Study & Evaluation Scheme of Bachelor of Technology in Civil Engineering

[Applicable for 2019-23]

Version 2019.

[As per CBCS guidelines given by UGC]

Approved in BOS	Approved in BOF	Approved in Academic Council
07/06/2019	18/06/2019	13/07/2019 Vide Agenda No 2.4

Quantum University, Roorkee
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Website: www.quantumuniversity.edu.in

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22 KM Milestone, Dehradun-Roorkee Highway, Roorkee (Uttarakhand)

Study &Evaluation Scheme

Study Summary

Name of the Faculty	Faculty of Technology
Name of the School	Quantum School of Technology
Name of the Department	Department of Civil Engineering
Program Name	Bachelor of Technology in Civil Engineering
Duration	4 Years
Medium	English

Evaluation Scheme

Type of Papers	**Internal Evaluation (%)**	**End Semester Evaluation (%)**	**Total (%)**
Theory	40	60	100
Practical/Dissertations/Project Report/Viva-Voce	40	60	100
Internal Evaluation Components(Theory Papers)			
Sessional Examination I	50Marks		
Sessional Examination II	50Marks		
Assignment–I	25Marks		
Assignment-II	25Marks		
Attendance	50Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	25Marks		
Quiz Two	25Marks		
Quiz Three	25Marks		
Lab Records/Mini Project	75Marks		
Attendance	50Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	30Marks		
ESE Practical Examination	50Marks		
Viva-Voce	20Marks		

Structure of Question Paper (ESE Theory Paper)

The question paper will consist of 5 questions, one from each unit. Student has to Attempt all questions. All questions carry 20 marks each. Parts a) and b) of question Q1 to Q5 will be compulsory and each part carries 2 marks. Parts c), d) and e) of Q1 to Q5 Carry 8 marks each and the student may attempt any 2 parts.

Important Note:

1. *The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy). The standard of question paper will be based onmapped BL level complexity of the unit of the syllabus, which is the basis of CO attainment model adopted in the university.*

2.Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy)for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.

3. There shall becontinuous evaluation of the student and there will be a provision ofreal time reporting on QUMS. All the assignments will evaluated through module available on ERP for time and access management of the class.

Program Structure – Bachelor of Technology in Civil Engineering

Introduction

Bachelor of Technology in Civil Engineering syllabus is broad and multidisciplinary consists of various courses in Structural Engineering, Environmental Engineering, Geotechnical Engineering, Transportation Engineering, Construction Engineering, Urban and Community Planning apart from supporting courses in Basic Sciences, Humanities, and Agricultural Engineering.

The Bachelor of Technology in Civil Engineering subjects are designed in such a way that students grasp all the knowledge related to Civil Engineering and environmental science. Towards enhancing employability and entrepreneurial ability of the graduates the Quantum University increase the practical content in the courses wherever necessary. The total number of credit hours is 8 semesters including Student READY programme will range from 175 to 187 for all the programmes.

In order to harness regional specialties and to meet region-specific needs the Quantum University modify the content of syllabus as per the regional demands and needs The Quantum University offering the specializations like majoring in Structural Engineering, Geotechnical Engineering, Transportation Engineering, Environmental Engineering, Water Resource Engineering.

SUMMER CAMP: This program will be undertaken by the students for a total duration of 02 weeks with a weightage of 2 credit. It will consist of general orientation and outside-campus training in hilly location. The students would be attached with the sloppy terrain to get an experience of the environment and working. Due weightage in terms of credit hours will be given depending upon the duration of stay of students in the camp. At the end of survey camp, the students will be given one week for project report preparation, presentation and evaluation.

The students would be required to record their observations in field on daily basis and will prepare their project report based on these observations.

Curriculum (19-23) Version 2019.01

Quantum School of Technology

Department of Civil Engineering

Bachelor of Technology in Civil Engineering– **PC: 01-3-10**

BREAKUP OFCOURSES

Sr. No	CATEGORY	CREDITS	
1	Foundation Core (FC)	40	
2	Program Core (PC)	72	
3	Program Electives (PE)	15	
4	Open Electives (OE)	9	Minor 9
5	Project	14	
6	Internship	5	
7	Value Added Programs (VAP)	12	
8	General Proficiency	7	
9	Disaster Management*	2*	
TOTAL NO. OF CREDITS		174	
TOTAL NO. OF CREDITS (with minor)		181	

*Non-CGPA Audit Course

DOMAIN-WISE BREAKUP OF CATEGORY

Domain	Foundation core	Program core	Program elective	Sub total	%age
Sciences	12	-	-	12	6.97
Humanities	5	-	-	5	2.9
Engineering	23	91	15	129	73.8
Open elective				9	5.23
VAP				12	6.97
GP				7	4.06
Disaster Management*				2*	0.0
Grand Total	**40**	**91**	**15**	**174**	**100**

#Credits of projects and internships included

*Non-CGPA Audit Course

SEMESTER-WISE BREAKUP OF CREDITS

SrNo	CATEGORY	SEM 1	SEM 2	SEM 3	SEM 4	SEM 5	SEM 6	SEM 7	SEM 8	TOTAL
1	Foundation Core	20	20	-	-	-	-	-	-	40
2	Program Core	-	-	20	16	15	12	9	-	72
3	Program Electives	-	-	-	-	-	3	6	6	15
4	Open Electives	-	-	-	3 (+3M)	3 (+3M)	3 (+3M)	-	-	9 (+9M)
5	Projects	-	-	2	2	2	2	2	4	14
6	Internships	-	-	1	-	2	-	2	-	5
7	VAPs	1	1	1	1	2	4	2	-	12
8	GP	1	1	1	1	1	1	1	-	7
9	Disaster Management*									2*
	TOTAL	**22**	**22**	**25**	**23**	**25**	**25**	**22**	**10**	**174**

H- Honors program M- Minor Program *Non-CGPA Audit Course

Minimum Credit Requirements:

B. Tech.: = 172Credits
With Minor: 172 +09 = 181 Credits

SEMESTER 1

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3102	FC	Mathematics I	3	2	0	4	1.0	Nil
PS3101	FC	Human Values and Ethics	2	0	0	2	1.0	Nil
CS3101	FC	Basics of Computer and C Programming	4	0	0	4	1.1	Nil
EC3101	FC	Basic Electrical and Electronics Engineering	3	0	0	3	1.1	Nil
EG3102	FC	Professional Communication	2	0	0	2	1.0	Nil
CS3140	FC	Basics of Computer and C Programming Lab	0	0	2	1	1.0	Nil
EG3140	FC	Professional Communication Lab	0	0	2	1	1.0	Nil
EC3140	FC	Basic Electrical and Electronics Engineering Lab	0	0	2	1	1.0	Nil
ME3141	FC	Engineering Graphics	0	0	4	2	1.0	Nil
VP3101	VAP	Personality Development Program	0	0	2	1	1.0	Nil
GP3101	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**14**	**2**	**12**	**22**		

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SEMESTER 2

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3202	FC	Mathematics II	3	2	0	4	1.0	Nil
PH3101	FC	Engineering Physics	2	2	0	3	1.0	Nil
CY3205	FC	Environmental Studies	2	0	0	2	1.0	Nil
ME3102	FC	Basic Mechanical Engineering	3	0	0	3	1.0	Nil
CS3207	FC	Advance Computer Programming & Software	4	0	0	4	1.0	Nil
PH3140	FC	Engineering Physics Lab	0	0	2	1	1.0	Nil
CS3245	FC	Advance Computer Programming & Software Lab	0	0	2	1	1.0	Nil
ME3140	FC	Workshop Practice	0	0	3	2	1.0	Nil
VP3201	VAP	Value Added program II/ Communication and Soft Skills	0	0	2	1	1.0	Nil
CE3101		Disaster Management*	2	0	0	2*	1.0	Nil
GP3201	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**16**	**4**	**9**	**22**		

*Non-CGPA Audit Course

Contact Hrs. 29

SEMESTER 3

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3301	PC	Hydraulic and Hydraulic Machines	3	0	0	3	1.0	Nil
CE3304	PC	Building Technology	3	0	0	3	1.0	Nil
CE3306	PC	Basics of Ground Surveying	3	2	0	4	1.0	Nil
CE3307	PC	Basics of Geology	2	2	0	3	1.0	Nil
ME3308	PC	Strength of Materials	2	2	0	3	1.0	Nil
CE3340	PC	Hydraulic and Hydraulic Machines Lab	0	0	2	1	1.0	Nil
CE3343	PC	Building Technology Lab	0	0	2	1	1.0	Nil
CE3346	PC	Basics of Ground Surveying Lab	0	0	2	1	1.0	Nil
ME3344	PC	Strength of Materials Lab	0	0	2	1	1.0	Nil
CE3344	P	Project Lab I	0	0	4	2	1.0	Nil
VP3301	VAP	Value Added Program - III	0	0	2	1		
CE3370	FW	Internship Presentation I	1	0	0	1		
GP3301	GP	General Proficiency	0	0	0	1		
	Total		**14**	**6**	**14**	**25**		

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SEMESTER 4

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3401	PC	Design of RC Elements	3	2	0	4	1.0	ME3308
CE3402	PC	Concrete Technology and NDT	3	0	0	3	1.0	Nil
CE3403	PC	Structural Analysis	2	1	0	3	1.0	CE3308
CE3406	PC	Ground Surveying	3	0	0	3	1.0	CE3306
CE3441	PC	Concrete Technology and NDT lab	0	0	2	1	1.0	Nil
CE3442	PC	Structural Analysis lab	0	0	2	1	1.0	Nil
CE3445	PC	Ground Surveying lab	0	0	2	1	1.0	Nil
CE3444	P	Project lab II	0	0	4	2	1.0	Nil
	OE	Open Elective I	3	0	0	3		
VP3401	VAP	Value Added Program - IV	0	0	2	1		
GP3401	GP	General Proficiency	0	0	0	1		
	Total		**14**	**3**	**12**	**23**		

All students are required to attend two weeks survey camp after 4th semester. Performance of this camp will be evaluated and awarded in 5th semester.

Open Elective I

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3011	OE	Carbon Emission & Control	3	0	0	3	1.0	Nil
CS3021	OE	Mining and Analysis of Big data	3	0	0	3	1.0	Nil
AG3011	OE	Ornamental Horticulture	3	0	0	3	1.0	Nil
BB3011	OE	Entrepreneurial Environment in India	3	0	0	3	1.0	Nil
JM3011	OE	Media Concept and Process (Print and Electronic)	3	0	0	3	1.0	Nil
HM3011	OE	Indian Cuisine	3	0	0	3	1.0	Nil
MB3011	OE	SAP 1	3	0	0	3	1.0	Nil
EG3011	OE	French Beginner A1	3	0	0	3	1.0	Nil
MT3011	OE	Elementary Robotics	0	0	5	3	1.0	Nil

SEMESTER -5

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3501	PC	Advance Structural Analysis	2	2	0	3	1.0	CE3403
CE3503	PC	Design of Steel Structures	2	2	0	3	1.0	Nil
CE3504	PC	Transportation Engineering	3	0	0	3	1.0	Nil
CE3507	PC	Soil Mechanics	3	2	0	4	1.0	Nil
CE3541	PC	Geology and Soil Mechanics lab	0	0	2	1	1.0	Nil
CE3542	PC	Transportation Engineering lab	0	0	2	1	1.0	Nil
	OE	Open Elective II	3	0	0	3		-
CE3543	P	Project lab V	0	0	4	2		-
VP3501	VAP	Employability Skills - II (Aptitude and Reasoning)	2	0	0	2		-
CE3571	FW	Survey Camp	2	0	0	2		-
GP3501	GP	General Proficiency	0	0	0	1		-
	Total		**17**	**6**	**8**	**25**		

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Open Elective II

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3013	OE	Environment Pollution and Waste Management	3	0	0	3	1.0	Nil
CS3023	OE	Big Data Analytics: HDOOP Framework	3	0	0	3	1.0	Nil
AG3013	OE	Organic farming	3	0	0	3	1.0	Nil
BB3013	OE	Establishing a New Business	3	0	0	3	1.0	Nil
JM3013	OE	Photo Journalism	3	0	0	3	1.0	Nil
HM3013	OE	Chinese Cuisine	3	0	0	3	1.0	Nil
MB3013	OE	SAP 3	3	0	0	3	1.0	Nil
EG3013	OE	French Intermediate B1	3	0	0	3	1.0	Nil
EG3002	OE	Report Writing	3	0	0	3	1.0	Nil
MT3013	OE	Introduction to Automation	3	0	0	3	1.0	Nil

SEMESTER -6

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3601	PC	Environmental Engineering	3	0	0	3	1.0	Nil
CE3602	PC	Design of Concrete Structures	3	2	0	4	1.0	CE3501
CE3603	PC	Foundation Engineering	3	0	0	3	1.0	CE3507
CE3640	PC	Environmental Engineering Lab	0	0	2	1	1.0	Nil
CE3641	PC	Foundation Engineering lab	0	0	2	1	1.0	Nil
CE3643	VAP	Technical VAP I	2	0	0	2	1.0	Nil
CE3608	PE	Program Elective I	3	0	0	3		
	OE	Open Elective III	3	0	0	3		
CE3642	P	Project lab IV	0	0	4	2		
VP3601	VAP	Value Added Program VI	2	0	0	2		
GP3601	GP	General Proficiency	0	0	0	1		
	Total		**19**	**2**	**8**	**25**		
All students are required to attend Six weeks summer internship after 6th semester. Performance of this internship will be evaluated and awarded in 7th semester.								

Contact Hrs. 29

Open Elective III

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3015	OE	Hydrology	3	0	0	3	1.0	Nil
CS3025	OE	Data Science Models : Regression, Classification and Clustering	3	0	0	3	1.0	Nil
AG3015	OE	Mushroom Cultivation	3	0	0	3	1.0	Nil
BB3015	OE	E-commerce	3	0	0	3	1.0	Nil
JM3015	OE	Media industry and Management	3	0	0	3	1.0	Nil
HM3015	OE	Italian Cuisine	3	0	0	3	1.0	Nil
MB3015	OE	SAP 5	3	0	0	3	1.0	Nil
EG3015	OE	French Advance C1	3	0	0	3	1.0	Nil
MT3015	OE	Robotic Industry 4.0	3	0	0	3	1.0	Nil

SEMESTER 7

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3701	PC	Health, Safety and Environment Management	4	0	0	4		Nil
CE3702	PC	Estimation and Costing	4	0	0	4		CE3501, CE3401
CE3740	P	Project Lab V	0	0	4	2	1.0	Nil
CE3741	PC	Estimation Lab	0	0	2	1	1.0	Nil
CE3703	PE	Program Elective-II	3	0	0	3		
CE3707	PE	Program Elective-III	3	0	0	3		
CE3770	FW	Internship Presentation III	2	0	0	2		
CE3742	VAP	Tech VAP II	2	0	0	2		
GP3701	GP	General Proficiency	0	0	0	1	-	-
		TOTAL	**18**	**0**	**6**	**22**		

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SEMESTER 8

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
	PE	Program Elective-IV	3	0	0	3	1.0	Nil
	PE	Program Elective-V	3	0	0	3	1.0	Nil
CE3870	FW	Project	0	0	0	4		
		TOTAL	**6**	**0**	**0**	**10**		

Contact Hrs. 6

OR

It is prerogative of the university to allow the student to opt for this option only after completing the process of approval before proceed on full semester internship on an industrial project. The evaluation of internal components should be done jointly by industrial supervisor and university supervisor. End semester evaluation should be done by a committee comprise of at least one expert from industry/corporate.

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3871	FW	Major Industrial Project	0	0	0	10		
		TOTAL	**6**	**0**	**0**	**10**		

Program Elective (PE) Courses/ Specialization

Category	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
1	CE3605	Prefabricated Structures	3	0	0	3	1.0	Nil
	CE3607	Renewable Energy Resources	3	0	0	3	1.0	Nil
	CE3608	Geomatics Engineering	3	0	0	3	1.0	Nil
II	CE3703	Bridge Engineering	3	0	0	3	1.0	Nil
	CE3704	Design of High-Rise Buildings						Nil
	CE3705	Earth Quake Resistant Constructions	3	0	0	3	1.0	Nil
III	CE3706	Irrigation Engineering	3	0	0	3	1.0	Nil
	CE3707	Hydrology	3	0	0	3	1.0	Nil
	CE3708	River Engineering	3	0	0	3	1.0	Nil
IV	CE3801	Environmental Impact Assessments	3	0	0	3	1.0	Nil
	CE3802	Groundwater Improvement Technology	3	0	0	3	1.0	Nil
	CE3803	Environment Pollution and Waste Management	3	0	0	3	1.0	Nil
V	CE3804	Advance Transportation Engineering	3	0	0	3	1.0	Nil
	CE3805	Pavement Management Systems	3	0	0	3	1.0	Nil
	CE3806	Traffic Planning & Design	3	0	0	3	1.0	Nil
Student can opt for course in MOOC platform after getting proper approval from department								

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our university.

The following is the course module designed for the Bachelor of Technology in Civil Engineering program:

Core competency: Students will acquire core competency in Bachelor of Technology in Civil Engineering and in allied subject areas.

Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic& advance knowledge and concepts of civil engineering.

Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

Ethical awareness/reasoning:A graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Value Added Course (VAC): A value added audit course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world.

Skill Enhancement Course: This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Open Elective (OE): Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each

Open Elective paper will be of 3 Credits in IV, V and VI semesters. Each student has to take Open Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Open Electives.

Program Course (PC): This is a compulsory course but audit that does not have any choice and may be of 3 credits. Each student of Bachelor of Technology in civil engineering program has to compulsorily pass the Environmental Studies and Human values & professional Ethics

C. Program Outcomes ofBachelor of Technology in Civil Engineering

Program Outcomes (POs)

The curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Program outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear course outcomes (COs) which are mapped to the program outcomes.

Engineering Graduate will be able to:

Program – Bachelor of Technology in Civil Engineering		
PO-01	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.
PO-02	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-03	**Design/development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-04	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-05	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-06	**The engineer and society**:	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-07	**Environment and sustainability**:	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-08	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-09	**Individual and team**	Function effectively as an individual, and as a member or leader in diverse

	work	teams, and in multidisciplinary settings.
PO-10	**Communication**:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and finance**:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	**Lifelong learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

D. Program Specific Outcomes (PSO's)

PSO1. Enhancing the employability skills by making the students find innovative solutions for challenges and problems in domains of Civil Engineering.

PSO2: Inculcating in students tech suaveness to deal with practical aspects of Civil Engineering.

E. Program Educational Objectives (PEO's)

PEO1. To be well familiar with the concepts of Civil Engineering for leading a successful career in industry or as entrepreneur or to pursue higher education.

PEO 2. To develop techno-commercial skills for providing effective solution using knowledge of Civil Engineering

PEO 3. To instil lifelong learning approach towards constantly evolving technologies with innovative and ethical mindset

F. Pedagogy & Unique practices adopted:

"Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning:

Role Play & Simulation: Role- play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual

share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become anindispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

Field/Live Projects: The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

MOOCs: Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students toundertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) It will necessary for every student to take at least one MOOC Course throughout the programme.
b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.
c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of

the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

Student Development Programs (SDP): Harnessing and developing the right talent for the right industry anoverall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

Industry Focused programmes: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice-based insight to the students.

Special assistance program for slowlearners &fast learners: write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

Induction program: Every year 3 weeks induction program is organized for 1st year students and senior students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

Mentoring scheme: There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

Competitive exam preparation: Students are provided with one class in every week for GATE/ Competitive exams preparation.

Extra-curricular Activities: Organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

Career & Personal Counseling: Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change. Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Participation in Flip Classes, Project based Learning (A2 Assignment), Workshops, Seminars &writing & Presenting Papers: Departments plan to organize the Flip Classes, Project based Learning (A2 Assignment), workshops, and Seminars& Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. This participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non-credit course.

