials against abrasion and impact.

VALUE ETHICS AND GENDER CULTURE

Course Code: GR20A2002 **L/T/P/C:2/0/0/2**

Course Outcomes

1. To enable the student to understand the core values that shapes the ethical behaviour and Student will be able to realize the significance of ethical human conduct and self-development
2. Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.
3. The students will learn the rights and responsibilities as an employee and a team member.
4. Students will attain a finger grasp of how gender discrimination works in our society and how to counter it.
5. Students will develop a better understanding on issues related to gender and Empowering students to understand and respond to gender violence.

ENVIRONMENTAL SCIENCE

Course Code: GR20A2001 **L/T/P/C:2/0/0/2**

Course Outcomes: Based on this course, the Engineering graduate will

1. Understand the harmonious co-existence in between nature and human being
2. Recognize various problems related to environment degradation.
3. Develop relevant research questions for environmental investigation.
4. Generate ideas and solutions to solve environmental problems due to soil, air and water pollution.
5. Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.

II YEAR II SEMESTER

SOLID MECHANICS- II

Course Code: GR20A2016 **L/T/P/C:2/1/0/3**

Prerequisites: Mathematics, Physics, Engineering Mechanics and Solid Mechanics I

Course Outcomes: At the end of course, the student will be able to

1. Compute various stresses in thin and thick cylinders under pressure, show stress distribution diagrams and define Lame's theorems.
2. Analysethetorsionalstrengthofstructuralmembersanddifferentiatebetweenclosedand open coiled helical springs.
3. Determine the buckling failure load for axially loaded and eccentrically loaded columns.
4. Evaluate stresses in chimneys, retaining walls and dams and to check the stability of dams.
5. Evaluate the behaviour of members under unsymmetrical bending and locate shear centre's for the section and find stresses in circular and semi-circular beams.

BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: GR20A2017 **L/T/P/C:3/0/0/3**

Course outcomes: At the end of the course, the student will be able to

1. Know the application of ohms law & Kirchhoff's laws.
2. Know about fundamental principles of electrical machines.
3. Measure the fundamental electrical quantities using oscilloscope.
4. Illustrate the basic principles of semi conducting devices.
5. Analyse the different applications of a transistor.

STRUCTURAL ANALYSIS I

Course Code: GR20A2018 **L/T/P/C:3/0/0/3**

Prerequisites: Engineering Mechanics, Solid mechanics.

Course Outcomes: At the end of course, the student will be able to

1. Determine deflections of beams and trusses using energy methods.
2. Analyse three and two hinged of circular and parabolic arches.
3. Analyse indeterminate beams using force method for propped cantilever, fixedand Continuous beams (Clapeyorns's three momenttheorem).
4. Apply Slope deflection, Moment distribution and Kani's methods to analyse statically In-determinate structures.
5. Analyse statically determinate structures using rolling load and influence line methods.

ECONOMICS AND ACCOUNTING FOR ENGINEERS

Course Code: GR20A2004 **L/T/P/C:3/0/0/3**

Course Outcomes: After studying this course, students will be in a position to:

1. The student will be able to understand the concepts of economics and Demand concepts, elasticity and techniques for forecast demand of products
2. The student will be able to plan the production levels in tune with maximum utilization of organizational resources and with maximum profitability.
3. To understand the types of markets, types of competition and to estimate the cost of products and decide the price of the products and services produced
4. The student will be able to analyze the profitability of various projects using capital budgeting techniques and
5. The student is able will be able prepare the financial statements and more emphasis on preparation of final accounts.

HYDRAULIC ENGINEERING

Course Code: GR20A2019 **L/T/P/C:2/0/0/2**

Prerequisite: Fluid Mechanics

Course Outcomes: At the end of the course, the student will be able to

1. Describe and predict the various economical channel sections
2. Apply dynamic equation in the uniform flows.
3. Analysing modal and proto type similarities.
4. Visualize behaviour the hydraulic jump, surface profiles of channel flows.
5. Evaluate the efficiency of the pumps and hydropower.

SURVEYING LAB

Course Code: GR20A2020 **L/T/P/C:0/0/2/2**

Prerequisite: Surveying

Course Outcomes: At the end of the course, the student will be able to,

1. Define the characteristics and applications of basic survey instruments.
2. Apply knowledge of mathematics, science and engineering in land measurement Techniques.
3. Calculate distances, inclinations, elevations, areas and volumes.
4. Generate maps of earth surfaces.
5. Analyzing the data and transfer relevant points onto ground.

COMPUTER AIDED DESIGN LAB

Course Code: GR20A2021 **L/T/P/C:0/0/2/2**

Prerequisite: Engineering Graphics

Course Outcomes: At the end of the course, the student will be able to:

1. Comprehend the fundamentals of building drawings and understand CAD software for drafting.
2. Draw Material, Sanitary, Electrical Symbols and various brick bonds by using drawing commands in CAD.
3. Develop Geometric Plan, Sections and Elevations for single and multi-storeyed building with suitable scale and dimensions.
4. Draft the building components and sectional view of doors, windows and trusses.
5. Create the drawings of various trusses like King post truss, Queen post truss and North light truss.

FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY

Course Code: GR20A2022 **L/T/P/C:0/0/2/2**

Prerequisite: Fluid Mechanics and Hydraulic Engineering

Course Outcomes: on completion of this Subject/Course the student shall be able to

1. Predict the discharge through venture meter and orifice meter.
2. Estimate the energy head compute the laminar flow, length of flow.
3. Predict the velocity distribution in pipe flows
4. Compute the major and minor losses in pipe flow
5. Evaluate the efficiency of Hydraulic machines

III YEAR I SEMESTER

GEOTECHNICAL ENGINEERING

Course Code:GR20A3001 **L/T/P/C:2/0/0/2**

Prerequisites: Engineering Geology

Course Outcomes:

1. Identify basic Engineering properties of soil and classify the soil.
2. Evaluate coefficient of permeability and effective stresses of soil.
3. Assess the mechanism of stress distribution and compaction in soils.
4. Analyse the behaviour of soil during consolidation process.
5. Evaluate the performance of shear strength of soil mass.

CONCRETE TECHNOLOGY

Course Code:GR20A3002 **L/T/P/C:2/0/0/2**

Prerequisites: Building Materials and Construction Planning

Course Outcomes:

1. Explain the physical and chemical properties of concrete ingredients and able to conducttests on cement and aggregates.
2. Illustrate workability of fresh concrete and also explain the properties of fresh and hardened concrete
3. Demonstrate different tests such as compression and tension on hardened concrete andalso summarize the quality control of concrete under different conditions.
4. Estimate the creep and shrinkage of concrete and also distinguish the special concretes
5. Design the mix proportions for the specific work for required strength and workabilitywith available materials at workplace.

HYDROLOGY AND WATER RESOURCES ENGINEERING

Course Code:GR20A3003 **L/T/P/C:3/0/0/3**

Pre-Requisites: Introduction to Fluid Mechanics

Course Outcomes:

1. Measure, estimate and process rainfall data, runoff data, evaporation data, Evapo-transpiration data and infiltration data.
2. Design a model in a region for direct run off hydrograph, unit hydrograph, S-Curve hydrograph and Synthetic unit hydrograph.
3. Calculate the discharge of radial flow to wells in a region of confined and unconfined aquifers by determining the aquifer parameters by field tests and pumping tests.
4. Design a suitable irrigation method depending on soil, water and plant conditions onthe field & Prepare irrigation schedules and irrigation efficiencies for farmers on the field
5. Design irrigation canals and estimate discharge by SCS Curve Number Method, analyzethe regional flood frequency, discuss the methods of stream gauging and evaluate the forces acting on gravity dam.

DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code:GR20A3004 **L/T/P/C: 2/1/0/3**

Prerequisite: Solid Mechanics, Structural Analysis, Building Materials and Construction Planning and Engineering Graphics.

Course Outcomes:

1. Classify Working Stress and Limit State method in design of reinforced concrete structures.
2. Analyze and design of beams.
3. Design of slabs, staircase and canopy.
4. Design of columns.
5. Design of footings, beams and slabs for limit state of serviceability.

STRUCTURAL ANALYSIS-II
(PROFESSIONAL ELECTIVE-I

Course Code:GR20A3005 **L/T/P/C: 3/0/0/3**

Pre-requisites: Solid Mechanics, Structural Analysis -I

Course Outcomes:

1. Analyze various types of frames with and without sway using Slope deflection and Moment distribution methods
2. Analyze various types of frames using Kani's methods of Analysis
3. Evaluate the shear forces, bending moments and axial forces in beams, columns and at joints of multi-storey frames using approximate methods of analysis
4. Analyze the simple beams and frames using stiffness matrix and flexibility matrix methods of analysis.
5. Apply the principles of virtual work to estimate the collapse load and plastic moment carrying capacity of simple beams and frames.

TRAFFIC ENGINEERING AND MANAGEMENT

(PROFESSIONAL ELECTIVE-I)

Course Code:GR20A3006 **L/T/P/C: 3/0/0/3**

Prerequisite: Surveying and Geomatics

Course Outcomes:

1. Analyze traffic problems and plan for traffic systems various uses
2. Explain traffic surveys and plan parking arrangements
3. Analyze traffic studies and implement traffic regulation and control measures and intersection design
4. Organize the basic traffic signal phasing and timing plan
5. Develop Traffic management Systems

GROUNDWATER

(PROFESSIONAL ELECTIVE-I)

Course Code:GR20A3007 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Introduction to Fluid Mechanics

Course outcomes:

1. Estimate the porosity and specific yield of aquifers
2. Apply ground water flow equation
3. Compute Dupuit's and Theim's equations
4. Apply the Surface methods and subsurface method of exploration.
5. Construct the Artificial recharge pits.

IRRIGATION MANAGEMENT

(PROFESSIONAL ELECTIVE-I)

Course Code:GR20A3008 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Hydrology and Water Resources Engineering

Course Outcomes:

1. Inculcate knowledge of soil physical & chemical properties with respect to soil water
2. plant relationship.
3. Acquire the knowledge to estimate water requirement for various principal crops
4. Apply the various methods to design and development of irrigation structures
5. Design the conveyance of water through field channels through underground pipe lines.
6. Analyze irrigated areas and design drainage systems

ENGINEERING MATERIALS FOR SUSTAINABILITY

(OPEN ELECTIVE-I)

Course Code:GR20A3009 **L/T/P/C: 3/0/0/3**

Pre-requisites: Building materials and construction planning

Course Outcomes:

1. Describe the different types of environmental factors effecting materials
2. Analyze the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify and compare Building Planning Specifications.

GEOTECHNICAL ENGINEERING LAB

Course Code: GR20A3010 **L/T/P/C: 0/0/4/2**

Pre-Requisites: Geotechnical Engineering.

Course Outcomes:

1. Analyse soil behaviour and its mechanism.
2. Analyse basic properties of soil in simple and complex applications.
3. Develop a proficiency in handling experimental data.
4. Compute the results of a laboratory experiment.
5. Recommend extensive research in geotechnical properties.

CONCRETE TECHNOLOGY LAB

Course Code: GR20A3011 **L/T/P/C: 0/0/4/2**

Pre-Requisites: Concrete Technology

Course Outcomes:

1. Identify the suitable materials used for concrete for particular purpose
2. Gauge the quality control of Cement and concrete
3. Identify, describe and carry out the main laboratory tests relevant to the use of concrete on site
4. Design normal concrete mixes.
5. Interpret the properties in tern to design or invent the new materials

CONSTITUTION OF INDIA

Course Code:GR20A2003 **L/T/P/C: 2/0/0/2**

Course Outcomes:

1. Know the importance of Constitution and Government.
2. Become Good Citizens and know their fundamental rights, duties and principles.
3. Learn about the role of PM, President, Council of Ministers and Local Administration.
4. Understand the importance of Election Commission.
5. Know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

III YEAR II SEMESTER

DESIGN OF STEEL STRUCTURES

Course Code: GR20A3081 **L/T/P/C: 2/1/0/3**

Pre-Requisites: Solid Mechanics, Structural Analysis II and Engineering Graphics.

Course Outcomes:

1. Identify various types of structural steel and its properties. Also able to define concepts of LSD.
2. Classify and design various types of connections.
3. Design of tension and compression members for the given loads and moments.
4. Design the beams and purlins.
5. Design of eccentric and moment connections.

FOUNDATION ENGINEERING

Course Code: GR20A3082 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Geotechnical Engineering

Course Outcomes:

1. Identify various soil exploration methods and interpret the results.
2. Assess the stability of slopes.
3. Compute earth pressures and stability of retaining walls.
4. Apply bearing capacity equations for shallow foundations and analyze settlement.
5. Estimate pile and pile group capacity and recognize the shapes and components of well foundations.

ENVIRONMENTAL ENGINEERING

Course Code: GR20A3083 **L/T/P/C: 2/0/0/2**

Pre-Requisites: Engineering Chemistry, Environmental Science.