Formation of Student Clubs, Membership & Organizing & Participating events: Every department has the departmental clubs with the specific club's name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

Capability Enhancement & Development Schemes: The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

Library Visit & Utilization of QLRC: Students may visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be

accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

Detailed Syllabus (Semester wise /course wise)

SEMESTER 1

MA3102	Title: Mathematics-I	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide essential knowledge of basic tools of Differential Calculus, Integral Calculus, Vector Calculus and Matrix Algebra.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Matrix Algebra	8
Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations. Eigen-values and Eigenvectors of a matrix, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Orthogonal and Unitary matrices and their properties, Cayley- Hamilton theorem, Diagonalization of a matrix.		
Unit II	Differential Calculus	8
Limit, Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations,. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Error approximations. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers		
Unit III	Integral Calculus	6
Review of curve tracing and quadric surfaces, Double and Triple integrals, Change of order of integration. Change of variables.		
Unit IV	Application of Multiple Integration	6
Gamma and Beta functions. Dirichlet's integral. Applications of Multiple integrals such as surface area, volumes, centre of gravity and moment of inertia.		
Unit V	Vector Calculus	8
Differentiation of vectors, gradient, divergence, curl and their physical meaning. Identities involving gradient, divergence and curl. Line and surface integrals. Green's, Gauss and Stroke's theorem and their applications.		
Text Books	1. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons 2. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for MA3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to learn the basic principles of multi-variable calculus with their proofs. They should be able to classify partial differential equations and transform them into canonical form. They will also understand how to extract information from partial derivative models in order to interpret reality.	2	Em
CO2	Students should be able to understand and learn how to find the area and volume of any region and solid body respectively by integral and also find the moments of inertia for a thin plate in plane.	2	S
CO3	Students should be able to understand theorems related to directional derivative of gradient and reproduce its proof. They should be able to Explain the concept of a vector integration in a plane and in space.	2	S
CO4	Students should be able to know basic application problems described by second order linear differential equations with constant coefficients. They should be also able to understand and solve the applications associated with Laplace Transform.	2	En
CO5	Students should be able to solve the linear equations using matrix properties and Determine characteristic equation, eigen values, eigenvectors and diagonalizable of a matrix.	1	None

CO-PO Mapping forMA3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	1	1	3	2	1	2	3	1	2	1	2	2
CO 2	3	3	2	3	3	3	2	3	1	3	3	1	1	3
CO 3	2	3	2	2	1	1	3	1	1	2	2	3	2	3
CO 4	2	3	3	3	3	3	3	2	2	2	2	3	1	1
CO 5	3	2	2	2	3	2	1	2	2	2	2	2	1	3
Avg.	2.6	2.4	2	2.2	2.6	2.2	2	2	1.8	2	2.2	2	1.4	2.4

PS3101	Title:Human Values and Ethics	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence	
Expected Outcome	This course will make the students aware and sensitive to value systems in real life situations. It will help them to discriminate between ephemeral and eternal value and to discriminate between essence and form	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction of Value Education	5
1. Understanding the need, basic guidelines, content and process of Value Education 2. A look at basic Human Aspirations: Self Exploration–its content and process		
Unit II	Understanding Harmony - Harmony in Myself!	5
1. Thoughtful human being in harmony; as a co-existence of the sentient, attitude and its importance in relationship. 2. Understanding the needs, characteristics and activities of Self ('I')		
Unit III	Understanding Harmony in the Family and Society	5
1. Harmony in the family; values in human relationships; meaning of Nyaya , Trust (Vishwas) and Respect (Samman) as the foundation values of relationships. 2. Harmony in society: Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals.		
Unit IV	Understanding Harmony in the Nature and Existence	4
1. Understanding the harmony in Nature: Interconnectedness among the four orders of nature- recyclability and self-regulation in nature 2. Natural perception of harmony at all levels of existence		
Unit V	Understanding Professional Ethics	5
1. Competencies in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production Systems.		
Text Books	1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and Professional Ethics, Excel books, New Delhi	
Reference Books	1. A.N. Tripathy, Human Values, New Age International Publishers 2. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow 2. B P Banerjee, Foundations of Ethics and Management, Excel Books	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for PS3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	2	Em
CO2	Students should be able to distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.	2	S
CO3	Students should be able to understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.	2	S
CO4	Students should be able to understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	2	En
CO5	Students should be able to distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	1	None

CO-PO Mapping for PS3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	3	2	2	3	1	1	1	3	3	1	3
CO 2	2	2	3	2	3	3	1	2	1	1	1	3	3	2
CO 3	3	3	1	1	1	2	2	1	2	1	1	2	3	2
CO 4	1	1	3	2	2	2	2	1	2	3	2	2	2	1
CO 5	2	1	2	2	2	1	2	2	1	3	3	2	3	1
Avg.	2	1.8	2.4	2	2	2	2	1.4	1.4	1.8	2	2.4	2.4	1.8

CS3101	Title:Basics of Computer and C Programming	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subjects aims to make student handy with the computers basics and programming.	
Expected Outcome	On completion of subject the students will be able to apply, Fundamental of Computers ,Architecture of Computer Arithmetic of Computer, Basics of Computer Programming	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Architecture of Computer	5
What is Computer: Brief History and Evolution Chain, Concept of Hardware, The Inside Computer [Hard Drives (HD), Solid State Drives (SSD), Concept of CPU, Concept Of RAM], The Peripherals [Input Devices: Keyboard, Mouse, Media Devices [Floppy, DVD ROM, CD ROM, USB Storage Drive], Scanner], Output Devices [Monitor, Printer, Speaker.		
Unit II	Arithmetic of Computer	4
Number System [Decimal, Binary, Octal, Hexadecimal], Conversions, Binary Arithmetic [Addition, Subtraction, Multiplication, Division, 1s Compliment, 2s Compliment], Floating Point Arithmetic [IEEE 754 Concept, Storage of Floating Point Numbers]		
Unit III	Algorithms and Flow Chart	4
Algorithm [What is Algorithm? Algorithm Writing Examples] Flow Chart [What is Flow Chart? Flow Chart Symbols, How to make Flow Chart? Types of Flow Chart, Flow Chart Examples]		
Unit IV	Basics of C Programming –Part 1	6
Types of Computer Languages:-Machine Language, Assembly Language and High Level Language, Concept of Compiler, Assembler, Linker and Loader.Fundamental Data Type: int, float, char and void. Qualifier for int (long and short), singed and unsigned numbers. Program vs. Process, Storage Classes: auto, static, extern and register. Operator vs. Operand. Operators: Arithmetic, Relational, Conditional and Logical.		
Unit V	Basics of C Programming – Part 2	5
Functions: Introduction [Function Definition, Declaration and Call], Types of Functions, Basic Programs, Recursive Function. Arrays: Introduction, Array Notation and Representation, Basic Programs, Types of Arrays [1-D, 2-D and n-D Array]. Pointer: Introduction, Declaration, Initialization and Access of data using pointer		
Text Books	1. KR Venugopal, Mastering C 2. Y. Kanetkar, Let us C	
Reference Books	1. Kernighan, B.W and Ritchie,D.M, The C Programming language, Pearson Education 2. Byron S Gottfried, Programming with C, Schaum's Outlines, Tata McGraw-Hill 3. R.G. Dromey, How to Solve it by Computer, Pearson Education 4. E. Balagurusamy, Programming in ANSI C	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	07-06-2019	
Date of Approval by the Academic Council on	13-07-2019	

Course Outcome for CS3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to approachthe programming tasks using techniques learned in Theory and write pseudo-codes based on the requirements of the problem.	2	Em
CO2	Students should be able to usethe comparisons and limitations of the various programming constructs and choosethe right one for the task in hand.	2	S
CO3	Students should be able to write the program based on numerical techniques learned and able to edit, compile, debug, correct, recompile and run it.	2	S
CO4	Develops the knowledge of different software on different Operating System Platform such as Linux/Windows (Open Source and Licensed) with understanding of different IDE	2	En
CO5	Makes students gain a broad perspective about the uses of computers in engineering industry	1	None

CO-PO Mapping for CS3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	2	3	3	3	1	1	3	3	2	1	2
CO 2	3	2	1	2	3	2	1	1	1	1	1	2	2	3
CO 3	3	1	1	2	1	2	2	2	2	1	1	3	2	2
CO 4	2	1	2	3	3	3	3	1	3	1	2	3	2	1
CO 5	1	3	2	3	1	1	2	1	2	1	1	2	2	1
Avg.	2.2	1.8	1.8	2.4	2.2	2.2	2.2	1.2	1.8	1.4	1.6	2.4	1.8	1.8

EC3101	Title: Basic Electrical and Electronics Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide an overview of electrical and electronics fundamentals.	
Expected Outcome	The student would acquire the knowledge of basics fundamentamentals of electrical and electronics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basic Concepts of Electrical Engineering	7
Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series-Parallel Circuits, Node Voltage Method, Mesh Current Method, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.		
Unit II	Transformers and Alternating Quantities	7
Transformers: Construction, EMF equation, ratings, pharos diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers. Alternating Quantities: Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Pharos Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3-Phase AC System.		
Unit III	Rotating Electrical Machines	8
DC Machines: Principle of Operation of DC Machine, EMF Equation, Applications of DC Machines. AC Machines: Principle of Operation of 3-Phase Induction Motor, 3-Phase Synchronous Motor and 3- Phase Synchronous Generator (Alternator), Applications of AC Machines.		
Unit IV	Basic Electronics	7
Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behavior of PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Rectifiers, Bipolar Junction Transistor, Field Effect Transistor, Transistor as an Amplifier.		
Unit V	Digital Electronics and Electrical Measuring Instruments	7
Digital Electronics:Boolean algebra, Binary System, Logic Gates and Their Truth Tables.Kaurnugh Map Electrical Measuring Instruments: Basic OP-AMP, Differential amplifier, PMMC instruments, shunt and series multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.		
Text Books	1. V. Jagathesan, K. Vinod Kumar and R. Saravan Kumar, Basic Electrical and Electronics Engineering, Wiley India 2. Sukhija and Nagsarkar, Basic Electrical and Electronics Engineering, Oxford Publication	
Reference Books	1. Kothari, Nagrath, Basic Electrical and Electronics Engineering, TMH 2. Prasad/Sivanagraju, Basic Electrical and Electronics Engineering, Cengage learning Indian Edition 3. Muthusubrmaniam, Basic Electrical and Electronics Engineering, TMH	
Mode of Evaluation	Internal and External Examinations	
Recommendation by	07-06-2019	

Board of Studies on	
Date of approval by the Academic Council	13-07-2019

Course Outcome for EC3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the basic theorems used in simplifying the electrical circuits.	2	Em
CO2	Students should be able to Know about the generation and utilization of three phase alternating quantities.	2	S
CO3	Students should be able to Know about single phase transformer and its various parameters.	2	S
CO4	Students should be able to understand the various components used in electronics like P-N junction and Zenerdioide.	2	En
CO5	Students should be able to understand basics of digital electronics and various electrical measurement devices.	1	None

CO-PO Mapping for EC3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	3	2	1	2	1	1	3	1	2	1
CO 2	3	3	2	3	3	2	3	2	1	1	3	3	2	1
CO 3	2	2	2	2	2	3	2	2	2	2	1	2	2	1
CO 4	1	1	1	2	2	1	3	2	2	3	2	2	3	3
CO 5	2	2	3	3	2	3	1	3	1	2	3	3	1	3
Avg.	2.2	2	1.8	2.2	2.4	2.2	2	2.2	1.4	1.8	2.4	2.2	2	1.8

EG3102	Title:Professional Communication	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills	
Expected Outcome	The student will develop a sound knowledge of English which will be integral to personal, social and professional interactions.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Fundamentals of Communication	5
Introduction–Communication Process, Distinction between General and Technical Communication. Language as a Tool of Communication; Interpersonal, Organizational, Mass Communication. Formal Communication: Downward, Upward, Lateral/ Horizontal, Diagonal; Informal Communication (Grapevine). Barriers to Communication		
Unit II	Components of Technical Written Communication	5
Vocabulary building: Synonyms and Antonyms, Homophones, Conversions. Common Grammatical Errors, Paragraph Development, Précis writing. Technical Papers: Project, Dissertation and Thesis.		
Unit III	Forms of Business Communication	5
Business Correspondence- Types:, Memorandum; Official letters. Job Application, Resume/CV/Bio-data; Notice, Agenda, Minutes of Meetings. Technical Proposal: Types, Significance, Format and Style of Writing Proposals. Technical Report: Types, Significance, Format and Style of Writing Reports.		
Unit IV	Presentation Techniques and Soft Skills	5
Presentation: Defining Purpose, Audience and Location; Organizing Contents; Preparing Outline; Audio-Visual Aids in Presentations.Non-Verbal Aspects of Presentation: Kinesics, Proxemics, Chromatics, and Paralanguage. Listening Skills: Importance, Active and Passive listening. Speaking Skills: Common Errors in Pronunciation; Vowels, Consonants and Syllables; Accent, Rhythm and Intonation.		
Unit V	Value-based Text Readings	4
Thematic and value-based critical reading of the following essays with emphasis on the mechanics of writing and speaking:1.The Language Of Literature And Science by Aldous Huxley 2.Of Discourse by Francis Bacon		
Suggested Reference Books	1. Barun K. Mitra, Effective Technical Communication, Oxford Univ. Press 2. Meenakshi Raman and Sangeeta Sharma, Technical Communication-Principles and Practices, Oxford Univ.Press 3. Prof.R.C.Sharmaand Krishna Mohan, Business Correspondence and Report Writing,Tata McGraw Hill andCo.Ltd.New Delhi 4. V.N.Arora and Laxmi Chandra,Improve Your Writing, Oxford Univ. Press, New Delhi 5. Ruby Gupta, Basic Technical Communication	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for EG3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to learn the fundamentals of communication process used within the organization.	2	Em
CO2	Students should be able to learn about the different forms of Business Communication.	2	S
CO3	Students should be able to learn about the different forms of Business Communication.	2	S
CO4	Students should be able to learn presentation techniques and soft skills.	2	En
CO5	Students should be able to understand Value-based Text Readings.	1	None

CO-PO Mapping for EG3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	1	1	2	1	3	1	1	2	3	1	2	3
CO 2	1	1	3	3	3	3	3	1	3	3	1	3	2	1
CO 3	2	1	1	2	1	2	3	1	1	1	2	2	1	2
CO 4	3	2	1	1	1	2	1	3	3	1	1	1	1	1
CO 5	3	3	3	3	3	3	1	2	3	2	3	1	1	1
Avg.	2.2	1.6	1.8	2	2	2.2	2.2	1.6	2.2	1.8	2	1.6	1.4	1.6

CS3140	Title:Basics of Computer and C Programming LAB	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Learning objectives is to improve confidence in technology use and increased awareness of opportunities afforded to individuals with Computer application skills.	
Expected Outcome	Recognize basic computer hardware architecture constructs such as instructions sets, memory, CPU, external devices, and data representation	

List of Experiments

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Given a string — a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input: a@gh%;j and output: j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
10. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
11. Solve towers of Hanoi using recursion.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CS3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to approachthe programming tasks using techniques learned in Theory and write pseudo-codes based on the requirements of the problem.	2	Em
CO2	Students should be able to usethe comparisons and limitations of the various programming constructs and choosethe right one for the task in hand.	2	S
CO3	Students should be able to write the program based on numerical techniques learned and able to edit, compile, debug, correct, recompile and run it.	2	S

CO-PO Mapping for CS3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	3	1	1	3	3	3	1	1	3	3	1
CO 2	2	1	1	1	3	3	3	1	1	2	3	3	1	1
CO 3	2	3	1	2	1	2	3	3	3	2	2	2	3	2
Avg.	2.3	2	1	2	1.7	2	3	2.3	2.3	1.7	2	2.7	2.3	1.3

EG3140	Title:Professional Communication LAB	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide practice to students in an interactive manner to apply the fundamentals and tools of English communication to life situations	
Expected Outcome	The student will be able to retain and apply his skills of English communication effectively in personal, social and professional interactions.	

List of Experiments

1. Common conversation skills
2. Introductions
3. Making requests
4. Asking for permission
5. Asking questions
6. Describing events, people, places
7. Learning correct pronunciation, syllable, stress, intonation
8. Extempore speaking
9. Role play
10. Presentation skills
11. Grammar-tense practice
12. Mother tongue influence- correction
13. Speech making / public speaking
14. Listening effectively
15. E-mail Etiquettes

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome ForEG3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to improve communication skills (Reading, Writing, and Speaking& Listening).	2	Em
CO2	Students should be able to achieve grammatical competency in drafting documents.	2	S
CO3	Students should be able to identify different situations & react accordingly using appropriate communication skills.	2	S

CO-PO Mapping for EG3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	2	1	1	3	2	1	2	2	2	1	2
CO 2	2	1	1	2	2	2	1	2	1	2	1	2	3	2
CO 3	2	2	2	3	3	2	1	1	3	3	3	2	1	3
Avg.	2	1.7	1.3	2.3	2	1.7	1.7	1.7	1.7	2.3	2	2	1.7	2.3

EC3140	Title:Basic Electrical and Electronics Engineering lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students familiar with the fundamental laws featuring in the field of Electrical and Electronics Engineering.	
Expected Outcome	Students shall conceptualize and firmly grasp the basic electrical and electronics engineering laws along with the knowledge of fundamental circuits governing the functioning of important devices.	

List of Experiments

1. To verify the Kirchhoff's current and voltage laws.
2. To verify the Superposition theorem.
3. To verify the Thevenin's theorem.
4. To verify the Norton's theorem.
5. To verify the maximum power transfer theorem.
6. To study the V-I characteristics of p-n junction diode.
7. To study the diode as clipper and clamper.
8. To study the half-wave and full-wave rectifier using silicon diode.
9. To study transistor in Common Base configuration and plot its input/output characteristics.
10. To study various logic gates and verify their truth tables.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for EC3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to know about the basic concepts of the Kirchhoff's current and voltage laws and perform Thevenin's, Norton's, and superposition and maximum power transfer theorems.	2	Em
CO2	Students should be able to analyze and understand the characteristics of transistors and semiconductor diodes and analyze the half-wave and full-wave rectifier using silicon diode.	2	S
CO3	Students should be able to Learn the basic concepts of various logic gates.	2	S

CO-PO Mapping for EC3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	2	1	3	1	3	2	2	3	2	3	1
CO 2	2	1	1	1	3	3	3	3	3	1	1	1	1	3
CO 3	2	3	3	2	3	2	2	3	2	3	3	3	3	2
Avg.	1.8	2	2	1.4	2	2.4	2.2	2.4	1.8	1.6	2.2	2	2.2	2.2

ME3141	Title: Engineering Graphics	L T P C 0 0 4 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions through drafting exercises.	
Expected Outcome	To know and understand the conventions and the methods of engineering drawing. To improve their visualization skills so that they can apply these skills in developing new products. Able to draw projection of lines, planes, solids in different positions.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction, Projection of Points, Projection of Straight Lines	12
Introduction to Engineering Equipment's, Elements of Engineering Drawing, dimensioning, Types of Lines, Various types of projections, First and third angle systems of orthographic projections. Projections of points in different quadrants. Projection of Lines.		
Unit II	Projection of Planes	8
Introduction, types of planes, Projection of planes by change of position method only, projection of plane perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other plane.		
Unit III	Projection of Solids	12
Types of solids, Projections of solid in different axis orientations.		
Unit IV	Section of Solids	8
Introduction - section planes - apparent section - true section - sectional view - need for sectional view - cutting plane - cutting plane line. Sectional view of simple solids. Section plane perpendicular to one plane and parallel to the other, section plane perpendicular to one plane and inclined to the other.		
Unit V	Development of Surfaces, Orthographic views (First Angle Projection Only)	8
Development of surface of various solids in simple positions, Three orthographic views of solids.		
Text Books	1 N.D. Bhatt and V.M.Panchal, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House	
Reference Books	1. Amar Pathak, Engineering Drawing, Dreamtech Press, New Delhi 2. T. Jeyapoovan, Engineering Graphics using AUTOCAD 2000, Vikas Publishing House 3. Thomas E.French, Charles J.Vierck, Robert J.Foster, Engineering Drawing and Graphic Technology, McGraw Hill International Editions 4. P.S. Gill, Engineering Graphics and Drafting, S.K. Kataria and Sons	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for ME3141

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to know about basic concepts of projection and To Draw the projection of points and lines located in different quadrants	2	Em
CO2	Students will be able to Draw the projection of plane surfaces in various positions	2	S
CO3	Students will be able to Draw the projection of solids in various positions	2	S
CO4	Students will be able to Draw sectional views of a given object	2	En
CO5	Students will be able to develop surfaces and draw orthographic view of given object	1	None

CO-PO Mapping for ME3141

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	1	1	2	1	1	2	1	1	1	1	3
CO 2	2	2	3	1	1	1	3	1	2	1	2	1	2	3
CO 3	2	2	2	1	3	2	2	3	2	2	2	1	1	3
CO 4	1	1	1	1	3	1	1	1	2	1	2	1	2	3
CO 5	1	1	1	3	3	3	3	3	3	1	2	3	2	3
Avg.	1.8	1.6	2	1.4	2.2	1.8	2	1.8	2.2	1.2	1.8	1.4	1.6	3

SEMESTER 2

MA3202	Title:Mathematics-II	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide knowledge of essential mathematical tools applied in solving ordinary and partial differential equations, initial and boundary value problems	
Expected Outcome	Students will be familiar with various methods that lead to solving ODEs and PDEs.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Ordinary Differential Equations	8
Ordinary differential equation of first order and first degree, Solution of linear differential equations with constant coefficients. Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables. Method of variation of parameters.		
Unit II	Laplace Transform	8
Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals. Convolution theorem, Initial and final value theorem. Laplace transform of periodic functions, Heaviside unit step function and Dirac delta function. Applications of Laplace transform for solving ODE.		
Unit III	Partial Differential Equations	8
Introduction to Partial differential equations, Linear partial differential equations with constant Coefficients of second order and their Classification. Method of separation of Variables for solving PDE, One dimensional wave equation , Laplace equation in two-dimensions, Heat conduction equations of one dimension and two dimension.		
Unit IV	Infinite Series	6
Infinite Series, Convergence and Divergence of an infinite series, Cauchy's General Principle, Comparison Tests, D'Alember's Ratio Test, Cauchy's Root test, Cauchy's Integral Test, Alternating series, Leibnitz test, Absolute convergence, Conditional Convergence		
Unit V	Fourier series	6
Trigonometric Fourier series and its convergence. Fourier series of even and odd functions. Fourier half-range series.		
Text Books	1. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Inc. 2. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics,Narosa Publishing House 3. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome forMA3202

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand ordinary differential equations, with their solutions through constant coefficients. They will also learn about Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables.	2	Em
CO2	Students should be able to understand the properties of Fourier series and the relationship between Fourier series and linear time invariant system.	2	S
CO3	Students should be able to learn the basics of the theory of error and the approximation theory; the fundamental principles of mathematical modeling; the numerical methods for solving problems of algebra; and the methods of numerical integration and differentiation.	2	S
CO4	Students should be able to learn about Interpolation which is a useful mathematical and statistical tool used to estimate values between two points.	2	En
CO5	Students should be able to formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data. They will also learn to analyses the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems. Taylor's and Laurent's series expansions of complex function will be also explored at the end of Unit.	1	None

CO-PO Mapping for MA3202

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	3	1	2	3	1	1	3	2	1	1	2	2
CO 2	3	3	1	3	1	1	3	1	1	2	1	1	2	1
CO 3	2	3	2	1	1	1	3	1	3	3	3	1	3	3
CO 4	2	2	2	3	3	3	2	2	1	3	1	2	3	2
CO 5	1	2	3	1	1	3	1	1	2	1	3	1	1	1
Avg.	1.8	2.6	2.2	1.8	1.6	2.2	2	1.2	2	2.2	1.8	1.2	2.2	1.8

PH3101	Title: Engineering Physics	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will be able to understand the basic of classical and modern physics and quantum mechanics and electromagnetic concepts with basic knowledge of optics.	
Expected Outcome	Will have the ability to Analyze the intensity variation of light due to Polarization, interference and diffraction. Will also be able to explain working principle of lasers and Explain fundamentals of quantum mechanics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Relativistic Mechanics	5
Inertial and Non-inertial Frames, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity. Radiation**:** Kirchhoff's Law, Stefan's law (only statement), Energy spectrum of Blackbody Radiation, Compton Effect.		
Unit II	Interference and Diffraction	5
Coherent Sources, Conditions of Interference, Fresnel's Bi-prism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings. Diffraction: Single Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, and Resolving Power of Grating.		
Unit III	Polarization and Laser	5
Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light. Laser**:** Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.		
Unit IV	Electromagnetic and Magnetic Properties of Materials	5
Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, PoyntingTheorem. Basic Concept of Para, Dia and Ferro-Magnetism.		
Unit V	Wave Mechanics	4
Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle and its applications, Schrödinger Wave Equation and Its Applications: Particle in a Box (one dimensional only).		
Text Books	1. Beiser, Concepts of Modern Physics, Mc-Graw Hill 2. Dr Amit Dixit, Engineering Physics, Nano Edge Publicatons	
Reference Books	1. Robert Resnick, Introduction to Special theory of Relativity, Wiley 2. AjoyGhatak, Optics, TMH 3. David J. Griffith, Introduction to Electrodynamics, PHI 4. William Hayt, Engineering Electromagnetics, TMH	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for PH3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand special theory of relativity (STR), concepts linked with STR and radiation laws.	2	Em
CO2	Students should be able to understand interference, diffraction and able to connect it to a few engineering applications.	2	S
CO3	Students should be able to explain the phenomena of polarization in electromagnetic waves and their production, Detection and analysis. They will also understand the operation and working principle of laser.	2	S
CO4	Students should be able to understand electromagnetic theory using Maxwell's equations, and its uses in various engineering application. They will also understand the difference between diameter, para and ferromagnetic materials.	2	En
CO5	Students should be able to explain fundamentals of quantum mechanics and apply it to problems on bound states.	1	None