Course Outcomes:

1. Analyze characteristics of water and wastewater.
2. Assess water demand and design components of water distribution systems.
3. Design conveyance elements of wastewater collection systems.
4. Assess sources of water and wastewater.
5. Plan and design water treatment units and wastewater treatment systems.

MASONRY STRUCTURES

(PROFESSIONAL ELECTIVE-II)

Course Code: GR20A3084 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Structural Analysis II, Design of Reinforced Concrete Structures.

Course Outcomes:

1. Identify the types of masonry units and Strength and stability of concentrically loaded masonry walls and factors affecting them.
2. Analyze the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements.
3. Identify the concept of effective height of walls and columns, effective length, effective thickness of wall and factors affecting them.
4. Analyze how to design load bearing masonry walls for buildings up to three stories using IS:1905 andSP-20.
5. Explain the concept of reinforced masonry and its applications, and how to bring flexural and compression elements (beams and columns) of reinforced masonry shear walls.

ROCK MECHANICS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR20A3085 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Engineering Geology

Course Outcomes:

1. Identify the objectives of geotechnical data collection and rock mass classification methods, and successfully collect and analyze a range of geotechnical datasets for design purposes.
2. Annotate on impact of geological features on civil engineering projects
3. Analyze the problems associated with different geological features on civil engineering structures and suggest alternatives.
4. Demonstrate various methods to improving the properties of rock masses.
5. Describe the theory and analysis of in situ and induced stresses in a rock mass and structurally controlled failure.

OPEN CHANNEL FLOW
(PROFESSIONAL ELECTIVE-II)

Course Code: GR20A3086 **L/T/P/C: 3/0/0/3**

Pre-requisites: Hydraulics and Water Resource Engineering

Course outcomes:

1. Explain properties and the type of channel flows
2. Design the different shapes channel section
3. Compute the energy loss due to hydraulic jump
4. Apply the dynamic equations and different method for energy loss in the Gradually Varied Flow
5. Apply the dynamic equation in Rapidly Varied Flow.

CONSTRUCTION EQUIPMENT AND AUTOMATION(PROFESSIONAL ELECTIVE-II)

Course Code: GR20A3087 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Building Material and Construction Planning

Course Outcomes:

1. Identify how structures are built and projects are developed in the field.
2. Explain modern construction practices.
3. Outline the process and importance of cost estimation, cost budgeting and cost control.
4. Demonstrate the handling of various kinds of Construction Equipment involved in the Construction industry.
5. Analyze construction projects cost based on Equipment Operational and Maintenance costs

GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE-II)

Course Code: GR20A3088 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Surveying and Geomatics

Course Outcomes:

1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. List out the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real life problems associated with geospatial and remote sensing.

ENVIRONMENTAL ENGINEERING LAB

Course Code: GR20A3089 **L/T/P/C: 0/0/4/2**

Pre-Requisites: Engineering Chemistry

Course Outcomes:

1. Describe the knowledge of physical, chemical and biological parameters of water and their importance.
2. Develop the social responsibility to eradicate water borne diseases
3. Recognize the methods to control environmental pollution
4. Express water quality parameters in written reports
5. Generalize the various quality control aspects of industrial effluents by performing the different lab tests.

GIS LAB

Course Code: GR20A3090 **L/T/P/C: 0/0/4/2**

Course Outcomes:

1. Inculcate hands on experience on fundamental commands.
2. Demonstrate proficiency in the basic functions of geospatial software.
3. To create awareness on raster layer to vector layer conversion
4. Analyze proficiency in the creation and acquisition of spatial data.
5. Recognize conversion of DEM to contour map and Contour to DEM map

MINI PROJECT WITH SEMINAR

Course Code: GR20A3141 **L/T/P/C: 0/0/4/2**
Pre-Requisite: Knowledge of all Civil Engineering subjects and Laboratories

Course Outcomes:

1. Acquire fundamental knowledge and practical knowledge to implement towards industries.
2. Analysis the building with software and Design, testing of materials with relevant standards.
3. Apply project management skills and scheduling of work in stipulated time.
4. Develop and demonstrate the problem finding ability in civil engineering technologies.
5. Communicate technical information by means of written and oral reports.

IV YEAR I SEMESTER

ESTIMATION AND COSTING

Course Code:GR20A4001 **L/T/P/C: 2/1/0/3**
Pre-Requisite: Building Materials and Construction planning.

Course Outcomes:

1. Estimate the quantities of materials and different types of materials required for different types of Buildings, Roads and Structures.
2. Produce the tendering process for executing any civil engineering work.
3. Recognize the process and importance of cost estimation, cost budgeting and cost control.
4. Estimate the rate per unit of any item of work.
5. Assess the value of any property and interpret the process and importance of valuationof buildings and other structures.

TRANSPORTATION ENGINEERING

Course Code:GR20A4002 **L/T/P/C: 3/0/0/3**
Pre-Requisites: Surveying and Geomatics

Course Outcomes:

1. Demonstrate the significance of highway alignment and road development
2. Compute the geometric features of road pertaining to horizontal and vertical alignment
3. Illustrate the basic traffic stream parameters and perform basic traffic signal phasing and timing plan.
4. Demonstrate the role of intersections and their significance
5. Analyze and compare the characteristics of Railway and Airport Engineering.

BRIDGE ENGINEERING
(PROFESSIONAL ELECTIVE III)

Course Code:GR20A4003 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Design of Reinforced Concrete Structures, Structural Analysis II

Course Outcomes:

1. Explain different types of Bridges with diagrams and Loading standards
2. Relate analysis and design of Slab bridges and suggest structural detailing
3. Distinguish analysis and design of T Beam bridges and suggest structural detailing
4. Differentiate analysis and design of Plate girder bridges
5. Explain analysis and design of substructure, piers and abutments

GROUND IMPROVEMENT TECHNIQUES
(PROFESSIONAL ELECTIVE III)

Course Code:GR20A4004 **L/T/P/C: 3/0/0/3**

Pre- Requisites: Geotechnical Engineering, Foundation Engineering

Course Outcomes:

1. Identify dewatering technique for the field related problem
2. Assess the field problems related to problematic soils by adopting various ground improvement techniques.
3. Differentiate reinforced earth retaining structures.
4. Recognize the suitability and practicability required for various ground improvement methods.
5. Assess the importance of extensive research in various ground improvement techniques.

SURFACE HYDROLOGY

(PROFESSIONAL ELECTIVE III)

Course Code:GR20A4005 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Hydrology and Water Resource Engineering

Course Outcomes:

1. Express the different types of hydrology definitions
2. Evaluate the consumptive use, infiltration and evaporation
3. Compute the discharge in the streams
4. Apply the hydrographs for the computing rain fall and run off
5. Apply the knowledge of computing flood estimation by various methods

TALL BUILDINGS

(PROFESSIONAL ELECTIVE III)

Course Code:GR20A4006 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Structural analysis II and Design of Reinforced Concrete structures

Course outcomes:

1. Analyse the components and various types of tall buildings
2. Design concepts and material properties used in tall building constructions.
3. Analyse the behaviour of tall buildings subjected to different types of loads
4. Analyse the tall buildings with and without shear walls.
5. Analyse shear walls with and without openings

INDUSTRIAL STRUCTURES
(PROFESSIONAL ELECTIVE IV)

Course Code:GR20A4007 **L/T/P/C: 3/0/0/3**

Pre-requisites: Design of reinforced concrete structures, Design of steel structures.

Course Outcomes:

1. Analysis and design of different industrial steel buildings.
2. Calculate the forces on transmission and communication towers
3. Correlate of silos and bunkers
4. Assess the design of concrete shell structures
5. Evaluate the design parameters of machine foundation

GEOMETRIC DESIGN OF HIGHWAYS
(PROFESSIONAL ELECTIVE IV)

Course Code:GR20A4008 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Transportation Engineering

Course Outcomes:

1. Analyze the factors influencing road vehicle performance, characteristics and design.
2. Compute the geometric features of road including horizontal and vertical alignment
3. Demonstrate the need of intersection planning and design and suggest solutions
4. Illustrate the importance of geometric design in highway system and suggest measures.
5. Demonstrate the need for road safety furniture and its importance in highway system

PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT

(PROFESSIONAL ELECTIVE IV)

Course Code:GR20A4009 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Environmental Engineering

Course Outcomes:

1. Estimate water for domestic and industrial requirement.
2. Determine the quality of generated sludge by treatment of water and wastewater andvarious methods for disposal of sludge
3. Explain methods of disinfection, chlorination – chlorine dose, chlorine demand,
4. Describe process for removal of oil, grease etc & disposal of skimming
5. Operate and maintain the sedimentation plant

REHABILITATION AND RETROFITTING OF STRUCTURES

(PROFESSIONAL ELECTIVE IV)

Course Code:GR20A4010 **L/T/P/C: 3/0/0/3**

Pre-requisite: Solid Mechanics, Structural Analysis

Course Outcomes:

1. Recognize various mechanisms for Structural distress and deterioration.
2. Learn the measures to prevent corrosion in concrete and steel structures
3. Apply the Inspection and Repair methods of distressed concrete and steel structures
4. Employ the methods of Rehabilitation in distressed concrete and steel structures
5. Carry out health monitoring and conditional assessment surveys on concrete andsteel Structures

ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS

(OPEN ELECTIVE III)

Course Code:GR20A4011 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Identify Elements of Community and Environment Likely to Be Affected by The Proposed Developments.
2. Develop Framework for Environmental Impact Assessment and Understand the RiskAnalysis and EIA Methods.
3. Explain The Importance of Public Participation, Fault Tree Analysis and ConsequenceAnalysis in EIA
4. Assess the Process of Environmental Impact Modelling and Prediction as A Design Tool.
5. Explain The Environmental Monitoring Systems and Legislation. Interact With Expertsof Other Fields to Assess the Impact.

TRANSPORTATION ENGINEERING LAB

Course Code:GR20A4012 **L/T/P/C: 0/0/4/2**

Pre-Requisites: Transportation Engineering.

Course Outcomes:

1. Estimate desired characteristics of aggregates.
2. Distinguish suitable materials for road construction.
3. Categorize pavement materials by their physical and mechanical properties.
4. Demonstrate various experiments on bitumen to measure various properties.
5. Demonstrate bituminous mixes as per pavement requirement.

COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING LAB

Course Code:GR20A4013 **L/T/P/C: 0/0/4/2**

Pre-Requisites: Structural Analysis – II, Design of Reinforced Concrete Structures, Designof Steel Structures, AUTOCAD

Course Outcomes:

1. Analyze and design the various beams for the different supports and loads.
2. Analyze and Design a Two and Three Dimensional (2D and 3D) frames of Multi-Storeyed Building with Wind and Seismic loads and Load combinations.
3. Analyze and Design a Reinforced Cement Concrete Over Head tank.
4. Analyze and design the distinct types of Steel Trusses and Industrial Steel Truss
5. Analyze and design the various types of Steel Beams for the different loads.

PROJECT WORK – PHASE I

Course Code:GR20A4129 **L/T/P/C: 0/0/12/6**

Pre-Requisites: Knowledge of all Civil Engineering subjects and Laboratories, communication skills

Course Outcomes:

1. Interpret ideas and thoughts into practice in a project and work in a team
2. Analyze the gap between theoretical and practical knowledge and evaluate the available literature on the chosen problem
3. Compose technical presentation in the conference and to develop organizational skills andteam work
4. Apply the principles, tools and techniques to solve the problem
5. Prepare and present project report

IV YEAR II SEMESTER

PRESTRESSED CONCRETE

(PROFESSIONAL ELECIVE V)

Course Code:GR20A4083 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Structural Analysis, Design of Reinforced Concrete Structures

Course Outcome:

1. Examine the transfer and development length as well as pre-stress losses.
2. Demonstrate the design calculations to predict service behaviour of pre-stressed concrete structures, accounting for the time-dependent effects of concrete creep and shrinkage.
3. Design for ultimate strength of pre-stressed concrete structures.
4. Illustrate the pre-stressed concrete structures to satisfy relevant Design Standards.
5. Evaluate the pre-stressed concrete fabrication and construction process.

PAVEMENT DESIGN

(PROFESSIONAL ELECIVE V)

Course Code:GR20A4084 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Transportation Engineering.

Course Outcomes:

1. Illustrate highway design methods, constraints and controlling factors.
2. Apply the design standards in designing principal elements of the highway.
3. Predict the resource constraints and utilize the available materials in a sustainable way.
4. Examine the basic parameter of traffic engineering and the methods which help to estimate those parameters.
5. Recognize the major failure modes of flexible and rigid pavement and helps in maintaining them properly.

DESIGN OF HYDRAULIC STRUCTURES
(PROFESSIONAL ELECIVE V)

Course Code:GR20A4085 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Hydraulics and Water Resource Engineering

Course Outcomes:

1. Plan and assess the capacity of reservoir by mass curve method and design differenttypes of irrigation channels
2. Evaluate the forces acting on gravity dams and analyze the stability of thegravity dam.
3. Apply the principles of design ofthe earthen dams and Ogee spillways
4. Design various diversion head works by using Bligh's and Khosla's theory.