CO-PO Mapping for PH3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	1	1	2	1	1	2	2	2	1	1	1
CO 2	2	1	1	2	2	2	2	1	3	1	3	3	1	1
CO 3	1	1	2	1	1	2	1	2	3	2	2	2	1	3
CO 4	1	3	3	1	1	3	2	2	2	1	1	3	1	1
CO 5	2	1	2	1	2	3	1	3	1	3	2	2	2	2
Avg.	1.6	1.4	2	1.2	1.4	2.4	1.4	1.8	2.2	1.8	2	2.2	1.2	1.6

CY3205	Title: Environmental Studies	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Creating awareness among engineering students about the importance of environment, the effect of technology on the environment and ecological balance is the prime aim of the course.	
Expected Outcome	Students will understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Environmental studies and Ecosystems	5
Multidisciplinary nature of environmental studies, Scope and importance, Need for public awareness. Concept, Structure and function of an ecosystem, Energy flow in an ecosystem: food chains, food webs and ecological pyramids. Examples of various ecosystems such as: Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)		
Unit II	Natural Resources: Renewable and Non- renewable resources	5
Land as a resource, land degradation, landslides (natural and man-induced), soil erosion and desertification. Forests and forest resources: Use and over-exploitation, deforestation. Impacts of deforestation, mining, dam building on environment and forests. Resettlement and rehabilitation of project affected persons; problems and concerns with examples. Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international and inter-state). Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems with examples. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs.		
Unit III	Biodiversity and Conservation	5
Levels of biological diversity: genetic, species and ecosystem diversity. Biogeographic zones of India. Ecosystem and biodiversity services. Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		
Unit IV	Environmental Pollution	4
Environmental pollution and its types. Causes, effects and control measures of :a) Air pollution b) Water pollution – freshwater and marine c) Soil pollution d) Noise pollution e) Thermal pollution Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste.		
Unit V	Environmental Policies and Practices	5
Concept of sustainability and sustainable development. Water conservation and watershed management. Climate change, global warming, acid rain, ozone layer depletion. Disaster management: floods, earthquake, cyclones and landslides. Wasteland reclamation. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Environment: rights and duties. Population growth. Field work Visit to a local polluted site-Urban/Rural/Industrial/Agricultural		

Study of simple ecosystems-pond, river, hill slopes, etc.	
Text Books	1. Bharucha. E, Textbook of Environmental Studies for Undergraduate Courses
Reference Books	1. KaushikAnubha, Kaushik C P, Perspectives in Environmental Studies, New Age Publication 2. Rajagopalan , Environmental Studies from Crisis to Cure, Oxford University Press
Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CY3205

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	2	Em
CO2	Students should be able to understand the solutions related to environmental problems related with the renewable & non-renewable resources.	2	S
CO3	Students should be able to understand the importance of ecosystem and biodiversity and the method of conservation of biological diversity.	2	S
CO4	Students should be able to understand different components of the environment and their function and the effects pollution on environment and should be able to understand the concept of sustainable development.	2	En
CO5	Students should be able to correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	1	None

CO-PO Mapping for CY3205

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	1	2	1	2	3	1	3	1	2	1	3	2
CO 2	2	1	1	1	2	1	2	1	3	2	3	2	2	3
CO 3	2	2	3	3	1	3	3	1	2	1	3	2	3	2
CO 4	2	3	1	1	2	3	1	3	3	3	3	3	1	1
CO 5	1	1	3	1	3	1	2	3	3	3	3	2	2	2
Avg.	2	1.6	1.8	1.6	1.8	2	2.2	1.8	2.8	2	2.8	2	2.2	2

ME3101	Title: Basic Mechanical Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge about various fields of Mechanical Engineering like Thermal Engineering, manufacturing, Mechanics and Materials.	
Expected Outcome	After learning the course the students will be able to understand basic laws of thermodynamics, basic manufacturing processes , working of IC engines and types of engineering materials available.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Thermodynamics and IC engines	8
Definition of thermodynamics, Energy and its forms, Enthalpy. Laws of thermodynamics, Processes - flow and non-flow, Steady flow energy equation, Heat engines, Efficiency; Heat pump, refrigerator, Coefficient of Performance. Internal Combustion Engines: Classification of I.C. Engines and their parts, working principle and comparison between 2 Stroke and 4 stroke engine, difference between SI and CI engines.		
Unit II	Mechanics	8
Basic concept: Review of laws of motion, transfer of force to parallel position, resultant of planer force system, Free Body Diagrams, Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions, Friction and Trusses.		
Unit III	Stress and Strain	8
Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One dimensional loading of members of varying cross-section, Strain energy.		
Unit IV	Introduction to Manufacturing	7
Introduction to manufacturing processes, Classification of the manufacturing processes, Cutting tools, Cutting tool materials, tool signature, Lathe and basic machining operations in lathe, Introduction to multi-point machining processes, Introduction to computerized numerical control (CNC) machines. Metal Forming: Forging and Sheet Metal operations. Joining Processes**:** Electric arc welding, Gas welding, Soldering and Brazing.		
Unit V	Engineering Materials	5
Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials. Introduction to Smart materials.		
Text Books	1. Hajra, Bose, Roy, Workshop Technology, Media Promotors 2. D.S. Kumar, Mechanical Engineering, S.K. Kataria and Sons	
Reference Books	1. Irving H. Shames I.H, Engineering Mechanics, P.H.I 2. Holman, J.P, Thermodynamics, McGraw Hill book Co. NY 3. Chapman W.A.J, Workshop Technology Part 1, Elsevier Science 4. Basant Agarwal, Basic Mechanical Engineering, Wiley India 5. Onkar Singh, Introduction to Mechanical Engineering, S.S.Bhavikatti	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for ME3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand application of the laws of thermodynamics to wide range of systems and aware about the basics of thermal engineering applications in IC engines and its working.	2	Em
CO2	Students should be able to know and apply the types of forces and concepts used to analyses force mechanisms	2	S
CO3	Students should be able to analyze and understand the Stress-strain diagrams and use of material.	2	S
CO4	Students should be able to understand the various machining processes	2	En
CO5	Students should be able to gain knowledge on the various engineering materials and their properties.	1	None

CO-PO Mapping for ME3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	2	2	3	3	1	1	1	3	1	1	3
CO 2	2	1	2	2	2	2	1	2	1	1	1	2	1	1
CO 3	2	1	2	1	1	1	1	3	3	3	2	1	1	2
CO 4	2	3	1	1	2	2	2	2	2	3	3	1	2	1
CO 5	1	1	3	1	1	2	1	1	3	2	3	3	2	2
Avg.	2	1.6	2	1.4	1.6	2	1.6	1.8	2	2	2.4	1.6	1.4	1.8

CS3207	Title:Advance Computer Programming & Software	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subject introduces the students with a deeper era of programming in C like Functions, Arrays, Pointer, Structure and Preprocessor Directive etc.	
Expected Outcome	On completion of subject the students will be able to apply learning Advance C, Device Driver Programming, Embedded C, Robotics Programming	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Pointers & Beyond Pointers	9
About Pointer [Declaration, Initialization and Access], Concept of memory maps, Concept of Process Control Block, Dangling Pointer, Orphan Objects, Dynamic Memory Allocation [malloc; calloc, realloc, free], Segmentation Fault, Core Dump and Illegal Memory Access, Pointer Arithmetic, Multiple Indirections.		
Unit II	Pointers & Arrays	9
Arrays, Understanding in depth 1-D, 2-D and 3-D array, Converting an array [1-D, 2-D, 3-D, n-D] to its pointer notation, Accessing array[1-D, 2-D, 3-D, n-D]with pointer, Creating Variable length array [1-D, 2-D], Limitation with array, Array of Pointers		
Unit III	Pointers & Functions, Arrays & Function	10
Understanding of function, Pointer pointing to function with different declarations, Accessing function with its pointer, Concept of Function returning function. Variable length arguments, Implementation of myPrintf and myScanf.Mixed Concepts:Array containing function(s), Array Containing array(s) [1-D, 2-D], Function returning array [1-D, 2-D].		
Unit IV	Making Header File and C Library	10
Understanding Preprocessor Directives and Compilation Process, Concept of Multiple Inclusion, Guard Macros, Role of Guard macros, Making Sample Header file, Understanding Concept of Linker, Creating Object code of function definition, Storing Object code in library, Setting path for Linker, Running code with user defined Header file and Library.		
Unit V	Tools and Software	10
Understanding Text Editors [vi and NANO], Understanding IDE (Integrated Development Environment) [Eclipse, Net beans and .Net Framework], VB Code Editor in MS Excel, Introduction AutoCAD, Introduction Matlab, Introduction CATIA, Introduction FreePCB		
Text Books	1. "Mastering C" by KR Venugopal 2. "Let us C" by Y. kanetkar **3.** "Programming in ANSI C" by E. Balagurusamy.	
Reference Books	1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Pearson Education, 2. 2. Byron S Gottfried, " Programming with C", Schaum's Outlines Tata McGraw-Hill 3. 3. R.G. Dromey, "How to Solve it by Computer", Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	07-06-2019	

Date of Approval by the Academic Council on	13-07-2019

Course Outcome for CS3207

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to Develop basic understanding of computers, the concept of algorithm, C programming and algorithmic/Programming thinking.	2	Em
CO2	Students should be able to use the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.	2	S
CO3	Students should be able to understand pointers, arrays, functions and macros that will be able to help them to design new problem solving approach in 'C'.	2	S
CO4	Students should be able to acquire the knowledge of different software's on different Operating System Platform such as Linux/Windows (Open Source and Licensed) with understanding of different IDE.	2	En
CO5	Students should be able to gain a broad perspective about the uses of computers in engineering industry.	1	None

CO-PO Mapping for CS3207

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	2	3	3	2	2	1	3	2	2	1	2
CO 2	1	2	3	2	1	2	1	3	3	1	3	2	1	1
CO 3	2	1	1	1	1	1	3	3	2	1	1	3	1	2
CO 4	2	3	2	2	1	2	1	3	1	3	3	2	1	1
CO 5	1	3	2	1	1	1	2	2	3	2	3	3	3	2
Avg.	1.8	2.2	1.8	1.6	1.4	1.8	1.8	2.6	2	2	2.4	2.4	1.4	1.6

PH3140	Title: Engineering Physics LAB	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment's.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.	

List of Experiments

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall effects and determine Hall coefficient, carnier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the balistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for PH3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the process of performing the experiments on wavelength and focal length practically.	2	Em
CO2	Students should be able to verify the theoretical calculations with observed results in practical experiments.	2	S
CO3	Students should be able to Enhance the skills of using apparatus for verification of different laws.	2	S

CO-PO Mapping for PH3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	2	2	1	2	1	1	2	3	1	2	3
CO 2	2	3	1	2	3	1	3	2	1	3	1	2	1	2
CO 3	3	3	1	3	1	3	1	2	3	1	1	3	3	3
Avg.	2	2.3	1	2.3	2	1.7	2	1.7	1.7	2	1.7	2	2	2.7

CS3245	Title: Advance Computer Programming & Software Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Study of basic programming principles introduced in Programming Fundamentals. Advanced concepts of program design, implementation and testing. Study of domain specific Software's	
Expected Outcome	Know concepts in problem solving, to do programming in C language. To write diversified solutions using C language. Study of domain specific Software	

List of Experiments

1. WAP accessing function definition with the help of pointer.
2. WAP accessing 2-D Array with the help of pointer.
3. WAP declaring an array taking length from the user.
4. WAP declaring 2-D array by using Dynamic memory allocation technique.
5. WAP passing arguments to main function.
6. WAP making function accepting VAR_ARGS.
7. Case Study on VB Script in Excel File.
8. Case Study on Matlab Tool.
9. Case Study on Free PCB Tool.
10. Case Study on AutoCAD.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CS3245

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop Pointer, recursion, functions and array based programs in C.	2	Em
CO2	Students should be able to develop Dynamic memory allocation technique based programs and execute Command line Arguments in C.	2	S
CO3	Students should be able to execute C programs and Shell Commands in Unix Environment.	2	S

CO-PO Mapping for CS3245

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	2	2	1	2	1	1	2	3	1	2	3
CO 2	2	3	1	2	3	1	3	2	1	3	1	2	1	2
CO 3	3	3	1	3	1	3	1	2	3	1	1	3	3	3
Avg.	2	2.3	1	2.3	2	1.7	2	1.7	1.7	2	1.7	2	2	2.7

ME3140	Title: Workshop Practice	L T P C 0 0 3 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know about the working methods adopted in various mechanical shops along with tools and equipment's for making a product. To understand the working of IC engines, Refrigerator, Air conditioner	
Expected Outcome	Student will be able to develop skill in using machines,tools and knowing the basic operations in each shop along with understanding the working of IC engine,refrigerator and airconditioner.	

List of Experiments

1. Carpentry Shop:
   - I. Study of tools and operations and carpentry joints.
   - II. To prepare half-lap corner joint / mortise - tendon joint.
   - III. To make duster from wooden piece using carpentry tools

2. Fitting (Bench Working) Shop:
   - I. Study of tools and operations.
   - II. Step fitting of two metal plates using fitting tools.
   - III. Drilling and Tapping for generating hole and internal thread on a metal plate.

3. Black Smithy Shop:
   - I. Introduction of different Forging process.
   - II. Study of tools and operations such as upsetting, drawing down, punching, bending, fullering and swaging.
   - III. To forge chisel from MS rod.

4. Welding Shop:
   - I. Introduction of Welding and its classification.
   - II. Simple butt and Lap welded joints.

5. Sheet-metal Shop:
   - I. Introduction of various sheet metal operations.
   - II. Study of tools and operations.
   - III. To make geometrical shape like frustum, cone and prisms using GI sheet.

6. Machine Shop:
   - I. Introduction of Single point cutting tool, various machine tools.
   - II. Simple operations like Plane turning, Step turning and Taper turning.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for ME3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to develop the ability to perform the various operations with the help of lathe machine and its tools	2	Em
CO2	Students will be able to develop the ability to perform the various operations using welding	2	S
CO3	Students will be able to develop the ability to perform the various operations using fitting tools	2	S
CO4	Students will be able to develop the ability to perform the various operations on wood using carpentry tools	2	En
CO5	Students will be able to develop the ability to perform the various operations using blacksmith tools	1	None

CO-PO Mapping for ME3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	1	1	1	2	3	2	1	3	2	2	2	1
CO 2	3	3	3	1	1	1	3	3	2	1	3	1	1	3
CO 3	1	1	3	1	2	3	1	3	3	2	2	2	2	1
CO 4	1	2	1	3	1	1	1	1	2	3	3	2	1	2
CO 5	1	3	2	3	3	2	1	1	2	2	2	1	1	2
Avg.	1.4	2.4	2	1.8	1.6	1.8	1.8	2	2	2.2	2.4	1.6	1.4	1.8

CE3101	Title:Disaster Management	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.	
Expected Outcome	Enhance the knowledge by providing existing models in risk reduction strategies to prevent major causalities during disaster.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction on Disaster	5
Different Types of Disaster : A) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail and Road), Structural failures(Building and Bridge), War and Terrorism etc. Causes, effects and practical examples for all disasters.		
Unit II	Risk and Vulnerability Analysis	4
Risk: Its concept and analysis 2. Risk Reduction 3. Vulnerability: Its concept and analysis 4. Strategic Development for Vulnerability Reduction		
Unit III	Disaster Preparedness	5
Disaster Preparedness: Concept and Nature. Disaster Preparedness Plan Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies. . Role of IT in Disaster Preparedness. Role of Engineers on Disaster Management.		
Unit IV	Disaster Response	5
Introduction Disaster Response Plan Communication, Participation, and Activation of Emergency Preparedness Plan Search, Rescue, Evacuation and Logistic Management Role of Government, International and NGO Bodies Psychological Response and Management (Trauma, Stress, Rumor and Panic). Relief and Recovery Medical Health Response to Different Disasters		
Unit V	Rehabilitation, Reconstruction and Recovery	5
Reconstruction and Rehabilitation as a Means of Development. Damage Assessment Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction Sanitation and Hygiene Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning Role of Educational Institute.		
Text Books	1. Bhattacharya, Disaster Science and Management, McGraw Hill Education Pvt. Ltd.	
Reference Books	1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd. 2. Jagbir Singh, Disaster Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to understand the basic concepts of disasters and its relationships with development.	2	Em
CO2	Students will be able to understand the approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.	2	S
CO3	Students will be able to understand the Medical and Psycho-Social Response to Disasters.	2	S
CO4	Students will be able to prevent and control Public Health consequences of Disasters	2	En
CO5	Students will have awareness of Disaster Risk Management institutional processes in India	1	None

CO-PO Mapping for CE3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	2	1	2	1	3	2	2	3	3	2	1	2
CO 2	2	2	1	3	1	3	3	2	1	1	1	3	3	3
CO 3	1	3	1	2	3	3	2	3	2	1	3	3	1	3
CO 4	2	2	3	2	2	1	2	2	2	2	3	2	3	3
CO 5	3	2	2	3	2	3	2	3	3	1	1	1	1	3
Avg.	1.8	2.4	1.8	2.2	2	2.2	2.4	2.4	2	1.6	2.2	2.2	1.8	2.8

SEMESTER 3

CE3301	Title: **Hydraulics and Hydraulic Machines**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To give knowledge on various types of forces acting on a fluid and basic knowledge of the hydraulic machinery.	
Expected Outcome	Students will be able to solve problems related to water and other fluids and will have an understanding of the machines.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: I	**Fluid Statics and Fluid Dynamics**	8
Relative Equilibrium of fluids, Liquid Masses subjected to Uniform Horizontal and Vertical acceleration, Acceleration of Fluid mass along a Slope, Free and Forced Vortex, Velocity Potential Function and Stream Function, Circulation, Kinetic Energy Correction Factor, Momentum Correction Factor,		
Unit II	**Fluid Kinematics**	7
Boundary Layer Theory, Displacement Thickness, Momentum Thickness, Laminar Boundary Layer Forces on Immersed Bodies, Drag and Lift, Magnus effect Viscous flow		
Unit III	**Pipe Flowand Dimensional Analysis**	7
Laminar incompressible flow in a circular pipe, Moody's diagram, Two dimensional laminar flow between parallel plates, Dimensional Analysis and Model Analysis (undistorted models), Reynolds's law and Froude's law of Similarity		
Unit IV	**Open Channel Flow**	7
Uniform flow computations in open channels, Critical Flow computations in Open Channel, Gradually Varied Flow		
Unit V	**Hydraulic Turbines and Pumps**	7
Introduction of Hydraulic Turbines, their types, Introduction of Hydraulic Pumps, their types. Calculation of efficiency, Work-done discharge, Pressure head and power requirement.		
Text Books	1. Subramanya K., Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publication,	
Reference Books	1. Garde R.J. and Mirajgaokar A.G.; Engineering Fluid Mechanics SciTechPublication 2. Streeter V.L. and Wyle E.B.; Fluid Mechanics; International Students Edition,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3301

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the concept of fluids & their types, related equations & theorems, concepts of pumps & turbines.	4	S
CO2	Students should be able to understand the concept of steam line, streamline, path flow, vortices& acceleration related with fluid flows.	3	S
CO3	Students should be able to understand the concept of fluids manometer, hydrostatic forces on submerged bodies, various important equations & theorems.	4	En
CO4	Students should be able to understand the concept of fluids boundary layer theories, behavior of fluid flows in open channels.	4	En
CO5	Students should be able to understand the concept of fluids drag, skin frictions on various elements, lift & drag theories.	3	En

CO-PO Mapping for CE3301

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	2	1	2	2	3	3	3	3	3	2	2
CO 2	1	3	3	3	2	1	3	2	1	2	3	1	2	2
CO 3	1	2	2	3	2	3	1	1	2	3	3	1	3	3
CO 4	3	3	1	1	3	3	3	3	3	3	3	1	3	2
CO 5	1	2	3	1	3	3	3	1	3	1	2	1	3	2
Avg.	1.8	2.2	2.2	2	2.2	2.4	2.4	2	2.4	2.4	2.8	1.4	2.6	2.2

CE3304	Title: **Building Technology**	L T P C 3 0 0 3
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To give knowledge on technologies behind building construction	
Expected Outcome	Student will able to understand applications and types of building material	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: 1	**Building Materials**	7
Stones: Types usesanddefect;Bricks: Types uses anddefect Tiles, Terra Cotta: Types uses anddefect;Steel:Types uses anddefect;Timber Types uses and defect		
Unit II	**Concrete**	7
Cement: types and Physical and Chemical property; Aggregate physical and Chemical property; Property of fresh and hardened concrete.		
Unit III	**Building Construction**	7
.Brick Masonry: Stone Masonry; Cavity wall; Foundations: Elements of Residential and Industrial Buildings		
Unit IV	**Components Of Building and Smart Materials**	7
Stairs, lintels, Trusses, Arches, Domes, Doors and Windows: Introduction, Classification, types, material of construction. Special Materials and Systems: Smart materials and structures, Geo-synthetics, Nano-materials and biomaterials, Fire resistant materials, Sound Insulation.		
Unit V	**Finishing Materials**	8
Paints And Varnishes: Constituents of paints, Types of paints, Distempering, White washing, Constituents and characteristics of varnishes, Rubber, Bitumen, Tar and Asphalt, Glass, Plastics. Introduction To Polymers: Polymeric materials, PVC, Polyester, HDPE, CDPE, Ceramics, Fibre glass and their applications in civil engineering		
Text Books	1. M.L. Gambhir and NehaJamwal, Building and Construction Materials, Mc-Graw Hill	
Reference Books	1. S.k.Duggal, Building Materials New Age Publication	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3304

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand properties and usage of bricks	2	S
CO2	Students should be able to learn property and usage of cement	2	S
CO3	Students should be able to understand properties and usage of stones	2	En
CO4	Students should be able to understand properties and usage of timber and metals	2	En
CO5	Students should be able to understand properties and usage of building materials like asphalt, Bitumen, insulating materials, Nano materials & smart materials	2	En

CO-PO Mapping for CE3304

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	2	1	3	2	2	3	2	2	2	2	2
CO 2	1	1	1	2	2	3	3	1	3	1	2	3	2	1
CO 3	1	1	3	2	2	3	1	2	1	1	2	3	3	3
CO 4	1	3	3	2	3	2	1	3	3	3	2	2	3	2
CO 5	1	3	2	1	3	1	2	2	1	1	2	3	3	1
Avg.	1.2	2.2	2.2	1.8	2.2	2.4	1.8	2	2.2	1.6	2	2.6	2.6	1.8

CE3306	Title: **Basics of Ground Surveying**	L T P C 3 2 0 4
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To prepare a map or plan to represent an area on a horizontal plan.	
Expected Outcome	The students would be able to understand the relative precision expected from pacing, taping, and electronic distance measurement techniques.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: 1	**Introduction to Surveying**	3
Definition, Divisions, Classification and Principles of surveying. Scales: plain, Venire, diagonal, plan and map.		
Unit II	**Linear Measurement**	3
Chain and Tape surveying, Types of chain and tape, ranging, obstacles and tape correction.		
Unit III	**Leveling**	6
Methods of determining elevations, Direct levelling- Basic terms and definitions, Principle, Booking and Reduction of field notes, Curvature and refraction correction, use of Automatic level, Digital Level, Vertical Control.		
Unit IV	**Angular Measurement**	6
Theodolite survey: Measurements of horizontal and vertical angles, Horizontal Control, Working of Electronic Theodolites. Tachometry: Principles of stadia systems, Sub tense bar and tangential methods.		
Unit V	**Curves**	6
Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types and their characteristics, Ideal transition curve, Equations of various transition curves, Introduction to vertical curves. Survey Layout for culverts, Canals, Bridges, Road/Railway alignment and Buildings.		
Text Books	1. BC Punmia et al: Surveying Vol. I, II, Laxmi Publication	
Reference Books	1. SK Duggal: Surveying Vol. I, II. 2. R Subramanian : Surveying and Leveling , Oxford University Press	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3306

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand basics of surveying	2	S
CO2	Students should be able to understand linear measurements	3	S
CO3	Students should be able to understand leveling methods in surveying	4	En
CO4	Students should be able to perform angular measurements	3	En
CO5	Students should be able to understand curves and its formations	4	Em

CO-PO Mapping for CE3306

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	2	1	3	3	1	2	3	3	1	1	3
CO 2	3	3	1	2	1	1	3	3	2	3	1	2	2	2
CO 3	1	1	3	3	2	1	1	1	1	3	1	3	3	3
CO 4	1	2	3	3	2	3	3	1	1	2	2	3	3	2
CO 5	2	3	2	1	3	3	3	3	3	3	2	2	1	3
Avg.	1.6	2	2	2.2	1.8	2.2	2.6	1.8	1.8	2.8	1.8	2.2	2	2.6

CE3307	Title: Basic of Geology	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart knowledge to students about types of rock and their formation as well as structures.	
Expected Outcome	Students will be able to understand how geologists identify the rock type and minerals, and will get basic knowledge about geology.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction	8
Dimensions of earth and its structure, Composition and Origin of earth-envelops of the Earth- crust, Mantle, Core. Internal dynamic process- Plate tectonics- Continental drift, Earthquake and volcanoes. External dynamic process- Weathering, Erosion and Deposition, Geological time scale.		
Unit II	Minerals and Rocks	8
Minerals and Rocks: Properties and identification of specimens in hand and under microscope.Origin of igneous (Intrusive and Extrusive rock), Sedimentary and metamorphic rocks. Sedimentary structures-petrographic character of conglomerate, Sandstone, Shale, Limestone.		
Unit III	Stratigraphy	8
Stratigraphy: Stratigraphy principle, Sequence, Litho-stratigraphy, Bio-stratigraphy, Stratigraphy of India –basics.		
Unit IV	Paleontology	6
Paleontology - Fossils and their mode of preservation, Fossils-micro, Macro, Paly no, Indexfossiland significance in petroleum exploration.		
Unit V	Structural Geology	6
Structural Geology, Rock structure type, Fault, Topography, Outcrops, Deformation of rocks, Simple dipping beds, Folds, Faults, Joints, Unconformity, Classification, Recognition and signification in petroleum exploration, Igneous intrusion-dykes, Sill and batholith.		
Text Books	1. Holmes, A., ‘‘Principles of Physical Geology’’, Ronald Press. 2. Mukherjee, P.K., ‘‘A Text Book of Geology’’ The World.	
Reference Books	1. Ramakrishnan, M., Vaidyanathan, R., ‘‘Geology of India’’,Geological Society of India Publication. 2. Raymond, L.A., ‘‘Petrology: The study of Igneous, Sedimentaryand Metamorphic Rocks’’, McGraw Hill.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic	13-07-2019	

Council	

Course Outcome for CE3307

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to understand basics of geology	2	S
CO2	Students will be able to understand minerals and rocks	2	S
CO3	Students will be able to understand Stratigraphy	2	S
CO4	Students should be able to understand Structural Geology	2	S
CO5	Students will be able to understand Geological Investigations of various structures	2	S

CO-PO Mapping for CE3307

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	3	1	3	1	2	1	1	3	2	1
CO 2	2	3	1	3	1	2	2	1	3	1	2	2	3	3
CO 3	2	1	3	3	2	2	2	2	3	1	1	3	3	2
CO 4	2	1	2	3	1	2	2	3	1	3	3	2	1	1
CO 5	2	2	3	1	1	1	3	3	2	1	1	1	3	2
Avg.	2.2	1.8	2	2.2	1.6	1.6	2.4	2	2.2	1.4	1.6	2.2	2.4	1.8

ME3308	Title: Strength of Materials	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know conceptual applications of principles of mechanics on rigid and deformable bodies	
Expected Outcome	After learning this subject the students will able to understand the behaviour of material under various forces.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Stress and Strain	6
Simple Stresses and Strains – Tension, Compression and Shear Stresses - Hooke's Law - Compound Stresses - Thermal Stresses – Compound Bars. Two-Dimensional System, Stress at a Point on a Plane, Principal Stresses and Principal Planes, Mohr's Circle.		
Unit II	Shear Force and Bending Moment	5
Shear Force and Bending Moment Diagrams for Beams and Simple Frames - Theory of Simple Bending, Bending Stress Distribution at Sections.		
Unit III	Torsion	6
Theory of Simple Torsion – Torsional Rigidity – Composite Shafts in Series and Parallel. Thin Cylinders and Shells – Thick Cylinders, Helical and Leaf Springs.		
Unit IV	Deflection of Beams	5
Derivation of Differential Equation of Moment Curvature Relation, Deflection of Simple Beams by Double Integration Method		
Unit V	Columns and Struts	4
Buckling of Column, Slenderness Ratio, Euler's Buckling Load for Slender Column, and Effective Length for Different End Condition. Introduction to Strain Energy, Stresses due to Impact and Concept of Virtual Work.		
Text Books	1 R K Bansal, Strength of Material, Kindle Edition. 2 R.K.Rajput, Strength of Materials, S.Chand.	
Reference Books	1. G.H.Ryder, Strength of Materials, Macmillan 2. P.K. Nag, Fundamentals of Strength of Materials, Wiley India 3. E. P. Popov, Engineering Mechanics of Solids, Prentice Hall. 4. P.Boresi , Advanced Mechanics of Materials, Wiley	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for ME3308

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the resisting behavior of materials under loads in different loading condition like tension, compression etc. and applying the learnings though numerical problems	4	S
CO2	Students should be able to understand the behavior of beams under the action of shear force and bending moment and applying the learnings though numerical problems	4	S
CO3	Students should be able to understand the behavior of different machine elements such as shafts and springs under twisting load and applying the learnings though numerical problems	4	En
CO4	Students should be able to understand the behavior of beams under deflection and applying the learnings though numerical problems	4	En
CO5	Students should be able to understand the behavior of building elements such as columns and struts under different loading condition and applying the learnings though numerical problems	4	En

CO-PO Mapping for ME3308

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	3	1	3	2	2	1	3	2	1	3	2	1
CO 2	3	2	2	3	3	2	2	1	3	3	2	2	2	1
CO 3	3	2	2	3	1	3	2	2	2	2	3	2	3	2
CO 4	3	2	3	2	2	1	2	1	2	1	2	3	1	1
CO 5	2	1	2	1	3	2	1	2	1	1	3	3	1	3
Avg.	2.4	1.8	2.4	2	2.4	2	1.8	1.4	2.2	1.8	2.2	2.6	1.8	1.6

CE3340	Title: **Hydraulics and Hydraulic Machines Lab**	L T P C 0 0 2 1
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To impart basic knowledge of problems involving flow of fluids such as in aerodynamics, force of fluid on structural surfaces, fluid transport.	
Expected Outcome	Student will able to understand the characteristic of fluid in different conditions.	

List of Experiments

1. To verify the Bernoulli's theorem.
2. To determine the friction factors for the pipes. (Major Losses)
3. To determine the Meta-centric height of a floating body.
4. To calibrate an orifice meter and study the variation of the co-efficient of discharge with Reynolds's number.
5. To determine the losses co-efficient for pipe fitting.
6. To study the transition from Laminar to Turbulent flow and to determine the Lower critical Reynolds's number.
7. To determine the coefficient of discharge of Venturimeter.
8. To determine the Manning's coefficient of roughness 'n' for the given channel bed
9. To study the characteristic of free hydraulic jump
10. To study the flow through a horizontal contraction in a rectangular channel

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3340

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the concept of Bernoulli's theorem & various losses in pipes.	3	S
CO2	Students should be able to understand the concept of Metacentric height of floating bodies & concepts of laminar & turbulent flows.	3	S
CO3	Students should be able to understand various coefficients of fluid flow.	3	En
CO4	Students should be able to understand the concept of Hydraulic jumps	3	En
CO5	Students should be able to conduct various test on fluids.	3	En

CO-PO Mapping for CE3340

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	3	1	3	1	2	1	1	3	2	1
CO 2	2	3	1	3	1	2	2	1	3	1	2	2	3	3
CO 3	2	1	3	3	2	2	2	2	3	1	1	3	3	2
CO 4	2	1	2	3	1	2	2	3	1	3	3	2	1	1
CO 5	2	2	3	1	1	1	3	3	2	1	1	1	3	2
Avg.	2.2	1.8	2	2.2	1.6	1.6	2.4	2	2.2	1.4	1.6	2.2	2.4	1.8

CE3343	Title: **Building Technology Lab**	**L T P C** **0 0 2 1**
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	Students will explore career options in the building construction industry.	
Expected Outcome	The students would be able to understand about the technical terms related to the building, various construction technologies, knowledge about foundation, aware about smart materials etc.	

List of Experiments

1. To conduct the field test on bricks via hardness, shape and size, soundness, colour and strength.
2. Construction of various types of Brick Masonry and Their Joint
3. Construction of various types of Stone Masonry and Their Joint
4. To determine the crushing strength of bricks using compressive testing machine.
5. To determine the normal consistency of cement paste.
6. To determine the initial and final setting times of cement.
7. To determine the compressive strength of cement.
8. To determine the tensile strength of cement.
9. To determine the percentage bulking of sand in moist condition.
10. To determine the specific gravity of fine and coarse aggregates.
11. To conduct the tension test on the given mild steel specimen to determine yield, strength, ultimate strength, breaking strength, percentage, elongation and young's modulus.
12. Study on defects in timber

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3343

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand properties and usage of bricks	2	S
CO2	Students should be able to learn property and usage of cement	2	S
CO3	Students should be able to understand properties and usage of stones	2	En
CO4	Students should be able to understand properties and usage of timber and metals	2	En
CO5	Students should be able to understand properties and usage of building materials like asphalt, Bitumen, insulating materials, Nano materials & smart materials	2	En

CO-PO Mapping for CE3343

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	3	2	1	1	3	1	2	1	2	1	2
CO 2	3	3	2	2	3	3	2	2	2	2	3	1	1	1
CO 3	1	3	2	3	1	1	3	3	1	1	3	3	2	3
CO 4	1	1	2	3	3	3	3	3	2	3	1	3	1	3
CO 5	1	2	3	1	3	3	3	3	3	2	1	1	2	2
Avg.	1.8	2.4	2.4	2.4	2.4	2.2	2.4	2.8	1.8	2	1.8	2	1.4	2.2

CE3346	Title: **Basics of Ground Surveying Lab**	L T P C 0 0 2 1
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To develop methods through the knowledge of modern science and the technology and use them in the field.	
Expected Outcome	The students would be able to understand construction points based on measured angles and distances calculate azimuths, chord distances and coordinates along a curve.	

List of Experiments

1. To prepare conventional symbol chart based on the study of different types of topographical maps.
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
3. To find out reduced levels of given points using Auto/dumpy level.
4. To perform fly leveling with Auto/tilting level.
5. To study parts of a Vernier theodolite and measurement of horizontal and vertical angle.
6. To measure horizontal angle between two objects by repetition/reiteration method.
7. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometrically leveling by taking observations in single vertical plane.
8. To study various parts of Electronic Theodolite,
9. Total Station and practice for measurement of distance, horizontal and vertical angles.
10. To set out a simple circular curve by Rankine's method.
11. To exercise two point and three point problem using plane table surveying
12. To prepare contour map

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3346

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to perform leveling and can find horizontal and vertical angles using surveying instruments	3	S
CO2	Students should be able to plot traverse and contours.	3	S
CO3	Students should be able to understand leveling methods in surveying	3	En
CO4	Students should be able to perform angular measurements	3	En
CO5	Students should be able to understand curves and its formations	3	En

CO-PO Mapping for CE3346

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	1	1	3	2	3	1	3	2	3	2	1
CO 2	2	1	1	3	2	3	1	3	3	2	2	2	3	2
CO 3	1	3	2	1	3	3	1	3	2	1	3	1	1	2
CO 4	3	2	1	1	1	2	1	3	2	1	3	1	3	1
CO 5	2	2	1	3	3	1	2	2	2	2	1	3	1	3
Avg.	2	2	1.2	1.8	2	2.4	1.4	2.8	2	1.8	2.2	2	2	1.8

ME3344	Title: Strength of Materials Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the methods to determine various properties of material.	
Expected Outcome	Students will able to understand the method to find properties of material.	

List of Experiments

1. Verification of principle of moment: Bell crank lever.
2. Determination of hardness of metals: Brinell / Vicker / Rockwell hardness test
3. Determination of impact strength of metals: Izod / Charpy impact test
4. Determination of tensile strength and percentage elongation of the given metal specimen
5. Determination of compressive strength of the given specimen.
6. Determination of torsional strength and modulus of rigidity for metals
7. Determination of spring index of the given helical coil spring
8. Experiment on deflection of beam
9. Performing creep test of the given specimen
10. To perform the buckling of column under different end conditions.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3344

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to perform test to determine mechanical properties of soil	3	S
CO2	Students should be able to perform test to determine strength of soil	3	S
CO3	Students should be able to perform test to determine water content of soil sample	3	En
CO4	Students should be able to perform test to determine Index property of soil sample	3	En
CO5	Students should be able to perform test to determine Specific gravity of different soil sample	3	En

CO-PO Mapping for CE3344

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	3	3	2	3	2	3	1	2	1	1	3
CO 2	1	3	1	2	1	3	3	1	2	1	2	2	1	2
CO 3	3	2	3	1	1	2	3	1	2	2	2	1	2	3
CO 4	1	2	1	3	3	1	3	1	1	3	2	3	3	2
CO 5	1	2	2	2	2	2	2	2	3	2	1	2	1	1
Avg.	1.4	2.2	1.6	2.2	2	2	2.8	1.4	2.2	1.8	1.8	1.8	1.6	2.2

SEMESTER 4

CE3401	Title:Design of R.C. Elements	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The design of Basic elements such as slab, beam, column and footing which form part of any structural system with reference to IS codes.	
Expected Outcome	The student shall be in a position to design the basic elements of reinforced concrete structures.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Methods of Design of Concrete Structures	3
Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method.		
Unit II	Limit State Design for Flexure	6
Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.		
Unit III	Limit State Design for Bond, Anchorage Shear and Torsion	6
Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behavior of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.		
Unit IV	Limit State Design of Columns	3
Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.		
Unit V	Limit State Design Of Footing	6
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.		
Text Books	1. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers andDistributors,NewDelhi, 2. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Rourkee	
Reference Books	1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd.,New Delhi. 2. Unnikrishna Pillai, S., DevdasMenon, "Reinforced Concrete Design", Tata McGraw-HillPublishing Company Ltd., New Delhi	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic	13-07-2019	

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Course Outcome for CE3401

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to design the portal frame	4	S
CO2	Students should be able to design the continuous beam	4	S
CO3	Students should be able to design the different types of water tank	4	En
CO4	Students should be able to design the combined footing and its type	4	En
CO5	Students should be able to design the retaining wall and its types	4	En

CO-PO Mapping for CE3401

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	2	2	2	1	2	2	2	1	1	2	1	3
CO 2	3	3	3	1	3	2	2	1	2	1	3	1	2	1
CO 3	2	3	3	2	2	1	2	3	1	2	3	3	1	2
CO 4	3	2	3	1	3	3	1	2	3	3	2	1	3	2
CO 5	3	1	1	3	1	1	2	2	3	3	2	2	2	2
Avg.	2.4	2.2	2.4	1.8	2.2	1.6	1.8	2	2.2	2	2.2	1.8	1.8	2

CE3402	Title: **Concrete Technology and Non Destructive Testing**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To impart knowledge to the students on the properties of materials for concrete by suitable	
Expected Outcome	The student will possess the knowledge on properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: 1	**Constituent Materials**	7
Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements- Water-Quality of water for use in concrete.		
Unit II	**Chemical And Mineral Admixtures**	7
Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties		
Unit III	**Proportioning Of Concrete Mix, Fresh And Hardened Properties Of Concrete**	8
Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus		
Unit IV	**Non Destructive Tests**	6
Introduction and types of NDT (ASTM Based)		
Unit V	**Special Concretes**	8
Light weight concretes - High strength concrete - Fiber reinforced concrete – Ferro cement - Ready mix concrete - SIFCON-Shotcrete – Polymer concrete - High performance concrete- Geopolymer Concrete		
Text Books	1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010. 2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003:	
Reference Books	1. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007 2. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995 3. Gambir, M.L; "Concrete Technology",3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007 4. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998	
Mode of	Internal and External Examinations	

Evaluation	
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3402

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the network techniques in construction	2	S
CO2	Students should be able to plan a construction site	2	S
CO3	Students should able to understand utility of construction materials	2	En
CO4	Students should able to understand construction equipment.	2	En
CO5	Students should be able to control quality of construction	2	En

CO-PO Mapping for CE3402

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	3	1	3	1	3	3	2	1	2	2	2
CO 2	3	3	1	2	3	3	2	1	1	3	2	1	1	1
CO 3	3	3	2	3	1	3	2	2	3	3	2	3	3	2
CO 4	3	1	3	3	3	3	2	2	1	2	2	1	3	3
CO 5	3	3	2	3	3	2	2	1	1	1	2	1	2	2
Avg.	2.6	2.4	1.8	2.8	2.2	2.8	1.8	1.8	1.8	2.2	1.8	1.6	2.2	2

CE3403	Title:**Structural Analysis**	**L T P C** **2 1 0 3**
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	An understanding of the basic behavior of skeletal structures and their response to applied loading with emphasis on development of analytical and intuitive skills.	
Expected Outcome	Student will be able to solve the problems related to beams, trusses and frames.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: I	**Beams**	3
Analysis of beams using Moment Area Method, Conjugate Beam Method and unit load method.		
Unit II	**Energy Principle**	3
Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees. Williot-Mohr diagram, Castiglione's theorem, Maxwell's reciprocal theorem, Betti's theorem		
Unit III	**Truss and Frames**	6
Introduction and different methods of solving trusses and frames. Method of joints and Method of section, Determination of deflection of trusses,		
Unit IV	**Arches**	6
Arches as structural forms, Types of arch, Analysis of two hinged, Three hinged, Fixed, Circular and Parabolic		
Unit V	**Influence Line**	6
Influence line diagram of determinate and indeterminate structures like trusses, beams and portal frames.		
Text Books	1. Krishnamurthy D., "Theory of Structures", J.K. Jain Brothers,	
Reference Books	1. Rajsekaran S., Shankarasubramanian G. "Computational of Structural Mechanics", Prentice Hall of India Pvt. Ltd., New Delhi, 2001	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3403

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	To perform analysis of determinate structures.	4	S
CO2	To understand the fundamental concepts and theorems for analysis of structures.	4	S
CO3	To perform analysis of trusses and frames using various conventional methods.	4	En
CO4	To analyze typical structures such as three hinged arch and two hinged arches.	4	En
CO5	To draw influence line diagrams for beams, girders, frames and indeterminate structures.	4	En

CO-PO Mapping for CE3403

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	3	3	2	1	2	1	3	2	3	3	1	2
CO 2	3	2	2	1	2	3	2	1	1	2	1	1	1	3
CO 3	3	2	2	2	3	3	2	2	1	1	2	3	1	3
CO 4	1	2	2	1	3	3	1	2	1	2	3	1	1	2
CO 5	2	2	1	2	1	1	3	2	1	1	3	1	2	3
Avg.	2	2	2	1.8	2.2	2.2	2	1.6	1.4	1.6	2.4	1.8	1.2	2.6

CE3406	Title: **Ground Surveying**	L T P C 3 0 0 3
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	Introduction of advance concepts of surveying. Application of advance surveying techniques to solving management of geospatial applications for natural and cultural resources	
Expected Outcome	The students would be able to understand about astronomical survey, triangulation, geodetic leveling, and hydrographic survey, remote sensing, GIS and GPS	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: 1	**Digital Theodolite**	8
Introduction of theodolite, Types of theodolite, Study parts of digital theodolite, Working and principles of digital theodolite, Adjustments (temporary and permanent), Measurements of angles (horizontal and vertical), co-ordinates, Measurements of Elevations of objects, computations of traverse coordinates.		
Unit II	**Triangulation**	8
Triangulation figure or systems, System of framework, Station marks, Signals and towers, Base line measurement, Measurements of angles, Field check in Triangulation, Trilateration Theory of Errors and Triangulation Adjustments: Definitions, Laws of weight, Laws of accidental errors, Principle of least squares, Distribution of error to the field measurement, Normal Equation, Triangulation adjustments, Adjustment of a Geodetic Quadrilateral		
Unit III	**Trigonometrically Leveling**	7
Correction for Curvature and Refraction, Axis Signal Correction, Difference of elevation of two stations by single observation, Difference of elevation of two stations by reciprocal observations, Determination of coefficient of refraction		
Unit IV	**Hydrographic Surveying**	7
Shore line measurement, soundings – tides and tide gauge – Mine surveying- Equipment for Mine survey- station and station markers, measurement of distance and difference in elevation- Introduction to– EDM and Total Station, – GIS, GPS. Plotting data in Auto Cad.		
Unit V	**Remote Sensing**	6
Introduction, Remote sensing in India, Electromagnetic energy(EME) and spectrum, Interaction of EME with matters, Sensor systems and platforms, Data acquisition and interpretation		
Text Books	1. B.C. Punmia, A.K. Jain and A.K. Jain, Surveying, Vol. II and III, Laxmi Publications (P) Ltd., New Delhi 2. S.K. Duggal, Surveying, Vol-II, TMH Publications, New Delhi	
Reference Books	1. K.R. Arora, Surveying, Vol. II and III, Standard Book House, Delhi. 2. R. Subramanian, Surveying and Levelling, Oxford University Press, New Delhi 3. A. M. Chandra, Higher Surveying, New age international Publications, Delhi	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of	07-06-2019	

Studies on	
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3406

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	students will be able to understand the basic concept of Digital Theodolite	4	S
CO2	Students will be able to understand the concept of Triangulation surveying.	4	S
CO3	students will be able to understand the concept of Trigonometrically Leveling	4	En
CO4	students will be able to understand the concept of Hydrographic Surveying	4	En
CO5	students will be able to learn & understand about Remote Sensing	3	En

CO-PO Mapping for CE3406

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	3	3	1	3	3	1	3	3	1	2	2
CO 2	2	1	3	1	2	1	3	2	2	3	2	1	2	2
CO 3	2	1	2	2	3	3	1	3	2	1	2	2	3	1
CO 4	3	3	1	1	2	3	3	1	1	3	2	2	1	1
CO 5	1	3	3	1	2	3	2	3	2	2	3	3	3	2
Avg.	2.2	1.8	2.2	1.6	2.4	2.2	2.4	2.4	1.6	2.4	2.4	1.8	2.2	1.6

CE3441	Title:Concrete Technology and NDT Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	NIL	
Objectives	To understand various test on concrete as per B.I.S.	
Expected Outcome	Student can perform any test on concrete and also control in-situ quality of concrete	

List of Experiments

1. To determine finesse of cement
2. To determine consistency and Initial and Final setting time of cement
3. To determine soundness of cement
4. To determine compressive and Tensile strength of cement
5. To determine fineness modulus of sand.
6. To determine flakiness and elongation of aggregate
7. To determine specific gravity of cement, sand and aggregate
8. Concrete mix design (M-20)
9. Workability of Concrete-Slump cone Test, Flow Test and Compaction factor test.
10. NDT Test on concrete: Rebound test hammer
11. Ultrasonic Impulsive Test on concrete
12. Electrical Resistivity Test on RCC Beam

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3441

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the network techniques in construction	2	S
CO2	Students should be able to plan a construction site	2	S
CO3	Students should able to understand utility of construction materials	2	En
CO4	Students should able to understand construction equipment.	2	En
CO5	Students should be able to control quality of construction	2	En

CO-PO Mapping for CE3441

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	2	2	1	2	2	1	2	2	1	1	3
CO 2	1	2	2	3	2	3	3	3	2	2	1	3	2	2
CO 3	1	2	3	3	1	1	3	1	2	1	2	3	1	1
CO 4	3	3	3	3	1	3	3	2	3	2	3	3	3	1
CO 5	3	3	3	2	2	1	3	3	1	1	2	3	1	2
Avg.	2	2.6	2.6	2.6	1.6	1.8	2.8	2.2	1.8	1.6	2	2.6	1.6	1.8

CE3442	Title:Structural Analysis Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart experimental knowledge of structural members under loading	
Expected Outcome	Student will able to analysis structure more practically	

List of Experiments

1. Analysis the redundant Joint
2. To determine Elasticity coupled beam
3. To determine Deflection of truss
4. To determine horizontal thrust of three hinged arch
5. To analysis a fixed Beam
6. To determine horizontal thrust of Two hinged arch
7. To determine Elastic properties of deflected beam apparatus
8. To determine buckling of Column with different end conditions
9. To analysis the Portal frame Apparatus
10. Analysis the Curved Member
11. To determine deflection of cantilever beam
12. To determine deflection of simply supported beam

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3442

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to analysis beams BY MAXWELL theorem	4	S
CO2	Students should be able to analysis column	4	S
CO3	Students should be able to analysis truss	4	En
CO4	Students should be able to analysis of arch	4	En
CO5	student will able to analyses the elastic deformation of curved beam	4	En

CO-PO Mapping for CDE3442

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	1	1	3	3	2	2	2	2	2	3	1
CO 2	2	1	3	2	2	2	1	1	1	3	2	1	2	3
CO 3	3	1	1	3	1	3	2	3	3	1	3	1	1	2
CO 4	1	1	1	1	1	1	2	2	1	3	3	3	3	3
CO 5	3	3	1	2	1	2	1	1	2	3	3	2	1	1
Avg.	2	1.6	1.4	1.8	1.2	2.2	1.8	1.8	1.8	2.4	2.6	1.8	2	2

CE3445	Title: Ground Surveying Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To develop methods through the knowledge of modern science and the technology and use them in the field.	
Expected Outcome	The students would be able to understand construction points based on measured angles and distances calculate azimuths, chord distances and coordinates.	