5. Design of various hydraulic structures like canal falls, canal regulator works and cross drainage works along with their suitability& explain the components of hydroelectric schemes.

CONSTRUCTION PROJECT PLANNING AND SYSTEMS

(PROFESSIONAL ELECIVE V)

Course Code: GR20A4086 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Estimation and Costing

Course Outcomes:

1. Understand how structures are built and projects are developed on the field
2. Analyze good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics
3. Interpret Plan, control and monitor construction projects with respect to time and cost, and also to Optimize construction projects based on costs
4. Remember how construction projects are administered with respect to contract structures and issues.
5. Summarize ideas and understandings to others with effective communication processes

EARTHQUAKE ENGINEERING

(PROFESSIONAL ELECIVE VI)

Course Code: GR20A4087 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Engineering Geology, Design of Reinforced Concrete Structures

Course Outcomes:

1. Identify movements of tectonic plates, and characterize earthquake ground shaking
2. Estimate the magnitude & intensity of earthquake
3. Utilize the principles behind earthquake resistant design of structures
4. Formulate earthquake analysis of multi storeyed buildings
5. Design earthquake resistant design and ductile detailing of frame members

URBAN TRANSPORTATION AND PLANNING

(PROFESSIONAL ELECIVE VI)

Course Code: GR20A4088 **L/T/P/C: 3/0/0/3**

Pre-requisites: Transportation Engineering

Course Outcomes:

1. Comprehend the urban travel demand and independent variables
2. Analyze the traffic surveys and trip generations modules
3. Assess, analyze and study the trip distribution factors and mode choice analysis
4. Evaluate the traffic assignment methods and plans
5. Illustrate device short termand long-termplans

GREEN BUILDING TECHNOLOGY

(PROFESSIONAL ELECIVE VI)

Course Code: GR20A4089 **L/T/P/C: 3/0/0/3**

Prerequisite: Environmental Science, Concrete Technology

Course Outcomes:

1. Correlate the underlying principles, history, environmental and economic impacts of green building technology and to identify the criteria for rating systems along with the established Indian codes and guidelines.
2. Identify various Renewable and Non-renewable sources of energy along with their carbon foot prints and building modeling and energy analysis, monitoring and metering.
3. Recognize the energy efficient green building materials and the cost-effective Building Technologies and materials with low embodied energy and incorporate theminto design.
4. Explain the application of design guidelines of Green Building considering the Energy Conservation Measures. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Explain broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course.

PAVEMENT MATERIALS
(PROFESSIONAL ELECIVE VI)

Course Code: GR20A4090 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Building Materials and Construction Planning

Course Outcomes:

1. Categorize the soil based on the geotechnical properties and justify the applicability.
2. Analyze the engineering properties of aggregates and customizing for applicationunder various field situations
3. Categorize the bitumen based on the properties and justify the applicability.
4. Select appropriate asphalt binder for construction of a flexible pavement dependingupon the traffic and climatic conditions.
5. Analyze Cement & Cement Concrete Mix characterization and application in various pavements.

ENTERPRENEURSHIP AND PROJECT MANAGEMENT

Course Code: GR20A4091 **L/T/P/C: 2/1/0/3**

Pre-Requisite: Estimation and Costing

Course Outcomes:

1. Apply Project Planning techniques and develop Project Schedules in real timeconditions.
2. Identify Critical path in CPM & PERT Networks; Evaluate Floats and Slacks for Activities & Events respectively to Progress and Complete the Project in Time.

3. Recall the Method Statements of various Activities and their ITPs with theKnowledge of Project Quality Plans.
4. Identify ideal Construction Equipment required and deploy in the best possible manner for better productivity; Conducts Field Tests for Soils at specified frequency.
5. Explore the Concept of Entrepreneurship & Social Entrepreneurship; Becomes an entrepreneur being familiar with Characteristics of Entrepreneurship & Entrepreneurs.

PROJECT WORK – PHASE II

Course Code: GR20A4130 **L/T/P/C: 0/0/12/6**

Pre-Requisite: Knowledge of all Civil Engineering subjects and Laboratories, communication skills

Course Outcomes:

1. Interpret ideas and thoughts into practice in a project and work in a team
2. Analyze the gap between theoretical and practical knowledge and evaluate the available literature on the chosen problem
3. Compose technical presentation in the conference and to develop organizational skills and team work
4. Apply the principles, tools and techniques to solve the problem
5. Prepare and present project report

SOFT SKILLS AND INTERPERSONAL SKILLS (OPEN ELECTIVE)

Course Code: GR20A3136 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Develop soft skills communication skills, leadership skills etc.
2. Implement goal setting techniques to build a promising career.
3. Design formal report and proposals with appropriate formal expressions.
4. Create healthy workplace environment by treating others with respect and dignity.
5. Evaluate the power of confidence building and self-esteem with examples.

HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR (OPEN ELECTIVE)

Course Code:GR20A3137 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organisational setting.
2. To Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.

3. To assess the group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations in the framework of organization and to familiarize the concepts, techniques and practices of human resource development in the current organizational view.
4. To impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
5. To report the current trends and applications in HRD and Balanced Scorecard to measures the performance and to develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.

CYBER LAW AND ETHICS
(OPEN ELECTIVE)

Course Code:GR20A3138 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students will be able understand cybercrime and ethical practices and the student will beable to know and learn web technologies and related issues.
5. Be in position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

ECONOMIC POLICIES IN INDIA
(OPEN ELECTIVE)

Course Code:GR20A3139 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Familiarize with the nature of business environment and its components.
2. The students will be able to demonstrate and develop conceptual framework of business environment.
3. Understand the definition of ethics and the importance and role of ethical behaviour in the business world today.
4. Explain the effects of government policy on the economic environment.
5. Outline how an entity operates in a business environment.

13. CO-PO MAPPINGS

GR20A1001-Linear Algebra and Single Variable Calculus													PSO's	
COs/POs	A	b	c	d	e	f	G	h	i	j	k	l	1	2
1. Compute the rank of a matrix to determine the existence of solutions of a linear algebraic system	H	H	H	M	M	H	M			M	H	H	H	M
2. Determine the eigenvalues and eigenvectors of a square matrix which arise in several engineering applications	H	H	H	M	M	H	M			M	H	H	H	H
3. Determine approximate solution of over determined systems using the pseudo inverse.	H	H	H	M	M	H	M			M	H	H	M	M
4. Develop the skill of determining optimal values of multivariable functions using classical methods.	H	M	H	M	M	H	M			M	H	H	H	M
5. Apply the definite integral concept for various computational problems in geometry.	H	H	H	M	M	H	M			M	H	M	M	H

GR20A1006 - ENGLISH													PSO's	
COs/POs	A	b	c	D	e	f	g	h	i	j	k	l	1	2
1. use English Language effectively in spoken and written forms.	M	H	M	M		H	H	M	M	M	M	M	M	M
2. comprehend the given texts and respond appropriately.	M	M	M	M	H	M	H	M	M	M	M	M	M	M
3. communicate confidently in various contexts and different cultures.	M	M	M	H	H	M	H	M	H	M	M	M	H	M
4. acquire proficiency in English including reading and listening comprehension, writing and speaking skills.	M	M	M	M	M	M	H	M	M	M	M	M	M	H
5. demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view	M	M	M	M	M	M	H	M	M	M	M	M	H	M

GR20A1004-ENGINEERING PHYSICS

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's 1	PSO's 2
1. Apply the principles of interference and diffraction of light in engineering applications.	H	H	H	M	M	M	H	H	H	H	M	H	M	M
2. Analyze the properties of Laser and its propagation in different types of optical fibers.	M	H	H	M	H	M	H	H	M	H	M	M	M	M
3. Classify materials based on the theory of Kronig Penny model.	H	M	M	H	M	H	M	M	H	M	H	H	M	M
4. Understand the nature and characterization of nanomaterials and its applications.	M	H	H	M	M	M	H	H	H	H	M	H	H	H
5. Comprehend the concepts of acoustics and non-destructive testing in solving engineering problems	H	M	H	M	M	H	M	H	H	M	H	M	H	H

GR20A1007 - PROGRAMMING FOR PROBLEM SOLVING

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's 1	PSO's 2
1. To write algorithms and to draw flowcharts and remember and reuse the fundamentals ofC language.	H	H	H	M	H	M	H	H	H	H	M	H	H	M
2. To apply decision making statements and arrays to solve problems.	H	H	H	H	M	M	H	H	H	H	H	M	H	M
3. To illustrate the need for strings and functions in problem solving.	M	H	M	H	H	M	H	M	H	H	H	H	H	M
4. To implement pointers and structures in writing programs.	H	M	H	H	M	H	H	H	H	M	H	H	H	M
5. To illustrate working with files and pre-processor directives in c.	H	M	H	M	H	M	M	H	H	M	H	M	H	M

GR20A1010 - ENGINEERING GRAPHICS														
													PSO's	
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	1	2
1. Familiarize with BIS standards and conventions used in Engineering Graphics.	M		H	M			M		M				H	
2. 2. Draw various engineering curves like ellipse, parabola, cycloids and involutes		M				M					M			M
3. etc and construct various reduced scales like plain, diagonal and vernier scales	H				H			M		M		M	M	
4. 3. Differentiate between first angle and third angle methods of projection and		H		H			M		H		H			H
5. distinguish parallel and perspective projection.			M		M	H		M		H		H	M	

GR20A1013 - ENGINEERING PHYSICS LAB														
													PSO's	
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	1	2
1. Evaluate the frequency of tuning fork, spring constant through coupled oscillation and analyze the resonance phenomena in LCR circuit	H	M	H	M	H	M	H	H	H	H	M	M	M	M
2. Compare the rigidity modulus of wires of different materials using Torsional pendulum.	H	H	H	H	M	M	H	H	H	H	H	M	M	M
3. Interpret the properties of light like interference and diffraction through experimentation.	H	H	H	H	H	H	M	M	H	H	H	H	M	M
4. Asses the characteristics of Lasers and infer the losses in optical fibers.	H	M	H	H	H	H	H	H	H	H	H	M	H	H
5. Identify the type of semiconductor by measuring energy gap	H	H	H	M	H	M	M	H	H	M	H	M	M	

GR20A1016 - PROGRAMMING FOR PROBLEM SOLVING LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Formulate the algorithms for simple problems and translate algorithms to a working and correct program.	H	H	H	M	M	H	H	H	H	H	M	H	H	M
2. Identify, analyse and correct syntax and logical errors encountered during coding..	H	H	H	H	M	M	H	H	H	H	H	M	H	H
3. Interpret and implement programs using branching and looping statements..	H	M	M	H	M	H	M	M	H	H	H	H	H	M
4. Represent and manipulate data with arrays, strings and structures and use pointers.	H	M	H	H	M	M	H	H	H	H	H	H	H	M
5. Create, read and write to and from simple text and binary files and modularize the code with functions so that they can be reused	H	H	H	M	M	H	M	H	H	M	H	M	H	H

GR20A1015 - ENGLISH LANGUAGE AND COMMUNICATION SKILLS														
COs/POs	**a**	**b**	**c**	**D**	**E**	**f**	**G**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. interpret the role and importance of various forms of communication skills.	M	M	M	H	M	M	H	M	M	M	M	M	H	M
2. demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.	M	M	M	H	M	M	M	M	M	M	M	M	M	M
3. utilize various media of verbal and non-verbal communication with reference to various professional contexts	M	M	H	H	H	M	H	M	M	M	M	M	M	H
4. recognise the need to work in teams with appropriate ethical, social and professional responsibilities.	M	M	M	H	H	H	H	M	M	M	M	M	M	M
5. evaluate and use a neutral and correct form of English.	M	M	M	H	M	M	H	M	M	M	M	M	M	M

GR20A1002 - DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS														
													PSO's	
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	1	2
1. Classify the differential equations of first order and solve them analytically by suggested methods	H	H	H	M	M	H	M			M	H	H	H	H
2. Solve linear differential equations of higher order under various forcing functions	H	H	H	M	M	H	M			M	H	H	H	H
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics.	H	H	H	M	M	H	M			M	H	H	H	H
4. Apply vector differential operators on scalar and vector fields and apply them to solve some field related problems	H	M	H	M	M	H	M			M	H	H	H	H
5. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces	H	H	H	M	M	H	M			M	H	M	H	H

GR18A1005- ENGINEERING CHEMISTRY														
													PSO's	
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	1	2
1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.	H		M			M			M					
2. Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.	H	M		M		M				M				H
3. Recognise various problems related to electrochemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in engineering	H	M	H	H				H	M		H	M	M	H
4. Know the origin of different types of engineering materials used in modern technology and Interpret different problems involved in industrial utilization of water.	H	M	M	M	H	H	H	M			H	M	M	H
5. Understand the processing of fossil fuels for the effective utilization of chemical energy.	H	H	H	M		M	M	M			H			H