List of Experiments

1. Demonstration and working on Electronic Total Station.
2. Measurement of distances, horizontal and vertical angles and coordinates. Using TS
3. Measurement of area of a land parcel using Total Station.
4. To carryout Triangulation and Trilateration of a given area.
5. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations.
6. Demonstration and working with Mirror stereoscopes
7. Parallax bar and Aerial photographs
8. Visual Interpretation of standard FCC (False colour composite).
9. Digitization of physical features on a map/image using GIS software.
10. Coordinates measurement using GPS.
11. To carryout Triangulation of a given area.
12. Application of Remote sensing in surveying

Mode of Evaluation	Internal and External Examination
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3445

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to perform leveling and can find horizontal and vertical angles using surveying instruments	4	S
CO2	Students should be able to plot traverse and contours.	4	S
CO3	Students should be able to understand leveling methods in surveying	4	En
CO4	Students should be able to perform angular measurements	4	En
CO5	Students should be able to understand curves and its formations	4	En

CO-PO Mapping for CE3445

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	3	2	3	2	2	2	2	3	3	1	2	2
CO 2	1	2	1	3	3	3	3	2	3	3	1	1	3	3
CO 3	2	1	3	1	1	3	1	3	3	3	2	1	1	3
CO 4	2	3	1	2	3	2	3	3	3	2	3	3	2	3
CO 5	1	2	1	2	3	1	3	2	1	3	2	1	3	1
Avg.	1.6	2.2	1.8	2	2.6	2.2	2.4	2.4	2.4	2.8	2.2	1.4	2.2	2.4

Open Elective and Minor
Environment Compliance (other than Civil Engineering)

CE3011	**Title:Carbon Emissions and Control**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	**Nil**	
Objectives	To study various types of carbon emission sources To study control of carbon emissions	
Expected Outcome	The student shall be in a position to define, analyze and control carbon emissions	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit: 1	**Introduction**	**6**
Carbon emissions, Types of emissions, Chemistry of carbon emissions, Various compounds associated with carbon emissions		
Unit II	**Sources of Carbon Emissions**	8
Pollutant formation in SI Engine, mechanism of HC , CO and NO in SI engine, Exhaust emission and factors affecting the emission, Evaporative emission, Crankcase emission, Lead emission CI engine emissions: formation of smoke, factors affecting the smoke formation, Diesel odor, Smog and comparison of diesel and petrol emissions.. Industries leading to carbon emissions, Types of emissions from industries		
Unit III	**Measurement Techniques and Emission Standards**	8
NDIR,FID, Chemiluminescent analyzers, Gas Chromatograph, Smoke meters, Emission Standards, Driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test- chassis dynamometers, Dilution tunnels.		
Unit IV	**Control of Emissions**	8
Design strategies to control emission from engines, Effect of design and operating parameters on emission concentrations, Modification in the engine design, Modifying the fuel used, Exhaust gas treatment devices, Crankcase Emission control, Evaporative Emission control, Exhaust emission control, Air injection system, Second generation air injection system, Spark timing emission control system, Thermal reactor package, Catalytic convertor package, Control of smoke, Odor control, and Pollution from gas turbine and its control, Control techniques for industries		
Unit V	**Lawsand Case Studies**	6
Laws for control of carbon emissions, Various studies regarding emissions policies, case studies		
Text Books	1. Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2. SAE Transactions- "Vehicle Emission"- 3. Marco Nute- " Emissions from two stroke engines, SAE Publication	
Reference Books	1. Paul Degobert – Automobiles and Pollution – SAE International ISBN-1-56091-563- 3	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval	13-07-2019	

by the Academic Council	

Course Outcome for CE3011

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand basics of Renewable energy sources	2	S
CO2	Students should be able to understand solar energy and its applications	2	S
CO3	Students should be able to understand hydro-energy and its applications	2	En
CO4	Students should be able to understand wind energy and its applications	2	En
CO5	Students should be able to understand biomass energy and its applications	2	En

CO-PO Mapping for C E3011

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	1	1	1	3	1	2	3	2	1	2	3	1	2	2
CO 2	1	3	3	3	3	2	3	1	3	3	3	3	1	3
CO 3	2	3	2	1	3	2	3	3	2	1	3	2	2	2
CO 4	2	2	3	3	2	1	3	3	3	3	1	3	2	1
CO 5	1	1	3	1	2	2	1	1	1	2	2	3	1	2
Avg.	1.4	2	2.4	2.2	2.2	1.8	2.6	2	2	2.2	2.4	2.4	1.6	2

CE3012	Title: Environmental Assessment	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To develop a basic knowledge about the environmental impact assessment and apply the same in the field application.	
Expected Outcome	Evaluate the suitability of different approaches to decision support that provide strategies for addressing environmental problems and related societal issues.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction	8
Introduction and scope of EA, various parts of EA, Environment Impact Assessment and Strategic Environmental Assessment, uses, applications		
Unit II	Environmental Impact Assessment (EIA)	8
Environmental Impact Assessment (EIA) - Environmental Impact Statement - Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectorial - social and cultural.		
Unit III	Strategic Environmental Assessment (SEA)	8
What is SEA, advantages of SEA, Good practice SEA steps, Implementing SEA, Informing and influencing decision-making, Monitoring and evaluation, SEA for Poverty Reduction, SEA for transport planning, SEA for spatial development,		
Unit IV	Difference Between EIAand SEA	6
Process, Screening, Scoping, Public Participation, Assessment, Quality review, Decision making, Monitoring		
Unit V	Case Studies of EIA	6
Case studies of EA of developmental projects		
Text Books	1. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York. 2. The World Bank Group, "Environmental Assessment Source Book Vol. I", II and III. The World Bank, Washington.	
Reference Books	1. Lawrence, D.P., "Environmental Impact Assessment - Practical solutions to recurrent problems", Wiley-Interscience, New Jersey 2. Biswas, A.K. and Agarwal, S.B.C., "Environmental Impact Assessment for Developing Countries", Butterworth Heinemann, London.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3012

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to able to carry out scoping and screening of developmental projects for environmental and social assessments	2	S
CO2	Student should be able to able to explain different methodologies for environmental impact prediction and assessment	2	S
CO3	Student should be able to able to plan environmental impact assessments and environmental management plans	2	En
CO4	Student should be able to able to evaluate environmental impact assessment reports	2	En
CO5	Student should be able to able to understand the different the case studies	2	En

CO-PO Mapping for CE3012

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	3	3	2	3	1	3	3	2	1	3	2
CO 2	2	1	3	1	3	3	3	3	2	2	3	1	3	3
CO 3	3	3	3	3	3	3	2	3	1	3	1	2	2	1
CO 4	1	1	3	3	3	1	2	1	1	1	2	1	1	3
CO 5	3	3	2	2	1	1	3	2	2	3	1	2	1	2
Avg.	2	1.8	2.4	2.4	2.6	2	2.6	2	1.8	2.4	1.8	1.4	2	2.2

CE3013	Title:Environment Pollution and Waste Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To study various types of pollution sources	
Expected Outcome	The student shall be in a position to define, analyze and control pollution	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction	8
Various types of pollution, Major cause of pollution, Sources of pollution, Various effects of pollution on health, air, water, Soil properties and ecology		
Unit II	Pollution Prevention	8
Definition-Importance-HistoricalEevolution-Benefits-Promotion-Barriers-Role of Industry, Government and Institutions - Environmental Management Hierarchy Source Reduction Techniques-Process and equipment Optimization, Reuse, Recovery, Recycle, Raw material Substitution-Internet Information and Other CP Resources..		
Unit III	Waste	8
Types of waste- solid-liquid-gaseous, and E-waste, Sources of waste production, Hazardous and non-hazardous waste, Nuclear waste, Properties of domestic and industrial waste,		
Unit IV	Waste Minimization	6
Recycling and Reuse of waste, Waste minimization techniques, Disposal Techniques, Types of disposal, Site of disposal, Biotechnological remedies for environmental pollution - Decontamination of groundwater systems, subsurface environment - reclamation concepts, Bioremediation.		
Unit V	Hazardous Waste Management	6
Sources of hazardous waste, Characterization of hazardous waste, Handling of hazardous waste, Processing of hazardous waste, disposal of hazardous waste		
Text Books	1. Blaine Metting. F (Jr.,),"Soil Microbiology Ecology", Marcel Dekker Inc 2. Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill.	
Reference Books	1. Micheael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management", Hazardous waste Management, McGraw-Hill International edition, New York, 2001. 2. Thibodeaux, L.J, "Environmental Chemo dynamics: Movement Of Chemicals In Air, Water and Soil", edition 2., Wiley – Interscience, New York,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3013

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to understand basic concepts of pollution, their causes, sources & effects on health.	3	S
CO2	Students will be able to understand about pollution preventions & Environmental management, methods of waste managements.	2	S
CO3	Students will be able to understand the concepts of waste, their types, sources & properties of domestic & industrial wastes.	3	En
CO4	Students will be able to understand basic concepts of waste minimization techniques- chemical, biological & disposal etc. Decontamination of groundwater systems	2	En
CO5	Students will be able to understand basic ideas of Hazardous of waste management, their sources, handling techniques & Processing of hazardous waste, Disposal of hazardous waste	3	En

CO-PO Mapping for CE3013

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	2	1	3	2	3	3	1	3	2	3	1	3
CO 2	2	2	3	1	2	1	1	1	2	1	2	3	3	1
CO 3	2	2	1	2	3	1	2	1	2	2	2	1	1	1
CO 4	2	1	1	2	3	1	1	2	3	1	2	1	2	2
CO 5	3	2	1	2	2	1	2	2	1	1	1	2	2	2
Avg.	2.2	1.8	1.6	1.6	2.6	1.2	1.8	1.8	1.8	1.6	1.8	2	1.8	1.8

CE3014	Title: Hydrology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To introduce the concept of hydrological aspects of water availability and requirements and theoryto quantify, control and regulate the water resources.	
Expected Outcome	The students will have an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Precipitation and Abstractions	8
Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyet methods-Interception - Evaporation. Horton's equation, Pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, Infiltration indices.		
Unit II	Runoff	8
Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Stranger's table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH		
Unit III	Flood and Drought	8
Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)		
Unit IV	Reservoirs	6
Classification of reservoirs, General principles of design, Site selection, Spillways, Elevation – area - capacity - storage Estimation, Sedimentation - Life of reservoirs – rule curve		
Unit V	Groundwater Management	6
Origin- Classification and types , Properties of aquifers- governing equations – steady and unsteady flow - artificial recharge – Rain Water Harvesting in rural and urban areas		
Text Books	1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill,	
Reference Books	1. David Keith Todd. "Groundwater Hydrology", John Wiley and Sons, Inc. 2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 4. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3014

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the concept of precipitation.	3	S
CO2	Student should be able to understand the concept of runoff.	3	S
CO3	Student should be able to understand the concept of flood and drought.	3	En
CO4	Student should be able to understand the concept of reservoirs.	3	En
CO5	Student should be able to understand the concept of groundwater and management	3	En

CO-PO Mapping for CE3014

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	2	3	3	1	3	2	3	2	3	1	2	2
CO 2	3	1	1	2	1	2	1	2	2	1	3	1	1	3
CO 3	1	3	2	2	3	1	3	3	3	1	3	1	2	2
CO 4	2	2	3	1	1	1	2	3	1	1	1	3	2	3
CO 5	3	2	3	3	3	1	3	1	3	3	1	2	3	1
Avg.	2	2	2.2	2.2	2.2	1.2	2.4	2.2	2.4	1.6	2.2	1.6	2	2.2

CE3015	Title: Environmental Policies and Legislations	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To educate the students on Indian Constitution, Administrative regime and Legal regime pollution control laws.	
Expected Outcome	Basic knowledge about the environmental policies and legislation.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction to Law	7
Basics of jurisprudence - Criminal law - Common Law - Relevant sections of the Code of Civil Procedure - Indian Penal Code.		
Unit II	Fundamental Rights	7
Introduction - Fundamental Rights - Directive Principles of State Policy - Article 48 (A) and 51-A(g) Judicial enforceability - Constitution and Resources management and pollution control - Indian Environmental Policy (1992).		
Unit III	Regulatory Boards	7
Administrative regulations - constitution of Pollution Control Boards, their hierarchy and Powers, functions, Accounts, Audit - Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement		
Unit IV	Water Act	7
Water (prevention and control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention and control or Pollution) Cass Act. 1977 as amended by Amendment Act 1987 and relevant notifications.		
Unit V	Hazardous Waste Regulation	8
Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Ecolabelling.		
Text Books	1. Tiwari H.N., "Environmental Law", Allahabad Law Agency 2. Kesari U.P.D., "Administrative Law "Universal Book Trade Delhi.	
Reference Books	1. Pandey J.N., "Constitutional Law of India", Central Law Agency Allahabad. 2. "Environmental Policy, Forest Policy", Bare Acts - Government Gazette Notification. 3. Divan A., and Noble M., "Environmental Law and Policy in India (cases, Materials and Statutes)",Tripathi Bombay 4. Constitution of India", Eastern Book Company Lucknow,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3015

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to able to carry out scoping and screening of developmental projects for environmental and social assessments	2	S
CO2	Student should be able to able to explain different methodologies for environmental impact prediction and assessment	2	S
CO3	Student should be able to able to plan environmental impact assessments and environmental management plans	2	En
CO4	Student should be able to able to evaluate environmental impact assessment reports	2	En
CO5	Student should be able to able to understand the different the case studies	2	En

CO-PO Mapping for CE3015

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	1	3	1	2	2	2	3	2	3	1	2
CO 2	1	3	1	3	1	2	3	1	3	2	2	2	2	3
CO 3	2	1	3	2	2	2	1	2	2	1	2	3	2	3
CO 4	1	3	3	3	1	1	2	2	3	1	3	2	1	3
CO 5	2	3	3	2	2	1	2	3	2	2	2	1	3	1
Avg.	1.8	2.4	2.6	2.2	1.8	1.4	2	2	2.4	1.8	2.2	2.2	1.8	2.4

CE3016	Title: Sustainable Development	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart knowledge on the principles for balancing social, economic and environmental dimensions of development framework.	
Expected Outcome	The students will have ability to describe the national and global environmental, economic and social issues and the principles of different sustainable development	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction	7
Status of environment – Environmental, Social and Economic issues – Need for sustainability – Nine ways to achieve sustainability – population, resources, development and environment.		
Unit II	Challenges of Sustainable Development and Global Environmental Issues	7
Concept of sustainability – Factors governing sustainable development – Linkages among sustainable development- Environment and poverty – Determinants of sustainable development – Case studies on sustainable development - Population, income and urbanization – Health care – Food, fisheries and agriculture – Materials and energy flows.		
Unit III	Sustainable Development Indicators	7
Need for indicators – Statistical procedures – Aggregating indicators – Use of principal component analysis – Three environmental quality indices.		
Unit IV	Environmental Assessment	7
National environmental policy act of 1969 – Environmental Impact Assessment – Project categories based on environmental impacts – Impact identification methods – Environmental impact assessment process.		
Unit V	Environmental Management and Social Dimensions	8
Revisiting complex issues – Sector policies concerning the environment – Institutional framework for environmental management - Achievements in environmental management - People's perception of the environment – Participatory development – NGOs – Gender and development – Indigenous peoples – Social exclusion and analysis.		
Text Books	1. Sayer, J. and Campbell, B., "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration and Sustainability), Cambridge University Press, London,	
Reference Books	1. K. irkby, J., O"Keefe P. and Timberlake, "Sustainable Development", Earth scan Publication, London, 2. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, "An introduction to sustainable development", Glen Educational Foundation,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic	13-07-2019	

Council	

Course Outcome for CE3016

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand basics of Renewable energy sources	2	S
CO2	Students should be able to understand solar energy and its applications	2	S
CO3	Students should be able to understand hydro-energy and its applications	2	En
CO4	Students should be able to understand wind energy and its applications	2	En
CO5	Students should be able to understand biomass energy and its applications	2	En

CO-PO Mapping for CE3016

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	2	1	2	2	2	1	2	3	3	3	1	2
CO 2	1	3	2	1	3	1	2	3	3	3	1	2	1	3
CO 3	1	2	2	1	1	3	1	3	3	1	2	2	3	1
CO 4	1	1	3	1	1	1	2	2	3	3	2	2	1	2
CO 5	3	3	1	3	2	3	2	3	2	1	1	3	3	3
Avg.	1.4	2.2	2	1.4	1.8	2	1.8	2.4	2.6	2.2	1.8	2.4	1.8	2.2

SEMESTER 5

CE3501	Title: **Advance Structural Analysis**	L T P C **2 2 0 3**
Version No.	1.0	
Course Prerequisites	**CE3403**	
Objectives	To provide information of fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, developing analytical and intuitive skills.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Moment Distribution Method**	8
Analysis of Beams and Portal frames using moment distribution method.		
Unit II	**Slope Deflection Method**	8
Analysis of Beams and Portal frames slope deflection method.		
Unit: III	**Flexibility Matrix Method**	8
Concept of static indeterminacy of structures, Formulation of Flexibility matrix and equations applied to simple trusses and continuous beams. Flexibility matrix for non-prismatic members		
Unit IV	**Stiffness Matrix Method**	8
Concept of kinematics indeterminacy of structures, Formulation of stiffness matrix and equations applied to simple trusses and continuous beams. Stiffness matrix method applied to simple plane frames.		
Unit V	**Plastic Analysis**	8
Plastic analysis of beams and frames (Static and kinematic method)		
Text Books	1. DevdasMenon, "Advanced Structural Analysis", Narosa Publishing House,	
Reference Books	1. AsslamKassimali, "Matrix Analysis of Structures. 2. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach"	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3501

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to analyze the beam & portal frames using moment distribution method.	3	S
CO2	Students should be able to analyze the beam & portal frames using slope deflection method.	3	S
CO3	Students should be able to analyze the beam & trusses using flexible matrix method.	3	S
CO4	Students should be able to analyze the beam & trusses using stiffness matrix method.	3	S
CO5	Students should be able to analyze the beam & frames using plastic analyzes.	3	S

CO-PO Mapping for CE3501

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	1	1	3	3	1	1	3	3	3	2	3	2
CO 2	2	2	1	2	2	2	1	1	1	1	3	2	3	3
CO 3	2	2	2	2	3	3	3	3	1	2	2	2	1	1
CO 4	2	3	3	2	3	2	2	2	1	3	2	3	1	1
CO 5	2	2	1	3	3	3	1	3	2	2	1	1	3	1
Avg.	1.8	2.4	1.6	2	2.8	2.6	1.6	2	1.6	2.2	2.2	2	2.2	1.6