GR20A1009 -ENGINEERING MECHANICS														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.	H		M					M					M	M
2. Solve problem of bodies subjected to friction	H	M		M				M			M			
3. Find the location of centroid and calculate moment of inertia of a given section.	H		M		M	M	M	H				M	M	H
4. Determine the forces in the members of the trusses	H		M				H	M		H			H	M
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion of rigid bodies.	H				M				M				M	M

GR20A1011- DATA STRUCTURES														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Analyze basic concepts of data structures, computation complexity and implement various searching and sorting techniques.	H	H	H	H	M	M	H	M	H	H	M	H	H	M
2. Apply various operations on linear data structures Stack and Queue and their applications.	H	M	H	H	M	M	H	H	M	H	H	H	H	M
3. Develop algorithms for operations on linked lists and convert them to programs.	M	H	H	M	M	H	H	M	H	H	H	H	M	H
4. Apply various operations on non-linear data structure tree	H	M	H	M	M	H	H	H	H	H	H	H	M	M
5. Implement various graph traversals techniques and idea of hashing.	H	M	H	M	H	M	M	H	H	H	H	M	M	M

GR20A1020– DESIGN THINKING														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. The students understand how to identify an Opportunity from a Problem		H	H	H	H		H							
2. Students will be able to frame a Product/Service Idea	H	H	H									H		
3. The students can explore how to empathize with the customers	H	H	H	H	H	H	H	H	H	H	H	H		
4. The student will be be able to design and develop a Prototype	H	H	H	H	H	H	H	H	H	H	H	H	M	H
5. Students will be able to pitch their idea and get hands on experience in designing Hvalue proposition		H	H					H		H	H	H	M	M

GR20A1014-ENGINEERING CHEMISTRY LAB														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.	H	H	H	H		M	M	H	M	M	M	M		M
2. Determination of parameters like hardness and chloride content in water	H	H	H	H	M	M	M	H	M	M	H	M	M	M
3. Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.	H	M	H			M	M	M	M	M				
4. Measurement of redox potentials and conductance	H	M				M	M	M	M	M				M
5. Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.	H	M	M			M		M		M		M		H

GR20A1019-ENGINEERING Workshop														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Develop various trades applicable to industries / Manufacturing practices.	H	H	H	M	M	M	H	H	H	H	M	H	M	M
2. Create Hands on experience for common trades.	H	H	H	M	M	M	H	H	H	H	H	M	M	M
3. Improve to fabricate components with their own hands.	H	H	H	H	H	H	M	M	H	H	H	H		H
4. Develop practical knowledge on the dimensional accuracies and dimensional tolerances possible with various manufacturing processes.	H	H	H	M	M	M	H	H	H	H	H	H		M
5. To build the requirement of quality of work life on safety and organizational needs	H	M	M	H	M	M	M	H	H	M	H	M	M	M

GR20A1021-LIFE SKILLS AND PERSONALITY DEVELOPMENT														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Apply the concept of Time Management to his own day to day life. They will also learn to cope with Information Overload, which has become a serious problem for the digital generation. They will be in a position to withstand harmful peer pressure, and steer themselves towards attaining their own objectives in the four years time they spend in the college.			M	M		M	M	M						
2. Apart from understanding the importance of English language skills in a globalized world, they will leart the methodologies as to how they can master English Language skills. They will become familiar with the communication skills and etiquette, body language, non-verbal communication and they will start applying these concepts in their day to day life. This will help them to become thorough professionals in their career.			M	M		M	H	M						

3. Large number of students are ignorant about the need for personal health management and the need to stay away from addictions. After this course, they will get a complete understanding of the biological basis behind these concepts. This will help them to maintain a robust health trough out their life and it will also keep them away from addictions like drug addiction, alcohol addiction & video games addiction. They will learn the techniques of stress management as well.			M	M		M		M						
4. They would start cultivating some good hobbies which will help them to maintain ideal work-life balance throughout their life. The students would start discarding bad habits & will start picking up good habits. Further, they will learn the techniques of holding difficult conversations and negotiations, which is an important skill set in the 21st century world.			M	M		M		M						
5. They will develop the aptitude for finding creative solutions to problems and they will come to realize the importance of continuous and lifelong learning in a fast changing technological landscape. They will appreciate why collaboration and team working skills are important for success in a modern world.			M	M		M		L	H				M	M

GR20A2009- Building Materials and Construction Planning

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Distinguish between various types of building stones, bricks and tiles and their structural requirements.	H			H			M					M		H
2. Recognize the need and process of manufacture of cement and lime	M		M			M	H		M	M		H	M	
3. Identify function of various materials like wood, glass, paints and building components	M		M			M	H		M	M		H	M	
4. Find the importance of masonry, finishing and form woks	M		M			M	H		M	M		H		M
5. Assess various building services and principles of building planning	H	H	M	H		M	H	M				M	H	

GR20A2010- ENGINEERING GEOLOGY														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Recognize the importance of geology from civil engineering point of view.	H	M	M			M	H	M	H		M	M	M	
2. Find the physical properties of minerals and their role for common rock forming.	H	M	M	M		M			M	M		M		H
3. Distinguish features of igneous, sedimentary and metamorphic rocks.	H	M	M	M		M				M		M	M	
4. Distinguish various geological structures.		M		M		M	H	M	H		M		M	
5. Analyse the failures of dams, reservoirs and tunnels due to geological reasons.	H			M		M			H	M	H	M		M

GR20A2011- STRENGTH OF MATERIALS-I														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types ofloading	H	M	M	M		M	M	M		M	M	M	M	M
2. Analyze the principal stresses and strains in different planes by using analytical and graphicalmethods	H	M	M	M		M	M	M		M	M	M		
3. Determine the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams with differetloading.	H	H	H	H	M	M	M	M	M	H	H	H	M	H

4. Formulate the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members.	H	H	H	H	M	M	M	M	M	H	H	H		M
5. Evaluate the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.	H	H	H	H	M	M	M	M	M	H	H	H		H

GR20A2008 - COMPUTATIONAL MATHEMATICS FOR ENGINEERS

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Apply well known techniques to find real roots of an equation and linear algebraic systems by iterative methods.	H	M		H		M						M		M
2. Utilize interpolation techniques for univariate and bivariate data using Gaussian and cubic splines	H	H		H		M	M					M		M
3. Apply numerical techniques to find eigenvalues and corresponding eigenvectors of a matrix.	H	H		M								M		M
4. Make use of numerical techniques in differentiation and integration.	H	H		M		M						M		M
5. Model finite differences method to solve IVP in ODE and PDE.	H	H		M		M		M				M		M

GR20A2012- INTRODUCTION TO FLUID MECHANICS

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Comprehend the various fluid properties and fluid statics	H	H	M	M			M				M		H	
2. Understand the broad principles of hydrostatic forces on submerged planes	H	H	M	M			M				M			M

3. Analyzing fluid dynamics and kinematics	H	H	M	M			M		H		M		M	
4. classify concept of boundary layer and predict the laminar and turbulent flows	M	M	M	M							M			M
5. Predict the losses in pipes flows and able to calculate discharge measurement	M	M	M	M							M			M

GR20A2013– SURVEYING AND GEOMETICS

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	1
1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to Engineering and surveying activities	H	H	M	H					M	M	M	M		
2. To be able to calculate, design and layout of horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings.	H	H	M	H						M	M			
3. Understand the advantages of electronic surveying over conventional surveying methods.	M				H					M	M	M		M
4. Acquire knowledge about photogrammetry principles, methods and. product generation strategies in both Analytical and digital Photogrammetry system.	M			M	H		M			M		M		M
5. Acquire knowledge about the principles and physics of Remote sensing and data acquisition and getting familiarized with various data analysistechniques.	M	M			H		M			M		M		H

GR20A2014– ENGINEERING GEOLOGY LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**1**
1. Identify various minerals and their properties				H		M	H		M			M		
2. Identify various rocks and their properties				H		M	H		M			M		
3. Understand various rocks and minerals used in the industries		M		H		M	H		M			M	H	
4. Prepare and interpret various sections of geological maps showing structures like faults, folds and Unconformities etc			M	H		M	H		M			M		M
5. Resolve simple structural Geology problems.				H		M	H		M			M		H

GR20A2015– SOLID MECHANICS LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**1**
1. Determine the important mechanical properties of materials.	H	M		M	M	M		M	M			H		
2. Identify the stiffness of an elastic isotropic material.	H		M	M	H	H	M			M	M			M
3. Evaluate the Reciprocal theorem.	H	H	H	M	H	M	M		M	M	M	H		M
4. Measure any substance's resistance to uniform compression.	H	H	H	M	H	M		M	M		M	M		
5. Resistance of various materials against abrasion and impact.	M	M	M	M			M	M			M	M		M

GR20A2002- VALUE ETHICS AND GENDER CULTURE														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. To enable the student to understand the core values that shapes the ethical behaviour. And Student will be able to realize the significance of ethical human conduct and self-development			M										M	M
2. Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.				M									M	M
3. The students will learn the rights and responsibilities as an employee and a team member.						M							M	M
4. Students will attain a finger grasp of how gender discrimination works in our society and how to counter it.									M				M	M
5. Students will develop a better understanding on issues related to gender and Empowering students to understand and respond to gender violence.										M			M	M

GR20A2001-ENVIRONMENTAL SCIENCE														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Understand the harmonious co-existence in between nature and human being	H	H								H				
2. Recognize various problems related to environment degradation.									M		M		M	M
3. Develop relevant research questions for environmental investigation	H			M		M	M							H
4. Generate ideas and solutions to solve environmental problems due to soil, air and water pollution	M					M						M	M	
5. Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.								M			M		H	M

GR20A2016- SOLID MECHANICS – II

COs/POs	a	b	C	d	e	f	g	h	i	j	k	l	PSO's 1	PSO's 2
1. Compute various stresses in thin and thick cylinders under pressure, show stress distribution diagrams and define Lame's theorems.	H	M		H		M		M	M	M		M		M
2. Analyse the torsional strength of structural members and differentiate between closed and open coiled helical springs	H	M		H		M		M	M	M		M	M	
3. Determine the buckling failure load for axially loaded and eccentrically loaded columns	H	M		H		M		M	M	M		M	M	
4. Evaluate stresses in chimneys, retaining walls and dams and to check the stability of dams.	H	M		H		M		M	M	M		M	M	
5. Evaluate the behaviour of members under unsymmetrical bending and locates herecentres for the section and find stresses in circular and semi-circular beams.	H	M		H		M		M	M	M		M		M

GR20A2017 -BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

COs/POs	a	b	C	d	e	f	g	h	i	j	k	l	PSO's 1	PSO's 2
1. Know the application of ohms law & Kirchhoff's laws	H	H			M			H	H	H			M	
2. Know about fundamental principles of electrical machines	M		H			M			M	M	M	M		M
3. Measure the fundamental electrical quantities using oscilloscope	M	M		H				M				H		M
4. Illustrate the basic principles of semi conducting devices	M	M			M			M		M		M	M	
5. Analyse the different applications of a transistor		H		H		M			H		M			M

GR20A2018- STRUCTURAL ANALYSIS – I														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Determine deflections of beams and trusses using energy methods	M				M		M		M	M				
2. Analyse three and two hinged of circular and parabolic arches	M	H			M				M	M			M	H
3. Analyse indeterminate beams using force method for propped cantilever, fixed and Continuous beams (Clapeyorns's three moment theorem)	M	H			M				M	M				M
4. Apply Slope deflection, Moment distribution and Kani's methods to analysestatically In-determinate structures.	M	H			M				M	M				M
5. Analyse statically determinate structures using rolling load and influence line methods	M	H	M		M	M			M	M	M		M	M

GR20A2004 - ECONOMICS AND ACCOUNTING FOR ENGINEERS														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. The student will be able to understand the concepts of economics and Demand concepts, elasticity and techniques for forecast demand of products	M	H	M	M	M			M	M	M	M	M	M	M
2. The student will be able to plan the production levels in tune with maximum utilization of organizational resources and with maximum profitability.	M	M	M	M	M			M	M	M	M	M	M	M
3. To understand the types of markets, types of competition and to estimate the cost of products and decide the price of the products and services produced	M	H	M	M	M			M	M	M	M	M	M	M
4. The student will be able to analyze the profitability of various projects using capital budgeting techniques	M	H	M	M	M			M	M	M	M	M	M	M
5. The student is able will be able prepare the financial statements and more emphasis on preparation of final accounts.	M	H	M	M	M			M	M	M	M	M	M	M

GR20A2019- HYDRAULIC ENGINEERING														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Describe and predict the various economical channel sections	M	M	H	M							M			
2. Apply dynamic equation in the uniformflows	M	M	M	M			M						H	
3. Analysing modal and prototype similarities	M	M		M			M				M			M
4. Visualize behaviour the hydraulic jump, surface profiles of channel flows	M	M	M	M			M				M		M	
5. Evaluate the efficiency of the pumps and hydropower.	H	M	M	M		M	M						M	