CE-3507	Title **Soil Mechanics**	L T P C 3 2 0 4
Version No.	**1.0**	
Course Prerequisites	**CE3306**	
Objectives	Describe the nature of soil problems encountered in civil engineering and give an overall preview of the behavior of soil.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	**Introduction and Properties of Soil**	8
Soil formation, Soil types, composition, Constituents of soil and representation by a phase diagram, Definitions of void ratio, Porosity, Water content, Degree of saturation, Specific gravity, Unit weight, Bulk density/bulk unit weight, Dry unit weight, Saturated unit weight and submerged unit weight of soil grains and correlation between them.		
Unit II	**Soil Classification**	8
Particle size, shape and their effect on engineering properties of soil, Particle size classification of soils- Unified soil classification system, IS soil classification system, field identification tests.		
Unit III	**Permeability and Seepage Analysis**	8
Darcy's law, determination of permeability, equivalent permeability in stratified soils, in situ permeability test, 1-D flow, Laplace's equation, flow nets, seepage, uplift pressure, Confined and unconfined flows.		
Unit IV	**Compaction, Compressibility And Consolidation**	8
General principles of compaction, dry density –water content relationship, Compaction tests, Factors affecting Compaction, Field Compaction techniques. Fundamentals, 1-D consolidation, Normally and over-consolidated clays, void ratio – pressure relationships, Compressibility Characteristics, Time rate of consolidation, Coefficient of consolidation, Curve fitting techniques, Secondary consolidation.		
Unit V	**Shear Strength, Slopes Analysis**	8
Principle of effective stress, Mohr-Coulomb failure criterion, Direct shear test, Unconfined compression test, Tri-axial shear test: Consolidated drained, Consolidated undrained, unconsolidated undrained, vane shear test, Mode of slopes failure Mechanism, Stability analysis of infinite slopes, Taylor's stability number.		
Text Books	1. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2. Dr. B.C. Punmia, Er. Ashok K.Jain and Dr. Arun K. Jain " Soil Mechanics And Foundation Engineering:	
Reference Books	1. Holtz, R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall. 2. Das, B.M., "Principles of Geotechnical Engineering", Thomson Asia. 3. Mittal, S. . Soil Testing for Engineers 4. Mittal, S. Pile Foundation Design and Construction.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3507

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the properties of soil.	2	Em
CO2	Students should be able to understand the soil classification and permeability and seepage analysis.	3	Em
CO3	Students should be able to understand the compaction, consolidation and compressibility on soil.	3	S
CO4	Students should be able to analyze the shear strength of soil.	3	S
CO5	Students should be able to understand the concept of shear strength, slope of soil structure.	2	S

CO-PO Mapping for CE3507

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	2	1	1	3	1	1	2	3	1	3	3
CO 2	3	2	3	1	1	3	3	3	1	2	2	1	1	2
CO 3	2	1	3	2	1	3	3	2	1	1	2	1	1	2
CO 4	3	3	1	3	3	2	1	2	2	3	3	2	3	1
CO 5	2	1	1	3	1	2	3	3	3	3	1	2	1	2
Avg.	2.2	1.8	1.8	2.2	1.4	2.2	2.6	2.2	1.6	2.2	2.2	1.4	1.8	2

CE3503	Title: **Design of Steel Structures**	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	CE3501	
Objectives	To introduce the limit state design of steel structural components subjected to bending, compression and tensile loads including the connections.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Introduction**	8
Properties of steel, Structural steel sections, Limit State Design Concept, Loads on Structures, Connections using bolting, Welding, and Design of bolted and welded joints, Eccentric connections.		
Unit II	**Tension Members**	8
Types of section, Net area, Net effective sections for angles and Tee in tension. Design of connections in tension members		
Unit: III	**Compression Members**	8
Compression members, Struts and Columns		
Unit: IV	**Roof Trusses**	8
Roof trusses, roof & side coverings, Design loads, Purlins, members, end bearings.		
Unit V	**Beam & Column**	8
Beam column, Stability consideration, Interaction formulae, Column bases, Slab base, Gusseted base and grillage footings.		
Text Books	1. N. Subramanian., "Steel Structures: Design and Practice", Oxford. 2. Duggal, S.K., "Design of Steel Structures", Tata McGraw-Hill.	
Reference Books	1. Arya, A.S. and Ajmani, J.L., "Design of Steel Structures", Nem Chand & Bros.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3503

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	The students will be able to understand the concept of designing of bolted and welded connections.	4	Em
CO2	The students will be able to analyze tension members and beams using the IS specifications.	3	Em
CO3	The students will be able to analyze compression member.	3	S
CO4	The students will be able to analyze columns under axial loads using IS specifications.	3	S
CO5	The students will be able to analyze roof truss and beam and column.	3	S

CO-PO Mapping for CE3503

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	1	3	1	1	3	2	1	1	1	2	3
CO 2	1	3	3	1	1	3	2	2	3	2	2	1	1	1
CO 3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO 4	1	3	3	3	3	3	3	2	1	3	2	3	3	1
CO 5	1	1	2	1	3	3	2	2	1	1	2	2	3	1
Avg.	1.8	2.2	2.6	1.6	2.2	2.2	1.8	2	1.6	1.6	1.8	2	2.2	1.6

CE3504	Title: **Transportation Engineering**	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will obtain a basic understanding of transportation engineering principles including historical development of transportation in the India and different traffic aspect.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: I	**Highway**	6
Introduction and Fundamentals of Transportation System. ,Development & Planning of Road transport Materials used in highway construction, Geometric Design, rigid pavement and flexible pavement		
Unit II	**Traffic Engineering**	6
Traffic Engineering &Studies, Traffic Capacity analysis, Traffic Design ,Traffic Control Devices ,Traffic Regulation & Management ,Traffic Flow theory		
Unit III	**Railway-I**	6
Railway Transportation and its development, Railway terminology, Railway Administration and Management. Traction and tractive Resistance. Permanent Way. Rail types and functions, Sleepers Ballast cushion, Ballast section Rail fixtures and fasteners. Geometric design of railway track.		
Unit IV	**Railway-II**	6
Points & crossings, railway track Junctions. Stations and Yards, Railway signaling and interlocking, track circuiting. Railway track construction, Signaling and Controlling		
Unit V	**Airport And Harbor**	6
Development of Air Transportation in India. Aircraft components and characteristics Imaginary surfaces, Approach and Turning zone, clear zone, vert. Clearance for Highway & Railway. Runway and taxiway design Docks and Harbor: Importance, Sea and tides, tidal theories, tide table, wind waves and Cyclones, harbor layout, break waters, jetties and moorings.		
Text Books	1. Khanna And Justo, "Transportation engineering"	
Reference Books	1. J H Banks,"Introduction to Transportation Engineering" 2. P H Wright and K Dixon ,"Highway Engineering"	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3504

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the fundamentals of transportation system.	2	S
CO2	Students should be able to analyze the traffic capacity.	3	S
CO3	Students should be able to understand the railway transportation system.	2	S
CO4	Students should be able to understand the railway track junctions and crossings.	2	S
CO5	Students should be able to understand the Airport &Harbors Engineering.	2	S

CO-PO Mapping for CE3504

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	2	3	1	3	3	1	2	3	3	3	1	3
CO 2	1	1	2	1	3	3	2	2	3	1	2	3	1	3
CO 3	1	2	1	1	3	2	3	2	3	2	1	2	2	3
CO 4	2	3	1	1	2	2	3	2	1	1	2	2	1	2
CO 5	2	1	3	2	1	3	1	1	3	1	1	2	1	1
Avg.	1.4	2	1.8	1.6	2	2.6	2.4	1.6	2.4	1.6	1.8	2.4	1.2	2.4

CE-3541	Title: **Geology& Soil Mechanic Lab**	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge on properties of soil and strength characteristics as well.	

List of Experiments

1. Determination Specific Gravity of Coarse and Fine Grained Soils
2. To Find Particle Size Distribution of coarse grained soil using Sieve Analysis
3. To Find Particle Size Distribution of fine grained soil using Hydrometer Analysis.
4. Determination of Mechanical properties of soil
5. Determination of water content- dry density relation using light Proctor Compaction Test
6. Determination of In Situ dry density of soil using Sand Replacement Method.
7. Determination of In Situ dry density of soils using Core Cutter Method.
8. To Perform Permeability Test.
9. Determination of the Shear Strength Parameters of soil using Direct Shear Test.

Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3541

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to analyze the different properties of soil.	3	S
CO2	Students should be able to analyze the types of the soil using different methods.	3	S
CO3	Students should perform the proctor test.	2	S
CO4	Students should be able to analyze the shear strength of soil.	3	S
CO5	Students should perform the aggregate impact value test.	2	S

CO-PO Mapping for CE3541

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	2	1	1	2	1	1	1	3	3	1	2
CO 2	3	1	1	1	2	2	3	1	3	3	2	3	1	3
CO 3	1	1	1	2	3	3	1	2	1	3	1	1	3	2
CO 4	1	3	2	2	1	3	1	1	3	2	3	1	3	2
CO 5	2	1	1	2	1	2	2	2	2	2	2	1	2	3
Avg.	2	1.6	1.6	1.8	1.6	2.2	1.8	1.4	2	2.2	2.2	1.8	2	2.4

CE-3542	Title: **Transportation Engineering Lab**	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge of strength of materials used for road construction	

List of Experiments

1. Los Angeles abrasion value for given aggregate sample
2. To find the Impact value of given aggregate.
3. To determine the aggregate crushing value of coarse aggregate.
4. To find the Flash and fire point for the given bitumen sample.
5. Determination of softening point of Bitumen.
6. To find out the Ductility of a given sample of Bitumen.
7. To determine the grade of given binder (penetration test).
8. To determine the elongation index of a given Aggregate sample.
9. To determine the flakiness index of a given Aggregate sample.
10. To determine the viscosity of bitumen binder.
11. To perform marshal stability test on a given sample
12. Study the plate load test on a pile foundation used in highway

Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3542

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to perform various tests on aggregate.	3	S
CO2	Students should be able to perform various tests on bituminous material.	3	S
CO3	Students should able to determine the aggregate crushing value of coarse aggregate.	3	S
CO4	Students should able to determine find the Flash and fire point for the given bitumen sample.	3	S
CO5	Students should determination of Softening point of Bitumen and viscosity of bitumen binder.	3	S

CO-PO Mapping for CE3542

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	1	1	2	3	2	2	2	3	1	2	2
CO 2	1	2	3	3	2	1	3	3	2	1	1	2	3	2
CO 3	2	3	3	3	3	1	1	2	3	1	1	3	3	3
CO 4	2	1	2	3	1	3	1	2	3	3	3	2	1	1
CO 5	1	1	2	3	3	3	2	2	3	2	3	3	1	2
Avg.	1.8	2	2.6	2.6	2	2	2	2.2	2.6	1.8	2.2	2.2	2	2

SEMESTER 6

CE3601	Title: **Environmental Engineering**	L T P C **30 0 3**
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide information of various sources and characteristics of wastewater various treatment methods available for wastewater treatment	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Wastewater Collection Characterization**	6
Plumbing, types of sewers, design considerations, construction & maintenance, storm water sewers, Constituents of waste water.		
Unit II	**Wastewater Treatment & Pre-and Primary Treatment**	6
On site and centralized treatment systems. Screen, grit removal, oil and grease removal.		
Unit: III	**Secondary Treatment**	6
Activated sludge process, conventional and extended aeration, waste stabilization ponds, UASB process, UASB post treatment.		
Unit IV	**Wastewater and sludge Disposal**	6
Reuse systems, wastewater disposal on land and water bodies, and disposal of sludge.		
Unit V	**Municipal Solid Waste**	6
Collection, characterization, transport, treatment & disposal.		
Text Books	1. Davis, M.L. And Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill. 2. Master, G.M., "Introduction to Environmental Engineering and Science", Prentice Hall of India.	
Reference Books	1. Peavy, H.S., Rowe, D.R. And Tchobanoglous, G., "Environmental Engineering", McGraw Hill. 2. Arcievala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw Hill.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3601

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the types of sewer and its design consideration.	2	S
CO2	Students should be able to understand the concept of waste water treatment (Primary Treatment.	2	S
CO3	Students should be able to understand the concept of waste water treatment (Secondary Treatment).	2	S
CO4	Students should be able to understand the disposal of waste water on land and water bodies.	2	S
CO5	Students should be able to understand the collection, transportation and treatment of municipal solid waste.	2	S

CO-PO Mapping for CE3601

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	2	3	2	2	2	2	2
CO 2	1	2	3	1	1	2	3	2	2	2	3	3	3	2
CO 3	1	3	3	1	2	3	1	1	2	2	1	1	3	1
CO 4	2	1	1	1	3	3	1	1	2	1	3	1	1	2
CO 5	2	3	2	2	3	3	3	2	2	1	1	2	3	2
Avg.	1.4	2	2	1.2	2	2.4	2	1.6	2.2	1.6	2	1.8	2.4	1.8

CE3602	Title: **Design of R.C. Structures**	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The subject aims to develop an understanding of design and detailing of structures	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	**Frames**	8
Analysis of Portal Frame & Design. Analysis of multi-stored frame for horizontal & vertical loading using cantilever & portal frame method.		
Unit II	**Continuous Beams**	8
Introduction to Continuous Beams - Effective span, Span/Depth ratio, Bending moment and shear forces, Design examples. Introduction to curved beams - Analysis of bending and torsional moments in a circular beam, Moments in semicircular beams supported on three columns, Design examples.		
Unit III	**Water Tanks**	8
Introduction, general design requirements on no crack basis, Design of circular and rectangular tanks resting on ground, Design philosophy for design of overhead tanks, intze type tanks and their staging and foundation		
Unit IV	**Combined Footings**	8
Different types, design of rectangular, trapezoidal, strap and raft footings, Pile Foundations		
Unit V	**Retaining Walls**	8
Types, behavior, stability requirements, design of cantilever type retaining walls. Introduction to design of counterfort retaining wall.		
Text Books	1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt.Ltd.,NewDelhi 2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers &Distributors, NewDelhi, 2003.	
Reference Books	1. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Rourkee 2. . Sinha, S.N., "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi. 3. UnnikrishnaPillai, S., DevdasMenon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., New Delhi	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3602

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to design the portal frame.	4	Em
CO2	Students should be able to design the continuous beam.	4	Em
CO3	Students should be able to design the different types of water tank.	4	Em
CO4	Students should be able to design the combined footing and its type.	4	Em
CO5	Students should be able to design the retaining wall and its types.	4	Em

CO-PO Mapping for CE3602

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	1	3	2	1	3	2	3	1	2	1	1
CO 2	3	1	2	1	1	1	1	3	3	2	1	3	3	1
CO 3	1	3	3	1	2	2	3	1	2	1	1	1	3	2
CO 4	2	2	3	3	1	3	3	3	3	2	1	3	2	1
CO 5	1	2	3	2	1	3	3	3	2	3	3	3	1	1
Avg.	1.8	2	2.8	1.6	1.6	2.2	2.2	2.6	2.4	2.2	1.4	2.4	2	1.2

CE-3603	Title: **Foundation Engineering**	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	CE3502	
Objectives	Describe the various methods for soil exploration encountered in civil engineering and give an overall preview of various types of foundations.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	**Soil Exploration**	6
Methods of soil exploration; boring, sampling, penetration tests, correlations between penetration resistance and soil design parameters.		
Unit II	**Earth Pressure and Retaining Walls**	6
Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, earth pressure due to surcharge, retaining walls, stability analysis of retaining walls, proportioning and design of retaining walls.		
Unit III	**Foundations**	6
Types of foundations, mechanism of load transfer in shallow and deep foundations, shallow foundations, Terzaghi's bearing capacity theory, computation of bearing capacity in soils, effect of various factors, use of field test data in design of shallow foundations, stresses below the foundations, settlement of footings and rafts, proportioning of footings and rafts, sheeting and bracing of foundation excavation.		
Unit IV	**Pile Foundation**	6
Types and method of construction, estimation of pile capacity, capacity and settlement of group of piles, proportioning of piles.		
Unit V	**Well & Machine Foundations**	6
Methods of construction, tilt and shift, remedial measures, bearing capacity, settlement and lateral stability of well foundation. Types of machine foundations, mathematical models, response of foundation – soil system to machine excitation, cyclic plate load test, block resonance test, criteria for design.		
Text Books	1. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2. Dr. B.C. Punmia, Er. Ashok K.Jain and Dr. Arun K. Jain " Soil Mechanics And Foundation Engineering:	
Reference Books	1. Holtz, R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall. 2. Lambe, T.W. and Whitman, R.V., "Soil Mechanics", John Wiley and Sons. 3. Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBSPublishers.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic	13-07-2019	

Course Outcome for CE3603

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the concept of soil exploration.	2	S
CO2	Students should be able to analyze the earth pressure for retaining wall.	3	S
CO3	Students should be able to understand the types of foundation.	2	S
CO4	Students should be able to analyze the bearing capacity of foundation.	3	S
CO5	Students should be able to understand the concept of well and machine foundation.	2	S

CO-PO Mapping for CE3603

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	3	2	1	2	1	1	1	2	1	2	1	2
CO 2	2	1	2	3	1	1	3	3	3	2	2	3	2	1
CO 3	1	3	2	1	1	1	1	2	1	1	3	3	3	1
CO 4	1	1	1	2	1	2	3	2	3	2	1	3	1	2
CO 5	3	2	3	1	3	2	1	3	3	1	2	1	1	1
Avg.	1.8	1.6	2.2	1.8	1.4	1.6	1.8	2.2	2.2	1.6	1.8	2.4	1.6	1.4

CE-3640	Title: **Environmental Engineering Lab**	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To equip the students in doing analysis of water and wastewater samples.	

List of Experiments

1. To determine turbidity of water sample.
2. To determine dissolved oxygen of given sample.
3. To determine pH value of water.
4. To perform jar test for coagulation.
5. To determine BOD of given sample.
6. To determine residual chlorine in water.
7. To determine conductivity of water and total dissolved solids.

Mode of Evaluation	Internal and External Examination
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3640

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to determine water quality parameters physically.	3	Em
CO2	Students should be able to determine the water quality parameters chemically.	3	Em
CO3	Students should be able to analyze the water quality parameters biologically.	3	Em
CO4	Students should able to identify the factors adversely affecting the quality of water.	3	Em
CO5	Students should able to understand the methods adopted to treat the water.	3	Em

CO-PO Mapping for CE3640

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	1	3	1	1	1	3	3	2	1	1	1	2
CO 2	3	1	3	1	3	3	3	3	1	1	3	3	1	1
CO 3	1	1	3	1	1	1	3	3	1	2	1	3	1	3
CO 4	1	2	3	2	2	3	1	3	1	1	2	2	2	2
CO 5	2	3	2	3	1	3	3	2	3	2	2	1	2	3
Avg.	1.8	1.6	2.4	2	1.6	2.2	2.2	2.8	1.8	1.6	1.8	2	1.4	2.2

CE-3641	Title: **Foundation Engineering Lab**	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge on properties of soil and strength characteristics as well which are used for foundation designing.	

List of Experiments

1. To Find Particle Size Distribution of coarse grained soil using Sieve Analysis.
2. Determination of water content- dry density relation using light Proctor Compaction Test
3. Determination of In Situ dry density of soil using Sand Replacement Method.
4. Determination of In Situ dry density of soils using Core Cutter Method
5. To Perform Permeability Test.
6. To Perform Relative Density Test.
7. To Perform Unconfined Compression Test.
8. Determination of the Shear Strength Parameters of soil using Triaxial Test.
9. Extraction of Disturbed and Undisturbed Samples
10. To study about Standard Penetration Test.

Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3641

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to determine the different properties of soil using various tests.	2	S
CO2	Students should be able to explore the different types of soil.	2	S
CO3	Students should able to evaluate the water content- dry density relation using light Proctor Compaction Test.	3	S
CO4	Students should able to Perform Permeability Test.	3	S
CO5	Students should able to determine In Situ dry density of soils using Core Cutter Method and Sand Replacement Method.	3	S

CO-PO Mapping for CE3641

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	1	2	3	2	3	2	1	1	3	3	3
CO 2	3	1	3	2	2	1	3	2	3	3	3	1	2	2
CO 3	3	1	2	3	1	2	3	3	3	1	1	3	3	1
CO 4	2	1	1	1	1	1	1	3	2	2	3	1	2	3
CO 5	3	2	3	3	1	3	1	1	3	3	2	2	2	2
Avg.	2.8	1.2	2.2	2	1.4	2	2	2.4	2.6	2	2	2	2.4	2.2

CE3643	Title: **Technical VAP I**	L T P C **2 0 0 2**
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course aims brush-up the topics important in terms of placement Activity.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	**Building Materials and Construction**	6
.Introduction to Bricks, Stone, Steel, Timber. Tiles, Construction elements of Commercial and Residential Buildings		
Unit II	**Concrete**	6
Introduction to Cement and Aggregates. Mix design of M25, M35, M45		
Unit III	**Structure Analysis**	6
Bending Moment and Shear force, Deflection,		
Unit IV	**RCC and Steel Structures**	3
Limit State Method, Working Stress Method, design of column beam and slab		
Unit V	**Truss and Frames**	3
Analysis of truss and portal frame		
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3643

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to apply the engineering knowledge to attain the problem-solving skills required during the placement drives.	2	Em
CO2	Student will be able to develop ability to face technical interviews.	2	Em
CO3	Student will be able to know the types of technical questions asked by the companies in the placement drives.	2	Em
CO4	Students should be able to solve complex civil engineering problems.	3	Em
CO5	Students should be able to give answers of technical questions.	3	Em

CO-PO Mapping for CE3643

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	3	1	2	3	2	2	1	2	3	1	3
CO 2	1	2	3	1	3	1	3	1	3	1	2	3	1	2
CO 3	1	2	2	2	2	2	2	3	3	2	1	2	2	3
CO 4	3	3	1	1	2	3	3	1	2	2	1	2	1	3
CO 5	3	1	1	2	2	1	1	3	2	1	3	3	3	3
Avg.	2	1.8	1.8	1.8	2	1.8	2.4	2	2.4	1.4	1.8	2.6	1.6	2.8

CE3606	Title: **Construction Engineering**	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	**Nil**	
Objectives	To provide knowledge of material selection, different construction procedures of major activities and inspection and submission of reports.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Network Techniques**	6
Introduction to network techniques; Use of computer aided CPM and PERT for planning, Scheduling and Control of construction works; bar charts: Error in networks; Types of nodes and node numbering systems.		
Unit II	**Construction Planning**	6
Planning for construction and site facilities using networks; Preparation of construction schedules for jobs, materials, Equipment, Labour and budgets using CPM.		
Unit: III	**Construction Materials**	6
Introduction of various materials commonly used in civil engineering construction and their properties: Bricks, Cement, Concrete and timber.		
Unit IV	**Construction Equipment's**	6
Equipment for earthworks; Concrete construction; Aggregate production; Concrete production, Handling and placement; Mixers, Vibrations and Temperature control.		
Unit V	**Control on Construction**	6
Construction quality control and inspection; Significance of variability and estimation of risk; Construction cost control; Clashing of networks.		
Text Books	1. Srivastava, U.K., Construction, Planning Management, Galgotia 1999 2. 2. Peurifoy, R.L., Construction Planning, Equipments and Methods, McGraw Hill. 1996	
Reference Books	1. Ahuj a, H.N., Construction Performance Control by Networks, Wiley Interscience. 1976 2. Moder and Philipese, Project Management with CPM and PER I, Van NO Strand. 1970	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3606

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the network techniques in construction.	2	Em
CO2	Students should be able to plan a construction site.	3	Em
CO3	Students should able to understand utility of construction materials.	2	Em
CO4	Students should able to understand construction equipment.	2	Em
CO5	Students should be able to control quality of construction.	3	Em

CO-PO Mapping for CE3606

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	3	3	3	2	3	3	3	1	2	1	1	1
CO 2	3	1	2	1	3	2	2	3	3	3	1	1	1	1
CO 3	2	3	1	3	3	3	2	3	2	2	3	1	3	3
CO 4	1	3	3	1	1	2	3	3	2	1	3	1	3	3
CO 5	1	1	3	1	2	1	3	1	3	2	3	2	2	3
Avg.	2	1.8	2.4	1.8	2.4	2	2.6	2.6	2.6	1.8	2.4	1.2	2	2.2