GR20A2020- SURVEYING LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Define the characteristics and applications of basic survey instruments.	H	M		M	M	M		M	M			H	H	M
2. Apply knowledge of mathematics, science and engineering in land measurement techniques.	H		M	M	H	H	M			M	M		H	H
3. Calculate distances, inclinations, elevations, areas and volumes	H	H	H	M	H	M	M		M	M	M	H		
4. Generate maps of earth surfaces.	H	H	H	M	H	M		M	M		M	M	M	H
5. Analyzing the data and transfer relevant points onto ground.	M	M	M	M			M	M			M	M		H

GR20A2021- COMPUTER AIDED DESIGN LAB														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Comprehend the fundamentals of building drawings and understand CAD software for drafting				H		M	H		M			M		
2. Draw Material, Sanitary, Electrical Symbols and various brick bonds by using drawing commands in CAD				H		M	H		M			M	M	M
3. Develop geometric plan for single and multi-storeyed building with suitable scaleand dimensions.		M		H		M	H		M			M		
4. Develop the Sections and Elevations for Single and Multi Storeyed Buildings usingCAD software.			M	H		M	H		M			M	M	M
5. Draft the building components and sectional view of doors, windows and trusses				H		M	H		M			M		

GR20A2022 - FLUID MECHANICS AND HYDRAULIC MACHINERY LAB														
COs/POs	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Predict the discharge through venture meter and orifice meter.	H	M	M	M	M		M				M		M	
2. Estimate the energy heads.Compute the laminar flow, length of flow	H	M		M			M		M	M				M
3. Predict the velocity distribution in pipe flows	H	M		M			M		M	M			M	
4. Compute the major and minor losses in pipe flow	H	M	M	M	M		M				M			M
5. Evaluate the efficiency of Hydraulic machines	H	M		M			M		M	M				

GR20A1019-Concrete Technology														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Explain the physical and chemical properties of concrete ingredients and able to conduct tests on cement and aggregates.	H					M	M					M	M	H
2. Illustrate workability of fresh concrete and also explain the properties of fresh and hardened concrete	M	M					M					M	M	
3. Demonstrate different tests such as compression and tension on hardened concrete and also summarize the quality control of concrete under different conditions.	M	M		H			M							M
4. Estimate the creep and shrinkage of concrete and also distinguish the special concretes	M	M		H			M					M		
5. Design the mix proportions for the specific work for required strength and workability with available materials at workplace.	H	M		H		M	H					H	H	H

GR20A1019-Geotechnical Engineering														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	1
1. Identify basic Engineering properties of soil and classify the soil.	H	M	M	M										M
2. Evaluate coefficient of permeability and effective stresses of soil.	M	H	M	H								M		
3. Assess the mechanism of stress distribution and compaction in soils.	M	H	H	H			M			M		M		M
4. Analyze the behavior of soil during consolidation process.	M	H	H	H			M			M		M		
5. Evaluate the performance of shear strength of soil mass.	M	M	H	H						M		M		

GR20A1019-Hydrology and water Resources Engineering														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Estimate and Process rainfall data, runoff data, evapo-transpiration data, evaporation data and infiltration data		H				M				M			M	
2. Design a model in a region for direct runoff hydrograph, unit hydrographs-Curve hydrograph& Synthetic Unit Hydrograph				H				M				M	H	
3. Calculate the discharge of Radial flow to wells in a region of confined and unconfined aquifers by determining the aquifer parameters by field tests and pumping tests					H		M			M			M	
4. Design a suitable irrigation method depending on soil, water and plant conditions on the field & prepare irrigation schedules and irrigation efficiencies for farmers on the field			H		`				M			M	H	
5. Design of irrigation canals and discharge by SCS Curve Number method & Analyze the regional flood frequency					H						H		H	

GR20A1019-Design of Reinforced Concrete structures														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Classify Working Stress and Limit State method in design of reinforced concrete structures.	M	M	M	M		M		M				M		M
2. Analyze and design of beams.	H	M	H	H		M		M				M	M	M
3. Design of slabs, staircase and canopy.	H	M	H	H		M		M				M	M	M
4. Design of columns.	H	M	H	H		M		M				M	M	M
5. Design of footings, beams and slabs for limit state of serviceability.	H	M	H	H		M		M				M	M	M

GR20A1019-Engineering Materials for Sustainability														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Understand the different types of environmental factors effecting materials	M		M			M	H		M		M	H		M
2. Work in sustainability for research and education	M	M	H	H			H	H	M		H	H		M
3. Having a broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course	H	H			H		H			M	H	H		M
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.	M	H	M	H			H	H			H	H	M	
5. Identify and compare cost and performance of building materials with recycled components, non-petroleum-based materials, materials with low volatile organic compounds, materials with low embodied energy and salvaged materials and incorporate them into design.		H				H	H	H	M			H		M

GR20A1019-GROUND WATER DEVELOPMENT AND MANAGEMENT														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. GroundWaterOccurrence, Aquifers, Retention	M			M		M	M						M	
2. Steady groundwater flow towards a well in confined and unconfined aquifers – DuPuy's andTheism's equations,	M	M		M		M	M					M	M	
3. Steady groundwater flow towards a well in confined and unconfined aquifers, Unsteady flow towards a well – Non equilibrium equations	M	H	M	M					M				M	
4. ArtificialRechargeofGroundWater:Conceptofartificialrecharge	M	M		M	M	M							M	
5. WellConstruction–DrillingEquipmentusedforWellConstruction. Saline Water Intrusion in aquifer	M	M	M	M		M	M	M	M				M	

GR20A1019- IRRIGATION ENGINEERING														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Inculcate knowledge of soil physical & chemical properties with respect to soil water plant relationship.	M		M			M	H		M		M	H		M
2. Acquire the knowledge to estimate water requirement for various principal crops	M	M	H	H			H	H	M		H	H	M	
3. Apply the various methods to design and development of irrigation structures	H	H			H		H			M	H	H		M
4. Design the conveyance of water through field channels through underground pipe lines.	M	H	M	H			H	H			H	H	H	
5. Analyze irrigated areas and design drainage systems		H				H	H	H	M			H	M	

GR20A1019- Structural Analysis - II														
COs/POs	a	b	c	D	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Analyse various types of frames with and without sway using Slope deflection and Moment distribution methods	M	M						M				M		
2. Analyse various types of frames using Kani's methods of Analysis	M	M						M				M		
3. Evaluate the shear forces, bending moments and axial forces in beams, columns and at joints of multi-storey frames using approximate methods of analysis	M	M						M				M		
4. Analyse the simple beams and frames using stiffness matrix and flexibility matrix methods of analysis..	M	M		M				M				M	M	
5. Apply the principles of virtual work to estimate the collapse load and plastic moment carrying capacity of simple beams and frames	M	M						M				M	M	

GR20A1019-Traffic Engineering and Management														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Analyse traffic problems and plan for traffic systems various uses	H	M		H			M				M		M	
2. Carryout traffic surveys and plan parking arrangements	M					M		M	M	H				
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design	M					M				M	M			
4. Organize the basic traffic signal phasing and timing plan	H	H			M	H					M		M	
5. Develop Traffic management Systems							M				M	M	M	

GR20A1019-CONCRETE TECHNOLOGY LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Identify the suitable materials used for concrete for particular purpose	H	M	H	M							H	H	M	H
2. Gauge the quality control of Cement and concrete	H	H	H	H			M	M			H	H	M	
3. Identify, describe and carry out the main laboratory tests relevant to the use of concrete on site	M	H	H	H			H		H	H	H			
4. Design normal concrete mixes.	H	H	H	H				H	M		H	H		
5. Interpret the properties in tern to design or invent the new materials	H	H	H	H			H	H			H	H	H	H

GR20A1019-Transportation Engineering Lab														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Estimate desired characteristics of aggregates.	M	M				M	M	M				M	M	H
2. Distinguish suitable materials for road construction.		M					M					H	M	M
3. Categorize pavement materials by their physical and mechanical properties.				M			M			M			M	M
4. Demonstrate various experiments on bitumen to measure various properties.				M		M	M			M			M	H
5. Demonstrate bituminous mixes as per pavement requirement.	M						M					H	M	M

GR20A1019-Design of steel structures														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Identify various types of structural steel and its properties. Also, able to define concepts of LSD	M			M		M		M				M		M
2. Classify and design various types of connections.	H	M	H	H		M		M				M	M	M
3. Design of tension and compression members for the given loads and moments	H	M	H	H		M		M				M	M	M
4. Design the beams and purlins.	H	M	H	H		M		M				M	M	M
5. Design of eccentric and moment connections.	H	M	H	H		M		M				M	M	M

GR20A1019-FOUNDATION ENGINEERING														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Identify various soil exploration methods and interpret the results	M	M												
2. Assess the stability of slopes	M	H	H	H				M				M		M
3. Compute earth pressures and stability of retaining walls	M	H	H	H				M				M		
4. Apply bearing capacity equations for shallow foundations and analyze settlement	M	H	H	H				M		M		M		M
5. Estimate pile and pile group capacity and recognize the shapes and components of well foundations	M	H	H	H				M		M		M		

GR20A1019-ENVIRONMENTAL ENGINEERING														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Analyse characteristics of water and wastewater.	H	H		M						M		H	H	M
2. Assess water demand and design components of water distribution systems.	M	H		H								M	H	M
3. design conveyance elements of wastewater collection systems.	M			M				M				H	H	M
4. Assess sources of water and wastewater.	H	M						H	M	M			M	
5. Plan and design water treatment units and wastewater treatment systems	H	M						H	M	M		M	H	M

GR20A1019-GEOGRAPHIC INFORMATION SYSTEM AND SCIENCE														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Analyse the basic components of GIS.	H	H	M		H	M	H		M			H		
2. Classify the maps, coordinate systems and projections.	M	M			H		H	H			H	H	M	
3. Process spatial and attribute data and prepare thematic maps.	H	H			H		H			H	H	H	H	
4. Identify and rectify mapping inaccuracies.	H	H	M	H	H		H	H		H	H	H		
5. Formulate and solve geospatial problems.	H	H			H	H	H	H	M			H	H	

GR20A1019-Rock Mechanics														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Identify the objectives of geotechnical data collection and rock mass classification methods, and successfully collect and analyse a range of geotechnical datasets for design purposes.		H	H	H									M	
2. Develop understanding on impact of geological features on civil engineering projects		H	M	M					M		H			
3. Identify the problems associated with different geological features on civil engineering structures and suggest alternatives.		H	H	H					H		H		H	M
4. Describe the theory and analysis of in situ and induced stresses in a rock mass and structurally controlled failure		H	H	H			H		M		H			
5. Introduced various methods to improving the properties of rock masses.		H	H	H					H		H	M		M

GR20A1019-Masonry Structures														
COs/POs	a	b	c	d	e	f	g	h	I	j	k	l	PSO's	
													1	2
1. Identify the types of masonry units and Strength and stability of concentrically loaded masonry walls and factors affecting them.	H	H	H	M						M			M	
2. Analyze the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements.	H	H	H	H										H
3. Identify the concept of effective height of walls and columns, effective length, effective thickness of wall and factors affecting them.	H	H	H	H						M				
4. Analyze how to design load bearing masonry walls for buildings up to three stories using IS:1905 andSP-20.	M	H	M	H						M				
5. Explain the concept of reinforced masonry and its applications, and how to bring flexural and compression elements (beams and columns) of reinforced masonry shear walls.	M	H	M	M			M			M		M		H

GR20A1019-CONSTRUCTION EQUIPMENT AND AUTOMATION														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Identify Elements of Community and Environment Likely to Be Affected by The Proposed Developments	M		H			M		M			M	H		H
2. Develop Framework for Environmental Impact Assessment and Understand the Risk Analysis and EIA Methods.	M		H			M						H		M
3. Explain the Importance of Public Participation, Fault Tree Analysis and Consequence Analysis in EIA	M	H	M			M	M						H	M
4. Assess Process of Environmental Impact Modelling and Prediction as A Design Tool.	M	M	M			M							H	
5. Assess the Environmental Monitoring Systems and Legislation. Interact with Experts of Other Fields to Assess the Impact.	M	H	M			M	M				M	M	H	

GR20A1019-Open Channel Flow														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Basics of open channels. Types open channel section velocity, pressure distribution	M			M		M	M						M	
2. Uniform flows, types of equations and types of flows	M			H		M	M					M		M
3. Critical Flow in Open Channel : Energy in open channel flow Specific features ; for critical depth in types of section	M	H	M	M					M				M	
4. Gradually Varied Flow : Types of non uniform flow, Dynamic equation: Governing equation	M	M		M	M	M								M
5. Rapidly Varied Flow : Hydraulic jump application of momentum equation, Types of jumCharacteristics of jump in channels and methods	H	M	M	M		M	M						M	

GR20A1019-GIS LAB														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Describe the fundamental concepts of Geographic Information Science and Technology.	H		M		H		M				M	M	M	
2. Demonstrate proficiency in the basic functions of geospatial software.	H		M		H						M			M
3. Find awareness of fundamental remote sensing and spatial analysis techniques.	H	M	H		H		M				M	M	M	
4. Analyze proficiency in the creation and acquisition of spatial data.	H		M	M	H		M							H
5. Recognize the topo maps prepared by survey of India	H		M		M		M				M	M		