CE3607	Title: **Renewable Energy Sources**	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	**Nil**	
Objectives	To give sufficient knowledge about the promising new and renewable sources of energy.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Introduction**	6
Introduction, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. ENERGY STORAGE: Sizing and Necessity of Energy Storage		
Unit II	**Solar Energy**	6
Solar energy - Solar radiation measurements - Applications of solar energy.		
Unit: III	**Hydro Energy**	6
Introduction of hydro energy, Thermal Electric Power Generation Effect of dams on environment.		
Unit IV	**Wind Energy**	6
Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy.		
Unit V	**Biomass Energy**	6
Introduction, Photosynthesis process, Biomass fuels, Urban waste to Energy Conversion, Biogas production from waste biomass, factors affecting biogas generation, types of biogas Biomass program in India.		
Text Books	1. A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977 2. Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, 2001.	
Reference Books	1. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011. 5. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 1978	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3607

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand basics of Renewable energy sources.	2	S
CO2	Students should be able to understand solar energy and its applications.	2	S
CO3	Students should be able to understand hydro-energy and its applications.	2	S
CO4	Students should be able to understand wind energy and its applications.	2	S
CO5	Students should be able to understand biomass energy and its applications.	2	S

CO-PO Mapping for CE3607

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	3	1	2	3	2	2	1	2	3	1	3
CO 2	1	2	3	1	3	1	3	1	3	1	2	3	1	2
CO 3	1	2	2	2	2	2	2	3	3	2	1	2	2	3
CO 4	3	3	1	1	2	3	3	1	2	2	1	2	1	3
CO 5	3	1	1	2	2	1	1	3	2	1	3	3	3	3
Avg.	2	1.8	1.8	1.8	2	1.8	2.4	2	2.4	1.4	1.8	2.6	1.6	2.8

CE3608	Title: **Geomatic Engineering**	L T P C **3 0 0 3**
Version No.	1.0	
Course Prerequisites	**Nil**	
Objectives	To provide information of remote sensing and its applications, explanation about the basic concepts of GIS& GPS.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	**Fundamentals of GPS**	6
Components of GPS, GPS receivers, Reference coordinates systems – datum's, geoid, ellipsoid, WGS 84 system, time, signal propagation through atmosphere-their modeling and estimation, satellite orbit.		
Unit II	**GPS Signals and GPS Data**	6
Navigational data. Collection methods – Static positioning, Kinematic positioning –pseudo-kinematic and stop & go, Observation planning and strategy.		
Unit: III	**Utility of GIS**	6
Introduction, Geographical concepts and terminology, Difference between image processing system and GIS. Utility of GIS, various GIS packages and their salient features, Essential components of a GIS.		
Unit IV	**Data acquisition**	6
Data acquisition through scanners and digitizers, methods of digitization. Raster and vector data, Data storage, Verification and editing.		
Unit V	**Applications of GPS & GIS**	6
Data manipulation and analysis, Spatial and mathematical operations on data, area analysis, Query-based analysis. Applications of GPS & GIS for various Natural resources mapping monitoring and for engineering applications.		
Text Books	1. Burrough, P.A. and McDonnell, R.A., "Principles of Geographic Information for Land Resources Assessment", Oxford University Press. 2. Demers, M.N., "Fundamentals of Geographic Information System", 3rd Ed.,John Wiley.	
Reference Books	1. Legg, C.A., "Remote Sensing and Geographic Information System", JohnWiley. 2. Chandra, A.M. And Ghosh, S.K., "Remote Sensing and Geographical Information Systems", Alpha Science. 3. Maguire, D.J., Batty, M. and Goodchild, M. (Eds.). "GIS, Spatial Analysis and Modelling", ESRI Press.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3608

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand fundamentals of GPS.	2	S
CO2	Students should be able to understand types of GPS signals and its data.	2	S
CO3	Students should be able to understand utility of GIS.	2	S
CO4	Students should be able to understand data acquisition.	2	S
CO5	Students should be able to understand applications of GPS & GIS.	2	S

CO-PO Mapping for CE3608

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	1	1	3	2	1	2	3	3	1	3	1	2
CO 2	2	3	3	3	1	1	3	3	1	3	1	3	2	3
CO 3	1	3	1	2	1	1	3	3	1	2	3	2	1	2
CO 4	1	1	1	1	2	1	1	1	3	1	3	3	1	2
CO 5	2	2	3	2	3	2	3	3	2	2	1	1	1	1
Avg.	1.8	2	1.8	1.8	2	1.4	2.2	2.4	2	2.2	1.8	2.4	1.2	2

SEMESTER 7

CE3701	Title: Health Safety & Environment Management	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic understanding of Health & Safety	
Unit No.	Unit Title	No.of hours (per Unit)
Unit I	Health Hazard	6
Toxicity, physiological, asphyxiation, respiration and skin effects. Effects of sour gases (H2 S and CO) on human health. Effect of corrosive material and atmosphere during sand control, fracturing and acidization operation.		
Unit II	Safety Analysis	6
Operational risk in Industry, production and handling of oil and Gas, fireHazard: safety in drilling. Manual. Gas leakage, fire detection and suppression systems. Hazard and failure mode analysis: disaster and crisis management.		
Unit III	Environment Health and Safety	6
Impact of oil and gas on air, water and soil pollution, impact of drilling and production operations, offshore problems, oil-spill control. Environmental impact assessment. Waste treatment & Management methods, effluent water treatment and disposal. Contaminated soil remediation.		
Unit IV	Noise pollution	6
Noise pollution and remediation measure. Industrial Accident & prevention: Safety sampling, Accident and Safety Audit; Legal requirements, Disaster Planning and control. Safety in offshore operations.		
Unit V	Detector	6
Gas detection fire detection and suppression, personal protection measures. Occupational Physiology: Respiratory and skin effect. HSE regulation; oil mines regulations.		
Text Books	1. Health Safety & Environment by Parker & Sons, BPB Publications 2. Health Safety & Environment by K.T.Narayanan	
Reference Books	1. Safety & Regulations 2015 , 2nd Ed., Academic Press 2. Safety in oil and Gas Fields of India, Indian Petroleum Publications 3. Guide to Environment Safety & Health Management, Frances Alston, Emily J Miliki 4. Health Safety & Environment, ChetanPrakashan	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3701

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand respiration and skin effects.	2	Em
CO2	Students should be able to understand safety analysis during drilling.	2	S
CO3	Students should be able to evaluate management & impact of oil and gas.	2	S
CO4	Students should be able to determine remediation measure & prevention.	2	En
CO5	Students should be able to understand HSE regulation.	1	None

CO-PO Mapping for CE3701

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	1	2	3	1	3	1	3	3	3	3	1	1
CO 2	2	1	1	2	2	2	2	3	3	2	1	3	1	1
CO 3	1	2	1	3	2	3	3	1	2	2	3	3	3	3
CO 4	1	3	1	2	3	3	3	1	1	1	2	3	1	2
CO 5	2	1	3	3	1	2	1	3	2	2	3	1	3	1
Avg.	1.6	1.6	1.4	2.4	2.2	2.2	2.4	1.8	2.2	2	2.4	2.6	1.8	1.6

CE3702	Title: Estimation and Costing	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the importance of preparing the types of estimates under different conditions and to know about the rate analysis and bill preparations	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction	6
Types of estimates - Units of measurements; Methods of estimates – Advantages of estimates of Buildings; Calculations of quantities of brick work, RCC, PCC, Plastering, white washing, color washing and paintings / varnishing for shops, rooms, residential building with flat roof.		
Unit II	Estimates of other Structures	6
Estimates of Septic tank, Soak pit, Sanitary and water supply installations (water supply pipe line, sewer line); Estimate of bituminous and cement concrete roads; Estimate of retaining walls, culverts; Estimating of irrigation works - aqueduct, siphon, fall.		
Unit III	Specifications and Tenders	6
P.W.D. Schedule and cost indices for building material and labor. Schedule of rates; Analysis of rates; Specifications – Sources, Detailed and general specifications; Tenders; Contracts - Types of contracts, Contract Documents.		
Unit IV	Valuation	3
Necessity - Basics of value engineering; Capitalized value; Depreciation; Escalation value of Building; Calculations of Standard rent - Mortgage, Lease.		
Unit V	Report Preparation	3
Principles for report preparation - report on estimate of residential building, Culvert, Roads; Water supply and sanitary installations - Tube wells, Open wells.		
Text Books	1. Kohli D D and Kohli R C., "A Text Book of Estimating and Costing (Civil)", S. Chand & Company Ltd.	
Reference Books	1. Rangwala, S.C, Estimating and Costing", Anand, CharotarBookStall 2. Chakraborti, M, "Estimating, Costing and Specification in Civil Engineering",Calcutta 3. Dutta, BN, "Estimating andCosting 4. Mahajan Sanjay, "Estimating and Costing" SatyaParkashan,Delhi	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3702

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the importance of estimation and costing.	2	Em
CO2	Student should be able to analyze the estimates of different structures.	2	S
CO3	Student should be able to understand about the Tenders.	2	S
CO4	Student should be able to analyze the concept of Valuation.	2	En
CO5	Student should be able to understand the concept of Report Preparation	1	None

CO-PO Mapping for CE3702

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	3	1	1	1	1	1	1	2	1	1	1
CO 2	3	2	3	1	3	1	2	2	1	2	3	2	1	3
CO 3	1	1	2	2	2	3	3	3	3	3	1	2	2	1
CO 4	1	3	2	3	3	3	1	2	3	3	1	1	2	2
CO 5	3	3	3	2	1	3	3	3	1	2	2	2	1	1
Avg.	2.2	2.4	2.4	2.2	2	2.2	2	2.2	1.8	2.2	1.8	1.6	1.4	1.6

CE3741	Title: Estimation lab	L T P C 0 02 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the importance of preparing the types of estimates under different conditions and to know about the rate analysis and bill preparations	

List of Experiments

1. Estimate the quantity Cement Sand & Aggregate of 2 BHK flat of a given drawing
2. Estimate the quantity Bricks and floors of 2 BHK flat of a given drawing
3. Estimate the quantity R.C.C of 2 BHK flat of a given drawing
4. Estimate the quantity of building material of a water tank flat of a given drawing
5. Prepare PPT of a quantity of building material of 2 BHK flat of a given drawing
6. Estimate the quantity of material of proposed MDR of a given drawing
7. Estimate the labor and material cost of proposed building

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3741

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to estimate the quantity of structures	2	Em
CO2	Students should be able to evaluate the quantity	2	S
CO3	Students should be able to present reports	2	S
CO4	Students should be able to estimate the material quantity	2	En
CO5	Students should be able to done price analysis	1	None

CO-PO Mapping for CE3741

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	3	1	1	1	1	3	3	1	1
CO 2	2	2	3	1	3	2	1	3	1	2	3	3	2	2
CO 3	3	2	3	3	2	1	2	3	2	3	3	3	1	1
CO 4	2	2	1	1	1	2	2	3	3	1	1	3	2	2
CO 5	3	1	3	2	2	3	2	2	1	2	2	3	2	1
Avg.	2.6	2	2.4	1.8	2.2	2.2	1.6	2.4	1.6	1.8	2.4	3	1.6	1.4

CE3742	Title: **Technical VAP II**	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course aims brush-up the topics important in terms of placement activity.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	**Construction Management**	6
Construction equipment's, PERT & CPM in construction management, Rate analysis, prefabricated structures		
Unit II	**Building by laws**	6
Building codes, IS456:2000, IS132, IS800:2007		
Unit III	**Structure Analysis**	6
ILD. Arches, Trusses		
Unit IV	**Prestressed Concrete**	3
Pre-tensioning & Post tensioning, System of prestress		
Unit V	**Surveying**	3
Levelling, Contouring & Application of TS, GIS, GPS & Remote sensing		
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3742

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to solve complex civil engineering problems.	2	Em
CO2	Students should be able to give answers of technical questions	2	S
CO3	Students should be able to learn to prepare a PowerPoint presentation on the training.	2	S
CO4	Students should be able to learn to prepare and submit a report on the training.	2	En
CO5	Students should learn the different concepts and ideas.	1	None

CO-PO Mapping for CE3742

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	3	2	2	1	1	3	3	3	3	3	3
CO 2	2	2	3	2	2	2	3	2	2	1	1	2	3	1
CO 3	3	2	3	1	3	1	1	3	3	2	3	1	2	2
CO 4	1	3	1	1	2	1	2	2	1	2	2	3	2	1
CO 5	2	1	2	3	1	1	1	2	1	2	2	1	2	2
Avg.	1.8	2	2	2	2	1.4	1.6	2	2	2	2.2	2	2.4	1.8

CE3703	Title: Bridge Engineering	L T P C 3 00 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	After the successful completion of the course student should be able to able to describe and understand better about the bridge engineering and various components of bridge.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: 1	Introduction	8
Types Of Bridges type of bridge: Timber and stone masonry bridges, Iron and steel bridges, RCC bridges a Prestressed concrete Bridges		
Unit II	Bridge Loading Standards	8
Indian Road Congress (Bridge loading standards), Impact factors, Indian Railway Bridge loading standards		
Unit III	Design Of Bridge Culvert, Tee Beam Bridge	8
General Features, Design Loads, Design Moments, Shears and Thrusts, Critical sections and its example		
Unit IV	Bearing and its Classification	8
Types of bearings and their design; Various types of bearings and their design		
Unit V	Foundation For Bridge Structure	8
General Aspects, Types of Foundation, Pile Foundation, Well Foundation and Caisson Foundation.		
Text Books	1. Ponnuswamy, S., Bridge Engineering", Tata McGraw-Hill 2005 2. Rajgopalan, N., "Bridge Super Structures", Narosa Publishing. 2006	
Reference Books	1. Mondorf, P.E., "Concrete Bridges", Taylor & Francis. 2006 2. Ryall, M.J., Parke, G.A.R and Harding. J.E., "The Manual of Bridge Engineering", Thom Telford. 2002	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for3703

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the types of bridge and its components.	2	Em
CO2	Student should be able to understand the concept of bridge loading standards.	2	S
CO3	Student should be able to analyze the design of Bridge Culvert, Tee Beam Bridge.	2	S
CO4	Student should be able to understand the concept of bearing and its classification.	2	En
CO5	Student should be able to understand the concept of foundation for Bridge Structure	1	None

CO-PO Mapping for CE3703

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	1	2	3	1	2	3	2	1	2	3	1	1
CO 2	1	1	3	1	3	2	1	1	1	1	1	1	2	3
CO 3	3	1	3	1	2	2	3	3	1	1	1	3	1	2
CO 4	3	2	1	1	1	3	3	2	2	3	2	3	3	1
CO 5	1	2	2	2	3	2	3	1	2	2	2	2	3	2
Avg.	1.8	1.6	2	1.4	2.4	2	2.4	2	1.6	1.6	1.6	2.4	2	1.8

CE3704	Title: Design of High-Rise Buildings	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	After successful completion of course students should be able to design tall buildings	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: 1	Tall Building systems and Concepts	8
Environmental systems, Service systems, Construction system, Foundation design, Architectural- structu interaction.		
Unit II	Loading and Safety	8
Gravity load, Earthquake loadings, Wind loading and effects, Fire and blast, Quality control crib Structural safety		
Unit III	Structural design of tall steel buildings	8
Commentary on structural standards, Elastic analysis and design, Plastic analysis and design, Stability, Design methods based on stiffness, fatigue and fracture; Load factor (Limit State) design		
Unit IV	Structural design of tall concrete and masonry buildings	8
Commentary structural standards, Plastic analysis-strength of members and correction, Non-linear analysis and limit design, Stability, Stiffness and crack control creep shrinkage and temperature effects. Limit state design, Masonry structures		
Unit V	Frame-shear wall systems	8
Twist of frame, Analysis of shear wall, Frame wall interaction, Analysis of coupled shear wall, Computation of earthquake loads dynamic analysis of tall building		
Text Books	1. Structural Analysis and design of Tall Buildings by Tara NathBungale 2. Advances in tall buildings by BeedleL. S	
Reference Books	1. Analysis of Shear walled buildings 2. Design of multistory reinforced concrete buildings for earthquake motion by J.A.Blume, N.M. Newmark.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3704

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the concept of Tall Building System.	2	Em
CO2	Student should be able to understand the concept of loading and safety.	2	S
CO3	Student should be able to analyze the structural design of tall steel buildings	2	S
CO4	Student should be able to analyze the structural design of tall concrete and masonry buildings.	2	En
CO5	Student should be able to analyze the concept of frame shear wall systems.	1	None

CO-PO Mapping for CE3704

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	1	1	1	1	3	3	3	2	3	2	3
CO 2	2	3	3	1	2	3	2	3	1	1	2	1	3	3
CO 3	1	2	3	3	3	3	3	2	2	3	1	3	1	2
CO 4	2	3	3	2	2	1	3	3	1	2	3	3	3	2
CO 5	2	2	3	2	2	1	1	1	3	1	1	2	2	2
Avg.	2	2.6	3	1.8	2	1.8	2	2.4	2	2	1.8	2.4	2.2	2.4

CE3705	Title: Earthquake Resistant Constructions	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students familiar about seismic forces and to provide techniques to resist collapses during earthquakes. To provide the knowledge about response spectra, and its implementation	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction	6
Origin of Earthquakes, Magnitude, Intensity, Ground motions, Sensors, Strong motion characteristics.		
Unit II	Response of Structures	6
Response of Structure to Earthquake motion, Base shear calculation, Distribution of base shear Modeling of structures, S.D.O.F. Systems- Equation of motion, Free and Forced vibrations, Damping, Response Spectrum.		
Unit III	System	6
M.D.O.F Systems. - Two degree and multi-degree freedom systems.		
Unit IV	Seismic Analysis and Modeling	3
Seismic Analysis and Modeling of R.C. Buildings- Codal procedure for determination of design lateral loads, In-fill walls, Seismic analysis of R.C. building as per IS: 1893 (Part1)		
Unit V	Earthquake Resistant Design	3
Earthquake Resistant Design of Buildings-Ductility considerations, E.R.D. of R.C. building, Design of load bearing buildings, Design of shear wall.		
Text Books	1. P. Agarwal & M. Shrikhande, "Earthquake Resistant Design of Structures", PHI PrivateLearning, Delhi. 2. Duggal S.K. "Earthquake Resistant Design of Structures", Oxford University Press Delhi	
Reference Books	1. Mario Paz, "Structural Dynamics – Theory & Computation Dynamics of Structures" 2. ChopraAnil K. "Theory and Applications to Earthquake Engineering", Prentice Hall India, Delhi 3. Kramer Steven L. "Geotechnical Earthquake Engineering", Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3075

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to able to understand the introduction about the Earthquake.	2	Em
CO2	Student should be able to able to understand the concept of Earthquake Response of Structure.	2	S
CO3	Student should be able to able to understand the concept of Two degree and multi-degree freedom systems.	2	S
CO4	Student should be able to able to understand the concept of Seismic Analysis and Modeling.	2	En
CO5	Student should be able to able to analyze the concept of Earthquake Resistant Design	1	None

CO-PO Mapping for CE3705

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	3	3	2	3	2	3	1	2	2	1	1
CO 2	3	2	2	3	3	2	2	2	1	2	2	1	1	1
CO 3	3	1	1	3	2	3	2	2	2	2	2	1	3	2
CO 4	1	3	2	3	1	3	2	2	3	1	2	2	1	1
CO 5	1	1	3	2	3	1	3	3	3	3	2	3	1	2
Avg.	2	1.8	2.2	2.8	2.4	2.2	2.4	2.2	2.4	1.8	2	1.8	1.4	1.4

E3706	Title: Hydrology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To introduce the student the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: I	Precipitation and Abstractions	08
Hydrological cycle- Meteorological measurements – Requirements, Types and forms of precipitation - Rain Gauges- Spatial analysis of rainfall data using Thiessen and Isohyetal methods, Pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - Double Ring Infiltrometer, Infiltration indices.		
Unit II	Runoff	08
Watershed, catchment and basin - Catchment characteristics - Factors affecting runoff - Run off estimation using empirical –Strange's table and SCS methods – Stage discharge relationships- Flow measurements- Hydrograph – Unit Hydrograph – IUH		
Unit III	Flood and Drought	08
Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, Hydrological and Agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)		
Unit IV	Reservoirs	08
Classification of reservoirs, General principles of design, Site selection, Spillways, Elevation – Area - Capacity - Storage estimation, Sedimentation - Life of reservoirs – Rule curve		
Unit V	Groundwater and Management	08
Origin- Classification and types - Properties of Aquifers- Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas		
Text Books	1. Subramanya.K. "Engineering Hydrology"- Tata McGraw Hill, 2010 2. Jayarami Reddy P. "Hydrology", Tata McGraw Hill, 2008. 3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.	
Reference Books	1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007 2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998. 3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3706

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the concept of precipitation.	2	Em
CO2	Student should be able to understand the concept of runoff.	2	S
CO3	Student should be able to understand the concept of flood and drought.	2	S
CO4	Student should be able to understand the concept of reservoirs.	2	En
CO5	Student should be able to understand the concept of groundwater and management	1	None

CO-PO Mapping for CE3706

Course Outcomes	Program Outcomes (Course Articulation Matrix(Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	1	3	2	1	3	3	3	3	2	2	1
CO 2	2	2	1	1	3	2	3	2	2	2	1	1	1	1
CO 3	2	3	1	2	3	2	2	1	3	3	2	1	1	3
CO 4	2	1	3	1	2	2	1	3	3	2	2	2	3	2
CO 5	2	1	2	2	2	3	1	3	3	2	2	3	2	2
Avg.	2	1.6	1.8	1.4	2.6	2.2	1.6	2.4	2.8	2.4	2	1.8	1.8	1.8

CE3707	Title: Irrigation Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart knowledge regarding hydrology, Flow irrigation – Storage and distribution system, constructional features of head works, River training works, Cross drainage works, Causes and prevention of water logging and construction of tube wells.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction And Water Crop Requirement	8
Definition and necessity of irrigation, History of development of Irrigation in India, Major, medium and minor rigation projects, Principal crops in India and their water requirements, Duty, Delta and base period, Gross ommanded area (GCA), Culturable commanded area (CCA).		
Unit II	Hydrological Cycle and Method of Irrigation	6
Rainfall, Types of rain, Catchment area runoff, Factors affecting runoff, Hydrograph, Basic concept of unit hydrograph, Flow irrigation, Lift Irrigation, Sprinkler irrigation, Drip irrigation, Component parts and advantages.		
Unit III	Canal and Tube Well Irrigation	8
Classification of a canal and their functions, Maintenance of lined and unlined canals, Water table, Radius of Influence, Depression head, Cone of depression, Confined and unconfined aquifers, Water harvesting techniques, Runoff from roof top and ground surface, Techniques for ground water recharge, Construction of recharge pits and recharge wells and their maintenance.		
Unit IV	Dams, Canal Head Works and Regulatory Works	6
Classification of dams, Method of construction, Concept of small and micro dams, Concept of spillways and energy dissipaters, Difference between weir and barrage.		
Unit V	Cross Drainage Works, Definitions of Hydraulic Structures with Sketches	8
Functions and necessity of the following types: Aqueduct, Super passage, Level crossing, Inlet and outlet, Pipe crossing, Sketches of the above cross drainage works Falls, Cross and head regulators, Outlets, Canal Escapes.		
Text Books	1. Bharat Singh, `Fundamentals of Irrigation Engineering', Nem Chand and Bros, Roorkee.	
Reference Books	1. Saharsabudhe SR, “Irrigation Engineering and Hydraulic Structures” 2. Central Ground Water Board and Central Water Commission Guidelines Books. 3. Punmia, BC; and PandeBrijBansiLal, `Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors, Delhi.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3707

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the concept of water crop requirement.	2	Em
CO2	Student should be able to understand the concept of hydrological cycle and method of Irrigation.	2	S
CO3	Student should be able to understand the concept of Canal and Tube Well Irrigation.	2	S
CO4	Student should be able to understand the concept of Dams, Weir, and Barrage, its components and methods of construction.	2	En
CO5	Student should be able to understand the necessity of aqueduct, crossing, pipes etc.	1	None

CO-PO Mapping for CE3707

Course Outcomes	Program Outcomes (Course Articulation Matrix(Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	3	3	1	2	1	2	1	3	2	2	1	3
CO 2	1	1	2	2	3	1	3	1	1	2	2	3	2	1
CO 3	3	1	1	3	2	3	1	1	1	2	1	2	1	3
CO 4	1	3	2	2	3	3	1	2	3	3	2	1	1	2
CO 5	2	2	3	3	3	3	2	3	3	1	3	2	2	3
Avg.	1.8	2	2.2	2.6	2.4	2.4	1.6	1.8	1.8	2.2	2	2	1.4	2.4

CE3708	Title: River Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course will help the students to understand the hydrodynamics and hydraulics of alluvial rivers. Moreover, it will impart knowledge of river training works, flood forecasting and the flood control measures.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: 1	River Engineering	8
Generalized characteristics of river channels. Charge in principle hydrological characteristics. Local characteristics of river channel. Stability of the channel and rate of the channel process.		
Unit II	Hydraulics of alluvial rivers	8
Variation of bed material, Slope along river; Dominant discharge; River plan-forms, straight, Meandering, braided; cross-sectional shape, Secondary circulation		
Unit III	Bends and models	8
Flow in bends of Alluvial streams: prediction of river plan forms, Local scour at hydraulic structures. Aggradation and degradation of streams; Occurrence and estimation. Hydraulic and mathematical models for alluvial streams.		
Unit IV	River training	8
Guide banks, Spurs and Groynes, Flood forecasting. Flood damage mitigation, Structural and nonstructural methods.		
Unit V	Flood Control	8
Flood routing through reservoirs and channels, Principles, Hydraulic methods; Principles of hydrologic routing, Probabilistic method; Flood damages and benefit studies.		
Text Books	1. Garde, R.J., 'River Morphology', New Age International. 2. Julin P.Y., 'Erosion and Sedimentation', Cambridge University Press.	
Reference Books	1. Rosgen, D., 'Applied River Morphology", Wildland Hydrology Books, Pagosa Springs. 2. gosh, S.N., 'Flood control and Drainage engineering'	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3708

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to able to understand the importance of river engineering.	2	Em
CO2	Student should be able to able to understand the concept of hydraulics of alluvial rivers.	2	S
CO3	Student should be able to able to understand the concept of flow in bends of stream and their models.	2	S
CO4	Student should be able to able to understand about the river training.	2	En
CO5	Student should be able to able to understand the methods of flood controls.	1	None

CO-PO Mapping for CE3708

Course Outcomes	Program Outcomes (Course Articulation Matrix(Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	3	1	3	3	1	1	1	1	2	3	3	1	1
CO 2	1	2	3	3	3	1	2	1	2	3	2	3	3	3
CO 3	3	3	2	3	2	3	2	3	1	3	3	2	2	1
CO 4	2	1	2	3	2	3	1	3	2	1	1	1	2	3
CO 5	3	3	2	2	2	1	3	2	1	3	3	2	2	3
Avg.	2	2.4	2	2.8	2.4	1.8	1.8	2	1.4	2.4	2.4	2.2	2	2.2

CE3741	Title: Estimation Lab	L T P C 0 0 2 1
Version No.		
Course Prerequisites	Nil	
Objectives	To impart knowledge of various civil engineering materials and their quantities used in a building, and making detailed estimates of simple building plan.	

List of Experiments

1. To make a list of measurement of works with their quantity's units.
2. Comprehensive drawing of planning including plumbing& electrical fitting drawing of residential & Multistoried Buildings
3. Preparation of estimates of residential & multistoried building, Plumbing & Electrical fittings.
4. Preparing the layout plan of water & sewer line services and their estimation using software
5. Project: To calculate the total quantity of various material components for a residential and multistoried building. i.e. – cement, sand, aggregates, brick etc. complete including estimating cost of the building using EXCEL or AUTODESK QUANTITY TAKE OFF

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3741

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to estimate the quantity of structures	2	Em
CO2	Students should be able to evaluate the quantity	2	S
CO3	Students should be able to present reports	2	S
CO4	Students should be able to estimate the material quantity	2	En
CO5	Students should be able to done price analysis	1	None

CO-PO Mapping for CE3741

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	3	1	1	1	1	3	3	1	1
CO 2	2	2	3	1	3	2	1	3	1	2	3	3	2	2
CO 3	3	2	3	3	2	1	2	3	2	3	3	3	1	1
CO 4	2	2	1	1	1	2	2	3	3	1	1	3	2	2
CO 5	3	1	3	2	2	3	2	2	1	2	2	3	2	1
Avg.	2.6	2	2.4	1.8	2.2	2.2	1.6	2.4	1.6	1.8	2.4	3	1.6	1.4

SEMESTER 8

CE3801	Title: Environmental Impact Assessment	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart knowledge on Environmental management and Environmental Impact Assessment To impart knowledge about various Environmental Impact Assessment procedures & steps	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: I	Introduction	08
Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA-Stages of EIA, Types of EIA		
Unit II	Methodologies	08
Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives		
Unit III	Prediction And Assessment	08
Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna- Mathematical models- Public participation.		
Unit IV	Environmental Management Plan	08
Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora & fauna - Addressing the issues related to the Project Affected People, Post project monitoring		
Unit V	Case Studies	08
EIA for infrastructure projects – Dams – Highways – Multi-story Buildings – Water Supply and Drainage Projects – Waste water treatment plant.		
Text Books	1. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996. 2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.	
Reference Books	1. John G. Rau and David C Hooten "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1990. 2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991. 3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to able to carry out scoping and screening of developmental projects for environmental and social assessments	2	Em
CO2	Student should be able to able to explain different methodologies for environmental impact prediction and assessment	2	S
CO3	Student should be able to able to plan environmental impact assessments and environmental management plans	2	S
CO4	Student should be able to able to evaluate environmental impact assessment reports	2	En
CO5	Student should be able to able to understand the different the case studies	1	None

Course Outcome for CE3801

CO-PO Mapping for CE3801

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	1	1	1	2	1	3	1	2	1	2
CO 2	1	1	3	1	1	3	1	3	2	1	3	3	1	2
CO 3	3	3	2	2	2	3	1	2	1	3	2	2	1	2
CO 4	1	3	1	3	2	1	2	2	3	3	2	1	2	2
CO 5	2	2	1	2	3	3	1	2	3	2	3	2	1	3
Avg.	2	2.4	1.8	2	1.8	2.2	1.2	2.2	2	2.4	2.2	2	1.2	2.2

CE3802	Title: Groundwater Improvement Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart knowledge on groundwater movement, development of ground water resources hydro chemical behavior of contaminants and the principals involved in contaminant transport through groundwater.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: I	Introduction	8
Ground water occurrence and movement: Ground water hydrologic cycle, Origin of ground Water, Rock properties affecting ground water, Vertical distribution of ground water, Zone of aeration and zone of saturation, Geologic formation as Aquifers, Types of aquifers, Porosity, Specific yield and Specific retention. Permeability, Darcy's law, Storage coefficient, Transmissivity, Differential equation governing ground water, Flow in three dimensions derivation, Ground water flow equation in polar coordinates system, Ground water flow contours their applications.		
Unit II	Data Analysis	8
Steady flow ground water flow towards a well in confined and unconfined aquifers, Assumptions, Formation constants, Yield of an open well interface and well tests, Unsteady flow towards a well		
Unit III	Investigations	8
Surface and Subsurface Investigation: Surface methods of exploration-Electrical resistivity and Seismic refraction methods. Subsurface methods-geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.		
Unit IV	Artificial Recharge	8
Artificial Recharge of Ground Water: Concept of artificial recharge- recharge methods, Relative merits. Applications of GIS and Remote Sensing in Artificial Recharge of Ground water.		
Unit V	Saline Water Intrusion	8
Saline Water Intrusion In aquifers: Occurrence of saline water intrusions, Ghyben-Herzberg relation, Shape of interface, Control of seawater intrusion.		
Text Books	1. Randall J. Charbeneau-Ground water Hydraulics and Pollutant Transport, Prentice Hall. Inc, 1999 2. Remson I.,Hornberger G.M. and MoltzF.J.,"Numerical Methods in Subsurface Hydrology", Wiley, New York, 1971	
Reference Books	1. Allen Freeze R. and John A. Cherry "Ground water. Prentice Hall. Inc, 1979 2. Raghunath, H.M., Ground Water, 2nd edition, Wiley Eastern Ltd., New Delhi, 1987. 3. Rushton K.R., "Groundwater Hydrology" Conceptual and Computational Models, Wiley, 2003 4. Elango L. and Jayakumar, R. "Modelling in Hydrology", Allied Publishers Ltd., 2001	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3802

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to know the basic knowledge about the subject.	2	Em
CO2	Student should be able to analyze the ground water flow.	2	S
CO3	Student should be able to understand the investigations of surface and subsurface water.	2	S
CO4	Student should be able to understand the concept of artificial recharge.	2	En
CO5	Student should be able to know about the saline water intrusion.	1	None

CO-PO Mapping for CE3802

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	1	2	3	1	2	1	1	3	2	1	2
CO 2	3	2	3	2	2	3	3	1	1	3	3	2	2	1
CO 3	2	1	3	2	1	2	1	3	1	2	1	2	2	2
CO 4	3	2	2	3	2	3	1	2	2	2	2	1	2	3
CO 5	1	3	2	3	2	1	1	2	2	1	2	2	3	1
Avg.	2.4	2.2	2.6	2.2	1.8	2.4	1.4	2	1.4	1.8	2.2	1.8	2	1.8

CE3803	Title: Environment Pollution and Waste Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: I	Introduction	8
Various types of pollution, Major cause of pollution, Sources of pollution, Various effects of pollution on health, air, water, Soil properties & ecology		
Unit II	Pollution Prevention	8
Definition-Importance-Historical Evolution-Benefits-Promotion-Barriers-Role of Industry, Government and Institutions - Environmental Management Hierarchy Source Reduction Techniques-Process and equipment optimization, Reuse, Recovery, Recycle, Raw material substitution-Internet Information and Other CP Resources.		
Unit III	Waste	8
Types of waste- solid-liquid-gaseous, Sources of waste production, Hazardous and non-hazardous waste, Nuclear waste, Properties of domestic & industrial waste,		
Unit IV	Waste Minimization	8
Recycling & Reuse of waste, Waste minimization techniques, Disposal Techniques, Types of disposals, Site of disposal, Biotechnological remedies for environmental pollution - Decontamination of groundwater systems, Subsurface environment - reclamation concepts bioremediation.		
Unit V	Hazardous Waste Management	8
Sources of hazardous waste, Characterization of hazardous waste, Handling of hazardous waste, Processing of hazardous waste, Disposal of hazardous waste		
Text Books	1. Blaine Metting. F (Jr.,), "Soil Microbiology Ecology", Marcel Dekker Inc., 2003. 2. Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill.	
Reference Books	1. Micheael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management", Hazardous waste Management, McGraw-Hill International edition, New York, 2001. 2. Thibodeaux, L.J, "Environmental Chemo dynamics: Movement of Chemicals in Air, Water and Soil", edition 2., Wiley – Inter-Science, New York, 2006	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

CO-PO Mapping for CE3803

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to understand basic concepts of pollution, their causes, sources & effects on health.	2	Em
CO2	Students will be able to understand about pollution preventions & Environmental management, methods of waste management.	2	S
CO3	Students will be able to understand the concepts of waste, their types, sources & properties of domestic & industrial wastes.	2	S
CO4	Students will be able to understand basic concepts of waste minimization techniques- chemical, biological & disposal etc. Decontamination of groundwater systems	2	En
CO5	Students will be able to understand basic ideas of Hazardous of waste management, their sources, handling techniques & Processing of hazardous waste, Disposal of hazardous waste	1	None

CO-PO Mapping for CE3803

Course Outcomes	Program Outcomes (Course Articulation Matrix(Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	2	2	1	2	1	3	1	3	3	2	1	1
CO 2	2	1	2	2	3	2	3	3	1	1	1	1	2	1
CO 3	1	1	2	3	2	1	1	1	1	2	2	1	2	2
CO 4	1	1	2	3	3	2	3	2	3	1	3	1	3	3
CO 5	2	1	3	3	2	1	2	2	2	1	3	1	2	2
Avg.	1.6	1	2.2	2.6	2.2	1.6	2	2.2	1.6	1.6	2.4	1.2	2	1.8

CE3804	Title: Advance Transportation Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Understand traffic safety is the foremost important agenda when we design transportation facilities and be able to estimate the effectiveness of safety design features.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: 1	Traffic Engineering	8
Scope of traffic engineering, Vehicular characteristics, Road users' characteristics, Necessity of traffic studies, Origin and destiny survey (O.D. Survey), Volume Study, Explain travel time and delay study, Accidents studies, Parking studies, Traffic signal design studies ROAD MARKINGS: - Function, Types of road marking, General principle of pavement markings, Material and Colour, Center lines, stop lines, traffic lane lines, No overtaking zone marking		
Unit II	Parking And Traffic Forecasting	8
Traffic and parking problem, Ill effects of parking, Zoning and parking space requirement standards, Design standards for on street parking facilities, Different types of parking, Traffic Forecasting, Need for traffic forecasting, Limitations of traffic forecasting, Types of traffic, Period of forecasting		
Unit III	Airport Engineering	8
Significance and importance of aircraft characteristics, Explanation of (Type of propulsion, Size of Aircraft, Weights of Aircraft.), Capacity of aircraft, Speed characteristics, Turning radius, Fuel spillage, Heat blast and noise, Aircraft circling radius		
Unit IV	Design Criteria	8
Airport in regional planning, Airport in city planning, Elements of airport planning, Facilities of passengers and baggage, Airport capacity, Necessity, explain wind rose diagram, Geometric design of runway and taxiway, Classification of apron according to use		
Unit V	Docks And Harbor Engineering	8
Natural phenomenon: - Wind, Tide, Current, Types of harbour, Choice of site for harbor, Master plan for port planning, Hydrographic and topographic survey, Necessities for fenders, Energy absorbed by fenders during berthing, Types of fender system, Mooring system		
Text Books	1. "Traffic engineering and Transportation planning", by Dr. L. R. Kadiyali, 7 th edition, Khanna Publishers 2. "Roads, Railways, Bridges, Tunnels &Harbour Dock Engineering", by B. L. Gupta & Amit Gupta, 5 th edition, Standard Publishers	
Reference Books	1. Dock and Harbour Engineering", by H. P. Oza& G.H. Oza, 5th edition, Charotar Publisher 2. "Airport Engineering", by Rangwala, 11th edition, Charotar Publisher	
Mode of Evaluation	Internal and External Examination	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3804

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to analyze the traffic engineering.	2	Em
CO2	Student should be able to forecast the future traffic and parking area.	2	S
CO3	Student should be able to understand about the airport engineering.	2	S
CO4	Student should be able to design the airport.	2	En
CO5	Student should be able to understand about the docks and harbor engineering.	1	None

CO-PO Mapping for CE3804

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	3	1	2	3	1	3	3	1	2	3
CO 2	3	1	2	3	2	1	3	2	3	2	2	2	1	3
CO 3	2	3	1	2	2	3	3	3	3	2	3	2	2	3
CO 4	2	3	2	2	2	2	2	1	1	1	1	3	1	1
CO 5	2	3	1	2	2	3	2	2	3	3	1	1	2	2
Avg.	2.4	2.4	1.6	2	2.2	2	2.4	2.2	2.2	2.2	2	1.8	1.6	2.4

CE3805	Title: Pavement Management	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To give knowledge on pavement design and its management	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction	6
Historical Review of Highway Pavements, Requirements and Objectives of Pavements; Types ofPavements, Functions and Evaluation of Components of Pavement, Factors affecting Design of Pavement; Traffic Considerations in Pavement Design - Vehicle Types, Axle Configurations, Contact Shapes and Contact Stress Distributions, Concept of Standard Axle Load, Various Factors in Traffic Wheel Loads; ESWL of Multiple Wheels. Repeated Loads and EWL Factors.		
Unit II	Pavement Materials	6
Subgrade Soil – Desirable Properties of Soil, Tests for Evaluation of Soil Strength; Stone Aggregates – Desirable Properties of Road Aggregates, Tests for Road Aggregate; Bituminous Materials – Types of Bituminous Materials: Bitumen, Cutback Bitumen, Bituminous Emulsions, Tar; Design of Bituminous Paving Mixes- Marshall Method of Bituminous Mix Design.		
Unit III	Analysis and Design of Flexible Pavements:	6
Stresses in Flexible Pavements, Stress Distribution through various layers, Design Methods: Empirical Methods – Group Index Method, CBR Method; Semi-empirical Method – Triaxial Method; Theoretical Method – Burmister Method;		
Unit IV	Analysis and Design of Concrete Pavements:	3
Evaluation of Subgrade, Modulus of Subgrade Reaction by Plate Bearing Test, Westergaard's Stress Theory, Stresses in Rigid Pavements, Temperature Stresses, Warping Stresses, Frictional Stresses, Critical Combination of Stresses, Critical Loading Positions; Design Methods - IRC Method, PCA & AASHTO Methods; Joints – Types of Joints, Design of Joints.		
Unit V	Evaluation and Strengthening of Existing Pavements:	3
Pavement Failures - Failures in Flexible Pavements, Failures in Rigid Pavements; Methods of Pavement Evaluation – Structural Evaluation of Pavements, Evaluation of Pavement Surface Conditions; Strengthening of Existing Pavements - Choice and Design of Overlay Type and Pavement Materials over existing Flexible and Rigid Pavements.		
Text Books	1. Khanna S.K. & Justo, C.E.G. "Highway Engineering", Nem Chand & Bros., Roorkee. 2. Kadiyali L.R. &Lal, N.B. "Principles and Practice of Highway Engineering Including expressways and Airport engineering", Khanna Publishers, New Delhi.	
Reference Books	1. IRC: 85 – "Code of Practice for Accelerated Strength Testing and Evaluation of ConcreteRoad and Air field Constructions", IRC, New Delhi. 2. IRC: 58– "Guidelines for the Design of Rigid Pavements for Highways", IRC, New Delhi. 3.	
Mode of Evaluation	Internal and External Examinations	

Recommendation by Board of Studies on	07-06-2019
Date of approval by the Academic Council	13-07-2019

Course Outcome for CE3805

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic history of pavement.	2	Em
CO2	Student should be able to understand the materials used in construction of pavement	2	S
CO3	Student should be able to design the flexible pavements.	2	S
CO4	Student should be able to design the concrete pavements.	2	En
CO5	Student should be able to analyze the strength of pavements.	1	None

CO-PO Mapping for CE3805

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	1	1	1	1	2	3	3	3	3	3	3
CO 2	2	1	2	1	1	3	2	3	1	2	3	3	2	1
CO 3	1	1	3	3	2	2	3	2	2	2	2	3	3	3
CO 4	3	1	3	2	3	2	2	2	3	2	2	1	3	2
CO 5	3	1	1	1	2	1	2	3	3	1	1	3	3	1
Avg.	2.4	1	2.2	1.6	1.8	1.8	2	2.4	2.4	2	2.2	2.6	2.8	2

CE3806	Title: Traffic Planning & Design	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the traffic flow characteristics, various traffic surveys.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit: 1	Introduction to Traffic Engineering	8
Introduction to Traffic Engineering Properties of Traffic Engineering Elements, Road Vehicle performance Traffic Studies Volume studies, Speed studies, Origin and destination studies and parking studies		
Unit II	Traffic Control devices	8
Various Traffic Control devices, Principles of Intersection Design, Design of signalized and unsignalized intersections, Signal Coordination, Traffic Regulations and Statistical methods		
Unit III	Traffic Safety and Level-of-service	8
Accidents, Lighting, Capacity and Level-of-service analysis		
Unit IV	Uninterrupted traffic Flow Theory	8
Fundamentals of Traffic flow theory, Uninterrupted, Traffic flow including Macroscopic and Microscopic Traffic flow models		
Unit V	Interrupted traffic Flow Theory	8
Fundamentals of Interrupted Traffic Flow, Shockwave Analysis, Car following theory, Queuing Theory, Vehicle arrival: Gap and Gap acceptance, Simulation of Traffic Systems		
Text Books	1. Traffic and Highway Engineering 5th Edition by Nicholas J. Garber, Lester A. Hoel 2. Transport Engineering Handbook, 6th Edition, Institute of Transportation Engineers 3. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publisher	
Reference Books	1. O'Flaherty C A, "Transport Planning and Traffic Engineering", Butterworth Heinemann, Elsevier, Burlington, MA 2. Mannering Fred L., Kilarski Walter P. and Washburn Scott S., Principles of Traffic Engineering and Traffic Analysis, Third Edition, Wiley 3. Roess, R. P., Prassas, E. S., and McShane, W. R., Traffic Engineering, 4th Edition, Prentice Hall 4. ChakrobortyPartha and Animesh Das, Principles of Transportation Engineering, Prentice Hall	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	07-06-2019	
Date of approval by the Academic Council	13-07-2019	

Course Outcome for CE3806

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand basics of traffic engineering.	2	Em
CO2	Student should be able to analyze the different traffic devices.	2	S
CO3	Student should be able to understand the necessity of traffic safety and level of services.	2	S
CO4	Student should be able to understand the fundamentals of uninterrupted traffic flow theory.	2	En
CO5	Student should be able to understand the fundamentals of interrupted traffic flow theory.	1	None

CO-PO Mapping for CE3806

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	3	3	1	3	3	3	1	2	3	1	2	1
CO 2	1	2	3	2	3	2	2	2	2	3	3	3	1	2
CO 3	2	3	2	3	3	2	3	3	1	1	3	1	1	1
CO 4	3	2	1	1	1	1	1	3	2	2	3	1	2	1
CO 5	3	1	3	3	3	3	1	1	1	1	2	2	1	3
Avg.	2.4	1.8	2.4	2.4	2.2	2.2	2	2.4	1.4	1.8	2.8	1.6	1.4	1.6