GR20A1019-Environmental Engineering Lab														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Describe the knowledge of physical, chemical and biological parameters of water and their importance.	H			H		M	M			M		M	H	M
2. Develop the social responsibility to eradicate water borne diseases		M	M	H		M	H			M	M	H	H	H
3. Recognize the methods to control environmental pollution	M	M		H		H	H		H	M	M	H	H	H
4. Express water quality parameters in written reports	M		H	H		M	H		M	M	M	H	M	H
5. Generalize the various quality control aspects of industrial effluents by performing the different lab tests		M	H	H		M	H		M	H	H	H	M	H

GR20A1019-Mini Project with seminar														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Choose the problem domain in the specialized area under Civil engineering discipline	H	H	H	H	H	H	M	H	H	M	H	H	M	
2. Acquire and categorize the solution paradigms with help of case studies	H	H	H	H	H	H	M	H	H	M	H	H	M	
3. Design and analyse the problems using selected hardware/software tools and experimental investigations.	H	H	H	H	H	H	M	H	H	M	H	H	H	
4. Execute, Implement, and demonstrate the problem statement by using the selected hardware/software tools and with suitable experimental investigations.	H	H	H	H	H	H	M	H	H	M	H	H	H	
5. Document the reports and deliver the final work with presentation.	H	H	H	H	H	H	M	H	H	M	H	H	M	

GR20A1019-Estimation and Costing														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Estimate the quantities of materials and different types of materials required for different types of Buildings, Roads and Structures.	H	M	M	H	M				H	M		H	H	H
2. Handle the tendering process for executing any civil engineering work.	H	H	M	M					H	H	H	H	M	M
3. Recognize the process and importance of cost estimation, cost budgeting and cost control.	H	H	M	H		M			M	H	M	H	M	M
4. Estimate the rate per unit of any item of work.	H	M		H	M		M	M	M		M	M	M	M
5. Assess the value of any property and Interpret the process and importance of valuation of buildings and other structures.	H		H	H	M	H	M	M	M		M	H	M	M

GR20A1019-ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Identify Elements of Community and Environment Likely to Be Affected by The Proposed Developments.	M	M		M		H	H			M		M	H	
2. Develop Framework for Environmental Impact Assessment and Understand the Risk Analysis and EIA Methods.	M	H	M	H		M	M						H	
3. Explain the Importance of Public Participation, Fault Tree Analysis and Consequence Analysis in EIA	M	H	M	M		M	H						M	H
4. Assess the Process of Environmental Impact Modelling and Prediction as A Design Tool.	M	M	M	M			M			M		M	H	
5. Explain the Environmental Monitoring Systems and Legislation. Interact with Experts of Other Fields to Assess the Impact.	M	M	M	M		M	M			M		M	M	

GR20A1019-TRANSPORTATION ENGINEERING														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Demonstrate the significance of highway alignment and road development	M			M			H			M		H	M	
2. Compute the geometric features of road pertaining to horizontal and vertical alignment	H	H	H		M			M		M		M	M	
3. Illustrate the basic traffic stream parameters and perform basic traffic signal phasing and timing plan.		H			M	H			M		M	M	M	
4. Demonstrate the role of intersections and their significance	H			M	M		M				M			M
5. Analyze and compare the characteristics of Railway and Airport Engineering.		H		H			M			M		M		M

GR20A1019-GROUND IMPROVEMENT TECHNIQUES														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Identify dewatering technique for the field related problem.	M	M	M	M			M						H	H
2. Assess the field problems related to problematic soils by adopting various ground improvement techniques.		H		M		M	M					M	H	H
3. Differentiate reinforced earth retaining structures.	M	M		M			M						H	H
4. Recognize the suitability and practicability required for various ground improvement methods.	M	M	M	M		H	H					M	H	H
5. Assess the importance of extensive research in various ground improvement techniques.	M				M			M	M			H	H	H

GR20A1019-GEOMETRIC DESIGN OF HIGHWAYS														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Analyse the factors influencing road vehicle performance, characteristics and design.	M	M	H	M		H			M	M	M	H	M	M
2. Compute the geometric features of road including horizontal and vertical alignment.	M	M	H	M			H	H	M		H	H	M	
3. Demonstrate the need of intersection planning and design and suggest solutions	H	H					H			M	H	H	M	M
4. Illustrate the importance of geometric design in highway system and suggest measures.	M	H	M	H			H	H			H	H	M	
5. Demonstrate the need for road safety furniture and its importance in highway system	H	H				H	H	H	M		H	H		

GR20A1019-PHYSICO CHEMICAL PROCESSES FOR WATER & WASTEWATER TREATMENT														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Estimate water for domestic and industrial requirement.	M		M	H			M				M	M	M	H
2. Determine the quality of generated sludge by treatment of water and wastewater and various methods for disposal of sludge			M	M		M	H	M	M	M	M	H	M	H
3. Explain methods of disinfection, chlorination – chlorine dose, chlorine demand,	M		M	H		M	H	M	H	M		H	H	M
4. Describe process for removal of oil, grease etc& disposal of skimming			M	M		H	H		H	M		H	H	M
5. Operate and maintain the sedimentation plant	M		H	H			H		M			M	M	H

GR20A1019-INDUSTRIAL STRUCTURES														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Analysis and design of different industrial steel buildings.	M		M			M	H		M		M	H	M	
2. Carryout analysis and design of transmission and communication towers	M	M	H	H			H	H	M		H	H		M
3. Carryout analysis and design of silos and bunkers	H	H			H		H			M	H	H	M	
4. Carryout analysis and design of concrete shell structures	M	H	M	H			H	H			H	H		M
5. Carryout analysis and design of machine foundation		H				H	H	H	M			H		M

R20A1019-REHABILITATION AND RETROFITTING OF STRUCTURES														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Recognize various mechanisms for Structural distress and deterioration	M	H	H	H			H	M			H	M	M	M
2. Learn the measures to prevent corrosion in concrete and steel structures	M	H	H	H		M	H				H	H	H	H
3. Apply the Inspection and Repair methods of distressed concrete and steel structures		H	H	H		M	H	M		M	H	H	H	H
4. Employ the methods of Rehabilitation in distressed concrete and steel structures	M	H	H	H		M	H				H	H	H	M
5. Carry out health monitoring and conditional assessment surveys on concrete and steel Structures		H	H	H		M	H	H		H	H	H	H	M

GR20A1019-SURFACE HYDROLOGY														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Express the different types of hydrology definitions	H			M		M	M						M	M
2. Evaluate the consumptive use, infiltration and evaporation	H	M		M		M	M					M	H	M
3. Compute the discharge in the streams	M	H	M	M					M				M	H
4. Apply the hydrographs for the computing rain fall and run off	H	M		M	M	M							M	H
5. Apply the knowledge of computing flood estimation by various methods	H	H	M	M		M	M	M	M				H	H

GR20A1019-Bridge Engineering														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Explain different types of Bridges with diagrams and Loading standards	H			M			M					M		
2. Carryout analysis and design of Slab bridges and suggest structural detailing	M		M			M	H		M	M		M	H	M
3. Carryout analysis and design of T Beam bridges and suggest structural detailing	M		M			M	H		M	M		H	H	M
4. Carryout analysis and design of Plate girder bridges	M		H			M	H		H	M		H	H	M
5. Carryout analysis and design of substructure, piers and abutments	H	H	M	H		M	H	H				M	H	M

GR20A1019-Tall Buildings														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Understand the components and various types of tall buildings		M	M			M	M	M		M		M	M	
2. Design concepts and material properties used in tall building constructions		M	M		M	M	M	M		M	M	M		H
3. Understanding the behavior of tall buildings subjected to different types of loads		M	M	M	M	M	M	H	M		M	M	M	
4. Analyze the tall buildings with and without shear walls.	H	M	M	H	H	M	M	H	M			M	M	
5. Analyze shear walls with and without openings	M	M	M	H	H	M	M	H	M			M	M	

GR20A1019-Computer Applications in Structural Engineering Laboratory														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Analyze and design the various beams for the different supports and loads.	M	H	H	H		H	M			M	H	H		
2. Analyze and design a Two and Three Dimensional (2D & 3D) frames of Multi-Storied Building with Wind and Seismic loads and load combinations.	M	H	H	H		H	M			M	H	H	M	M
3. Analyze and design a Reinforced Cement Concrete Over Head tank.	M	H	H	H		H	M			M	H	H		
4. Analyze and design the distinct types of Steel Trusses and Industrial Steel Truss	M	H	H	H		H	M			M	H	H	M	M
5. Analyze and design the various types of Steel Beams for the different loads.	M	H	H	H		H	M			M	H	H		

GR20A1019-Project work (Phase I)														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Ability to interpret ideas and thoughts into practice in a project and work in a team	M	H	H	M									M	H
2. Ability to analyze the gap between theoretical and practical knowledge and evaluate the available literature on the chosen problem	M	H	M			M								H
3. Ability to compose technical presentation in the conference and to develop organizational skills and team work						M	M	M	M	H		M	M	
4. Ability to Apply the principles, tools and techniques to solve the problem					M			M	H	H				H
5. Ability to Prepare and present project report		H	H	H	M	M		M	M	H				M

GR20A1019-CONSTRUCTION PROJECT PLANNING & SYSTEMS														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Understand how structures are built and projects are developed on the field	H		H	H	H	M	M	M			M	H	H	M
2. Analyse good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics	H	M	M		M	H	M		H	H	M	H	H	H
3. Plan, control and monitor construction projects with respect to time and cost, and also to Optimise construction projects based on costs	H	H		H	M				H	M	M	H	H	H
4. Remember how construction projects are administered with respect to contract structures and issues.	H	H	H	M		M		H	H		H	H	H	H
5. Put forward ideas and understandings to others with effective communication processes		H	M	H		H	M	M		H	M	H	M	H

R20A1019-Earthquake Engineering														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Identify movements of tectonic plates, and characterize earthquake ground shaking.	H		M			M	H		M		M	H		M
2. Estimate the magnitude & intensity of earthquake	M	M	H	H	M		H	H	M		H	H		M
3. Utilize the principles behind earthquake resistant design of structures	H	H			M		H			M	H	H		
4. Formulate earthquake analysis of multistoried buildings	H	H	M	H			H	H			H	H		M
5. Design earthquake resistant design and ductile detailing of frame members	M	H				H	H	H	M			H	M	

GR20A1019-ENTERPRENEURESHIP & PROJECT MANAGEMENT														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Able to do Project Planning and develop Project Schedules	H	H	M	H						M	M			
2. Capable to identify Critical Path in CPM & PERT Networks; Compute Floats and Slacks for Activities & Events respectively to Progress and Complete the Project in Time.	H	H	M	H										
3. Familiar with Method Statements of various Activities and their ITPs with the Knowledge of Project Quality Plans	M	H		H						M	M		M	M
4. Construction Equipment requirement is known and deploys in best possible manner for better productivity; Conducts Field Tests for Soils at specified frequency.	H	M		H								H		H
5. Broaden the Concept of Entrepreneurship & Social Entrepreneurship; Becomes an Entrepreneur being familiar with Characteristics of Entrepreneurship & Entrepreneurs						H	H			H	H	M	H	H

GR20A1019-Green Building Technology														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Correlate the underlying principles, history, environmental and economic impacts of green building technology and to identify the criteria for rating systems along with the established Indian codes and guidelines		M	H	H		M	H	M					H	
2. Identify various Renewable and Non-renewable sources of energy along with their carbon foot prints and building modeling and energy analysis, monitoring and metering.							H	M	H	M			M	
3. Recognize the energy efficient green building materials and the cost-effective Building Technologies and materials with low embodied energy and incorporate them into design.	M			M		M	H					M	H	H
4. Explain the application of design guidelines of Green Building considering the Energy Conservation Measures. Perform cost/benefit analysis and life-cycle analysis of green buildings.	H	M		M			M		M		H		M	M
5. Explain broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course		H	H	H		M	M	M		M		M	H	M

GR20A1019-PAVEMENT DESIGN														
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO's	
													1	2
1. Illustrate highway design methods, constraints and controlling factors.	M		H		M	H		M		H		M	M	
2. Apply the design standards in designing principal elements of the highway.		H		H			M			M		M		M
3. Predict the resource constraints and utilize the available materials in a sustainable way.						H	H			H	M	H	M	H
4. Examine the basic parameter of traffic engineering and the methods which help to estimate those parameters.		M		H	H	H			M	H				
5. Recognize the major failure modes of flexible and rigid pavement and helps in maintaining them properly	H	H					M	M		H		H		M

GR20A1019-PAVEMENT MATERIALS														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Characterize the soil based on the geotechnical properties and justify the applicability.	M			H		H	M	M		H	L	M		M
2. Analyze the engineering properties of aggregates and customizing for application under various field situations	H	M		H		M	H	M		H		L		M
3. Characterize the bitumen based on the properties and justify the applicability.	L		M			M	M		L	M		L		M
4. Select appropriate asphalt binder for construction of a flexible pavement depending upon the traffic and climatic conditions.	M		M		L	M	H		L	M		L	M	
5. Analyse Cement & Cement Concrete Mix characterization and application in various pavements.	H	M		M	L	M	H	M		H	L	L	M	

GR20A1019-PRESTRESSED CONCRETE														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Examine the transfer and development length as well as pre-stress losses.	H		M		M	M	H		M		M	H	M	M
2. Demonstrate the design calculations to predict service behaviour of pre-stressed concrete structures, accounting for the time-dependent effects of concrete creep and shrinkage	M	M	H	H			H	H	M		H	H		
3. Design for ultimate strength of pre-stressed concrete structures	H	H			H		H			M	H	H	H	M
4. Illustrate the pre-stressed concrete structures to satisfy relevant Design Standards	M	H	M	H			H	H			H	H	M	H
5. Evaluate the pre-stressed concrete fabrication and construction process		H				H	H	H	M			H	M	

GR20A1019-URBAN TRANSPORTATION PLANNING														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Comprehend the urban travel demand and independent variables	H	H		M	H		M			H		M		
2. Analyze the traffic surveys and trip generations modules	H	H		H	M				M	M			M	
3. Assess analyze and study the trip distribution factors and mode choice analysis	H	H	M	H	M					M		M		
4. Evaluate the traffic assignment methods and plans		M	M	H		M				M		M	M	
5. Understand and device short term and long term plans				H			H	M			H	H	H	

GR20A1019-Design of Hydraulic Structures														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. fix the capacity of reservoir by mass curve method and design different types of irrigation channels	M	H	H	H	H	H	H					H		H
2. estimate the forces acting on Gravity Dams and assess the stability of the gravity dam.	M	H	H		H	M	H					H		H
3. apply the principles of design of the earthen dams and Ogee Spillways	M	H	H		H	M	H					H	M	M
4. design various diversion head works by using Bligh's and Khosla's theory.	M	H	H		H	M	H					H		H
5. design of various hydraulic structures like canal falls, canal regulator works and Cross drainage Works along with their suitability& explain the components of Hydroelectric schemes.	H	H	M	H	H	M	H					H	H	H

GR20A1019-Project work (Phase II)														
COs/POs	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**PSO's**	
													1	**2**
1. Ability to interpret ideas and thoughts into practice in a project and work in a team	M	H	H	M									M	H
2. Ability to analyze the gap between theoretical and practical knowledge and evaluate the available literature on the chosen problem	M	H	M			M								H
3. Ability to compose technical presentation in the conference and to develop organizational skills and team work						M	M	M	M	H		M	M	
4. Ability to Apply the principles, tools and techniques to solve the problem					M			M	H	H				H
5. Ability to Prepare and present project report		H	H	H	M	M		M	M	H				M

14. Assessment Methods

Assessment

"Assessment is the systematic collection, review and use of the information about educational programs undertaken for the purpose of improving student learning and development"

Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the objective or outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

Assessment Methods and Tools

Following are some possible Program-level (P) and Course-level(C) Assessment Methods and Tools. These Methods and Tools are used to assess Program Educational Objectives (PEOs), Program Outcomes (POs) and Course Outcomes (COs).

Title of the Feedback Form	Periodicity
Program Exit Survey	Every Year by final year students for each program
360 Degree Survey	Every Year by Faculty and Students
Student Feedback on Faculty	Three times in a Semester by the Students
Course Exit Feedback	Once, after End of the Course by the Faculty
Consolidated Course Feedback	Once, after End of the Course by the Faculty
Alumni Feedback	Whenever available by the Students
Employer Feedback	Whenever available by the Employer
Parent Feedback	Whenever available by the Parent

Choose some of the above assessment methods at program-level (P) and course-level (C) most suitable to your Course. For I, II &III year B.Tech Courses choose mostly from course-level(C) assessment methods. For IVth year B.Tech Courses choose from both program-level (P) and course-level (C) assessment methods.

Direct Measures

Direct measures provide for the direct examination or observation of student knowledge or skills against measurable learning outcomes.

Indirect Measures

Indirect measures are those that ascertain the opinion or self-report of the extent or value of learning experiences.

Written Surveys and Questionnaires

Asking individuals to share their perceptions about the program (e.g.theirown or others skills/attitudes/behaviour, or program/course qualities and attributes)

Exit and other Interviews

Asking individuals to share their perceptions about the program (e.g. their own skills/attitudes, skills and attitudes of others, or program qualities) in a face-to-face dialog with an interviewer

-Generally indirect measure

-Interview could be crafted to include elements of direct measures

Locally developed exams

Objective (includes true/false, fill in the blank, matching, and multiple choice question) and/or subjective (open-ended require students to write) tests designed by faculty of the program

- Most common at class room level
- Direct measure of student learning
- Can be specific to performance indicators for the learning outcomes
- Can be difficult to get faculty agreement on questions related to outcomes

Focus Groups

Group discussions conducted by a trained moderator with participants to identify trends/patterns in perceptions

- Indirect method that can provide valuable informationabout student perceptions and experiences
- Can be used to provide insights about student responses on other assessments
- Results cannot be generalized to entire cohort

Portfolios

Collections of student work which is archived and rated for level of attainment using scoring rubrics. The design of a portfolio is dependent upon how the scoring results are going to be used.

- Direct measure of student learning
- Possible to measure more than one learning outcome at one time (e.g.,writing and use of technology)
- Course management systems often support portfolio development

Simulations (Competency-Based Measure)

A person's abilities are measured in a situation that approximates a “real world” world setting

- Direct measure of student learning
- Need well defined outcomes with appropriate tasks
- Can be designed for individuals and groups of Students

Performance Appraisals

Systematic measurement of the demonstration of acquired skills through direct observation

- Provides a direct measure of student abilities to apply what has been learned
- Internships and co-op experiences provide a good setting for data collection
- Need to be focused data collection process
- Those who are in a position to make judgment
- Well-constructed instrument for data collection

External Examiner

Using an expert in the field from outside the program (usually from a similar program at the institution) to conduct, evaluate, or supplement assessment of your students

- Generally a direct measure of student learning (if they assess against specific competencies)

- Outsider scan "see" attributes to which insiders have grown accustomed
- Evaluators may haves kills, knowledge, or resources not otherwise available

Oral Exams

An assessment of student knowledge levels through a face-to-face dialogue face to between the student and examiner usually faculty

- Direct measure of student learning
- Content and style can be geared to specific learning outcome sand characteristics of the program, curriculum, etc.
- May not be allowed by institution who have concerns about pressure on students

Behavioural Observations

Measuring the frequency, duration, relationships, etc. of student actions, usually in a natural setting with non-interactive methods (e.g.formal or informal observations in a classroom).

- Direct measure of student behaviour
- Observations are most often made be an individual and can be augmented by audio or video tape.
- Requires experienced observers.

Rubrics and Mapping

Rubric is a tool that helps to make subjective measurements as objective, clear and consistent as possible by defining the criteria on which performance should be judged.

A tool often shaped like a matrix, with criteria on one side and levels of achievement across the top used to score products or performances. Rubrics describe the characteristics of different levels of performance, often from exemplary to unacceptable. The criteria are ideally explicit, objective, and consistent with expectations for student performance.

Rubrics may be used by an individual or in multiple to judge student work. Rubrics are meaningful and useful when shared with students before their work is judged so they better understand the expectations for their performance.

EXAMPLE OF RUBRIC

OBJECTIVE: Work effectively with others
STUDENT OUTCOME: Ability to function in a multi-disciplinary team

Representative Student's Name:					
Level	**Beginner**	**Developing**	**Acceptable**	**Exemplary**	**Score**
performance Measure	**(2M)**	**(3M)**	**(4M)**	**(5M)**	
Spontaneity(20)	Monotonous, Rate of speech too fast or too slow.	Uneven rate, only little expression.	Steady rate, excessively rehearsed.	Steady rate, enthusiasm, confidence.	
Communication skills (20)	Significant mumbling and incorrect pronunciation of terms. Voice level too low or too high.	Occasional mispronunciation of terms.	Voice is clear and at a proper level. Most words pronounced correctly.	Clear voice and correct, precise pronunciation of terms.	
Critical Thinking(20)	Is unable to predict problem outcomes for the given input data set.	Is able to predict but can't solve problem outcomes for the given input data set.	Approximately predicts and Defends problem outcomes	Can predict and defend problem outcomes	
Problem solving ability(20)	Is neither understand the concept nor mapping of theory concepts with practical problem solving Approaches.	Is able to under the concept but Improper mapping of theory concepts with practical problem solving Approaches.	Moderate mapping of theory concepts with practical problem solving approaches.	Efficient mapping of theory concepts with practical problem solving Approaches.	
Knowledge (20)	No grasp of information. Unable to answer questions about subject.	Uncomfortable with information. Capable only of answering rudimentary questions.	At ease with content and able to elaborate and explain to some degree.	Demonstration of full knowledge of the subject with explanations and elaboration.	

Mapping

Mapping is the process of representing preferably in matrix form, the correlation among the parameters such as PEOs, POs, COs, etc.

Evaluation

Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program educational objectives and student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement. Evaluation gives value judgment. It is a statement about quality.

Grading

It is a process of evaluating students, ranking and distributing each student value across a scale. Typically, grading is done at the course level. Grades can be numeric or descriptive or both. Grading is focused on strengths and weaknesses in each individual student's learning for use by each student.

Accreditation Criteria

The assessment and evaluation process of accreditation of an engineering program is based on broad Criteria and specific Criteria. An engineering program to be accredited or re-accredited has to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the program and seek to improve the standards and quality continually and address deficiencies if any aspect falls short of the standards set by the accreditation criteria. During the full term of accreditation, the institutions are required to submit their annual self-assessment report to NBA.

Criteria-1. Vision, Mission and Program Educational Objectives
Criteria-2. Program Outcomes
Criteria-3. Program Curriculum
Criteria-4. Students Performance
Criteria-5. Faculty Contributions
Criteria-6. Facilities and Technical Support
Criteria-7. Academic Support Units and Teaching-Learning Process
Criteria-8. Governance, Institutional Support and Financial Resources
Criteria-9. Continuous Improvement

15. Program Outcomes – Competencies – Performance Indicators

The following table gives a list of competencies and associated performance indicators for each of the PO in B.Tech Civil Engineering Program.

PO 1: Engineering knowledge: Apply knowledge of mathematics, science and fundamentals of Civil Engineering.			
Competency		**Indicators**	
1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply mathematical techniques such as calculus, linear algebra and statistics to solve problems
		1.1.2	Apply advanced mathematical techniques to model and solve Civil engineering problems
1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply fundamental engineering concepts to solve engineering problems
PO 2: Problem analysis: Analyse problem and interpret the data.			
Competency		**Indicators**	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Articulate problem statements and identify objectives
		2.1.2	Identify engineering systems, variables and parameters to solve the problems
		2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe complex problems into interconnected sub-problems
		2.2.2	Identify, assemble and evaluate information and resources
		2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution processes to select the best process
2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy.
		2.3.2	Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.

2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Apply engineering mathematics and computations to solve mathematical models
		2.4.2	Produce and validate results through skilful use of contemporary engineering tools and models
		2.4.3	Identify sources of error in the solution process and limitations of the solution.
		2.4.4	Extract desired understanding and conclusions consistent with objectives and limitations of the analysis
PO 3: Design/Development of Solutions: Design a system component, or process to meet desired needs in Civil Engineering within realistic constraints.			
Competency		**Indicators**	
3.1	Demonstrate an ability to define a complex / open-ended problem in engineering terms	3.1.1	Recognize that need analysis is key to good problem definition
		3.1.2	Elicit and document the engineering requirements
		3.1.3	Synthesize engineering requirements from a review of the state-of-the-art
		3.1.4	Extract engineering requirements from relevant engineering Codes and Standards such as ASCE, ASTM, BIS, ISO, etc.
		3.1.5	Determine design objectives, functional requirements and arrive at specifications
3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Build models/prototypes to develop diverse set of design solutions
		3.2.2	Identify suitable criteria for evaluation of alternate design solutions
3.3	Demonstrate an ability to select optimal design scheme for further development	3.3.1	Apply formal decision making tools to select optimal engineering design solutions for further development
		3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Refine a conceptual design into a detailed design within the existing constraints (of the resources)
		3.4.2	Generate information through appropriate tests to improve or revise design

PO 4: Conduct investigations of complex problems: Identify, formulate, analyse and interpret data to solve Civil Engineering problems.			
Competency		**Indicators**	
4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem, its scope and importance for purposes of investigation
		4.1.2	Examine the relevant methods and techniques of experiment design, system calibration, data acquisition, analysis and presentation
		4.1.3	Establish a relationship between measured data and underlying physical principles.
4.2	Demonstrate an ability to design experiments to solve open ended problems	4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures
		4.2.2	Understand the importance of statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3	Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data
		4.3.2	Analyze data for trends and correlations, stating possible errors and limitations
		4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
		4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
PO 5: Modern tool usage: Use modern engineering tools such as CAD and GIS for the Civil Engineering practice.			
Competency		**Indicators**	
5.1	Demonstrate an ability to identify / create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools such as CAD, modelling and analysis, techniques and resources for engineering activities
		5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2	Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulating, (iii) monitoring system performance and (iv) creating engineering designs.
		5.2.2	Demonstrate proficiency in using discipline specific tools

5.3	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1	Discuss limitations and validate tools, techniques and resources
		5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
PO 6: The engineer and society: Understand the impact of engineering solutions in a global, economic and societal context.			
Competency		**Indicators**	
6.1	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, economic, health, safety, legal and public welfare	6.1.1	Identify and describe various engineering roles, particularly as pertains to protection of the public and public interest at global, regional and local level
6.2	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its importance and contribution
PO 7: Environment and sustainability: Understand the effect of Civil Engineering solutions on environment and to demonstrate the need for sustainable development.			
Competency		**Indicators**	
7.1	Demonstrate an understanding of the impact of engineering and industrial practices on environmental and sustainable contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering activity
		7.1.2	Understand the relationship between the technical and environmental dimensions of sustainability
7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Understanding of professional and ethical responsibility.			
Competency		**Indicators**	
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives

8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the ASCE professional code of ethics
		8.2.2	Examine and apply moral & ethical principles to known case studies
PO 9: Individual and team work: Work effectively as an individual or in a team and to function on multi-disciplinary context.			
Competency		**Indicators**	
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences, appreciate the value of diversity on a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2	Demonstrate effective individual and team operations like communication, problem solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
		9.2.2	Treat other team members respectfully
		9.2.3	Listen to other members, maintain composure in difficult situations
9.3	Demonstrate success in a teambased project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts
PO 10: Communication: Communicate effectively with engineering community and society.			
Competency		**Indicators**	
10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed and well-supported written engineering documents
		10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions and viewpoints of others
		10.2.2	Deliver effective oral presentations to technical and non- technical audiences
10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

PO 11: Project management and finance: Demonstrate the management principles in Civil Engineering projects.			
Competency		**Indicators**	
11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity
		11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1	Analyse and select the most appropriate proposal based on economic and financial considerations.
11.3	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
		11.3.2	Use project management tools to schedule an engineering project so that it is completed on time and on budget.
PO 12: Life-long learning: Recognize the need for and an ability to engage in life-long learning.			
Competency		**Indicators**	
12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for requirement for continuing professional development
		12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2	Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
		12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3	Demonstrate an ability to identify and access sources for new information	12.3.1	Source and comprehend technical literature and other credible sources of information
		12.3.2	Analyse sourced technical and popular information for feasibility, viability, sustainability, etc.

16. Model Question paper with CO, BT and PI

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Department of Civil Engineering

I B.Tech II Semester Regular Examinations, August 2021

ENGINEERING MECHANICS
(Civil Engineering)

Time : 3hours **Max Marks: 70**

Instructions:

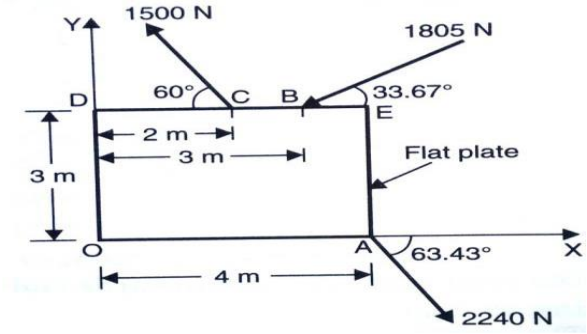
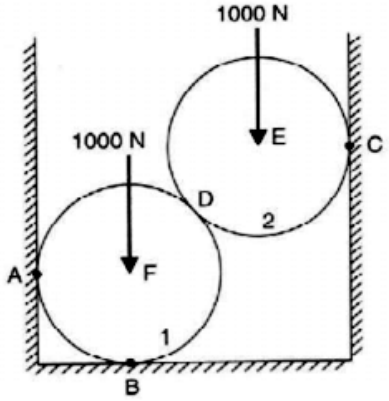
1. Question paper comprises of **Part-A** and **Part-B**
2. **Part-A** (for 20 marks) must be answered at one place in the answer book.
3. **Part-B** (for 50 marks) consists of **five questions with internal choice,** answer all questions.

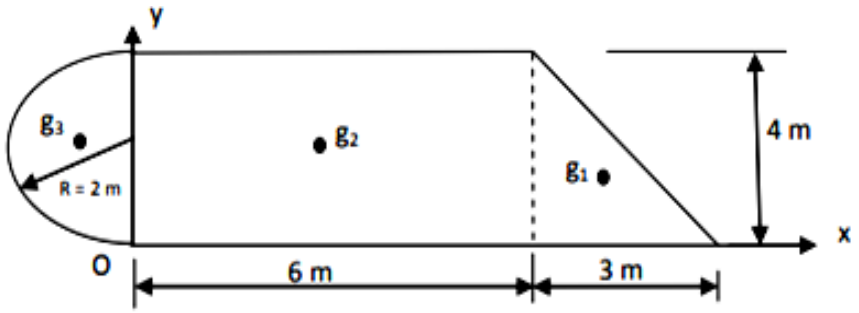
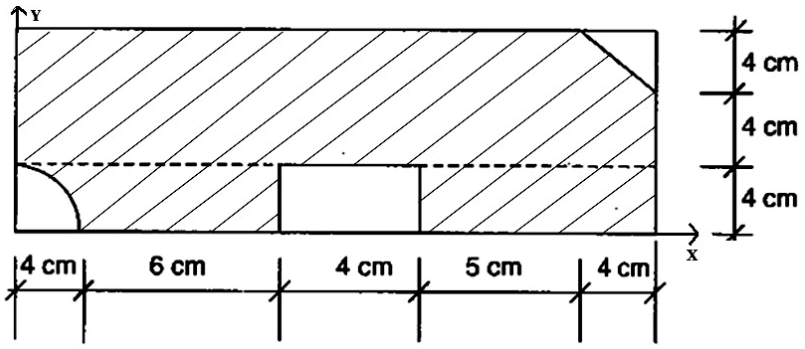
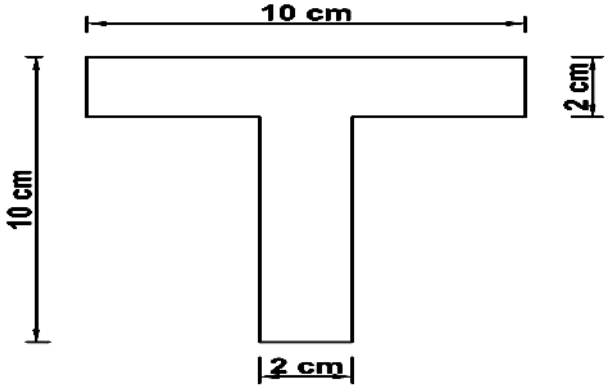
PART – A
Answer ALL questions. All questions carry equal marks.***10 * 2 Marks = 20 Marks**

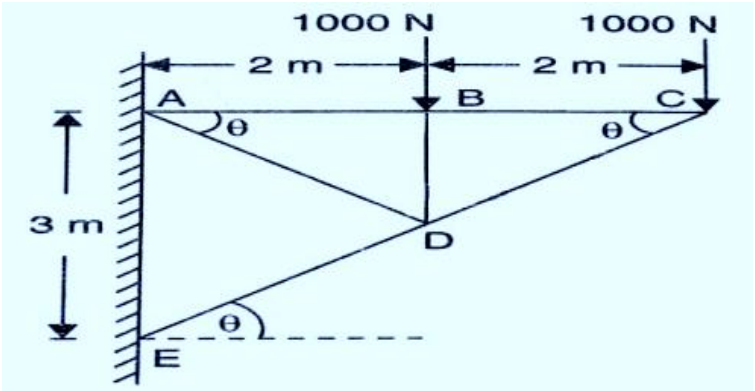
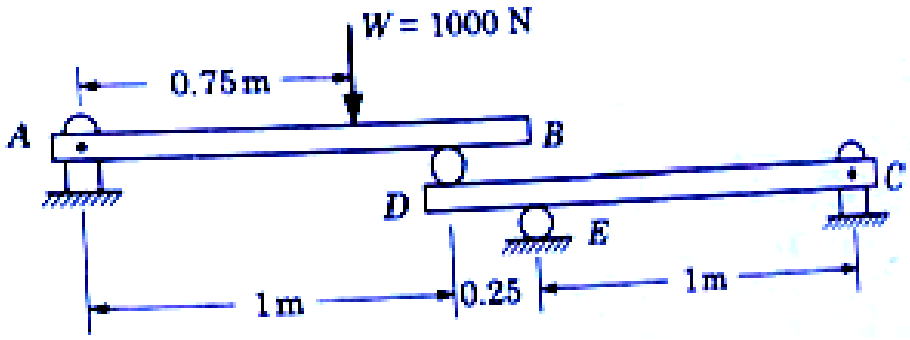
		Marks	CO	BL	PI
1.a.	Define 'moment' and 'couple moment'.	**[2]**	**1**	**1**	**1.3.1**
b.	State Lami's theorem.	**[2]**	**1**	**2**	**1.3.1**
c.	Define 'angle of friction' and 'coefficient of friction'	**[2]**	**2**	**1**	**1.2.1**
d.	Differentiate centroid and centre of gravity.	**[2]**	**2**	**4**	**1.2.1**
e.	State perpendicular axis theorem.	**[2]**	**3**	**4**	**1.3.1**
f.	Define the terms 'moment of inertia' and 'radius of gyration'	**[2]**	**2**	**1**	**1.3.1**
g.	What are the assumptions of analysis of trusses?	**[2]**	**4**	**1**	**2.3.2**
h.	What are the applications on principle of virtual work?	**[2]**	**4**	**1**	**1.3.1**
i.	What do you mean by rectilinear motion?	**[2]**	**5**	**1**	**2.3.1**
j.	State the Principle of Conservation of Momentum.	**[2]**	**5**	**2**	**1.3.1**

PART – B

Answer any FIVE questions. All questions carry equal marks. 5 * 10 Marks = 50 Marks

2	a) State parallelogram law of forces	**[5]**	**1**	**2**	**3.1.1**
	b) The following figure shows the coplanar system of forces acting on a flat plate. Determine the magnitude of the resultant and the direction of the resultant.  **OR**	**[5]**	**1**	**6**	**3.4.1**
3	a) **)** What are the equations of equilibrium of coplanar force systems?	**[5]**	**1**	**1**	**4.1.1**
	b) Two spheres, each of weight 1000N and radius 25cm rest in a horizontal channel of width 90 cm as shown in the figure. Find the reactions on the points of contact A, B and C.  	**[5]**	**1**	**1**	**3.2.2**
4	a) State the laws of friction.	**[5]**	**2**	**2**	**1.3.1**
	b) An effort of 200 N is required just to move a certain body up on an inclined plane of angle 15 degrees, the force acting parallel to the plane. If the angle of inclination of the plane is made 20 degrees, the effort required again applied parallel to the plane is found to be 230 N. Find the weight of the body and co-efficient of friction.	**[5]**	**2**	**1**	**2.3.1**

	OR				
5	a) What is the concept of first moment with respect to X and y axes? .	**[5]**	**2**	**1**	**3.1.5**
	b) Find the centroid of the section given in the figure below. 	**[5]**	**2**	**1**	**2.4.1**
6	Determine the moment of inertia about centroidal axes of the shaded area shown in figure given below.  **OR**	**[10]**	**3**	**6**	**2.4.1**
7	Determine the M.I. of the section shown in the figure about the centroidal X and Y axes. 	**[10]**	**3**	**6**	**2.4.1**

8	Determine the forces in all the members of a cantilever truss shown in the following figure.  **OR**	**[10]**	**4**	**6**	**2.4.1**
9	Two beams AB and CD are arranged and supported as shown as shown in figure. Find the reaction at E if a load W of 1000 N acts as shown.  	**[10]**	**4**	**1**	**2.4.1**
10	a) A motorist takes 10 seconds to cover a distance of 20 m and 15 seconds to cover a distance of 40 m. Determine the uniform acceleration of the car and the velocity at the end of 15 seconds.	**[5]**	**5**	**6**	**4.1.1**
	b) An automobile track is so designed that when a car travels at 100 km/hour, the force between the car and track acts normal to the surface of the track. Find the angle of banking the track assuming it to be a circle of radius 250 m. **OR**	**[5]**	**5**	**1**	**3.1.5**

11	a). A bullet of mass 25 g is fired with a velocity of 500 m/s into a wooden block resting against a rigid vertical wall. If the bullet is brought to rest in 0.5 m. Determine the average impulsive force exerted by the bullet on the block.	**[5]**	**5**	**6**	**2.3.2**
	b). A sphere of mass 4 kg moving with a velocity of 5 m/s overtakes a sphere of mass 3 kg moving with 4 m/s. If a direct impact takes place find their velocity after the impact. Assume e = 0.5.	**[5]**	**5**	**1**	**2.4.1**