

Vision of University

To be a globally renowned university.

Mission of University

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

Vision of Department

To impart knowledge and excellence in Civil Engineering with global perspectives to the student community and to make them ethically strong engineers to build our nation.

Mission of Department

M1: To provide holistic development of student

M2: To meet the ever-changing needs of civil engineering industry

M3: To be involved in forward looking research

M4: To be involved in consultancy useful to society

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. **PEO1:** Practice engineering in a broad range of industrial, societal and real-world applications.
2. **PEO2:** Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.
3. **PEO3:** Conduct themselves in a responsible, professional, and ethical manner.
4. **PEO4:** Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.

PROGRAMME OUTCOMES (POs):

On completing the B. Tech. – Civil Engineering Programme successfully the students will exhibit the following capabilities:

1. **PO1: Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems in engineering.
2. **PO2: Problem Analysis:** An ability to identify, formulate, research literature, analyze complex engineering problems in mechanical engineering using first principles of mathematics, natural sciences and engineering sciences
3. **PO3: Design/ development of solutions:** An ability to design solutions for complex engineering problems and system component or processes that meet the specified needs considering public health & safety and cultural, societal & environment
4. **PO4: Conduct investigations of complex problems:** An ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to obtain solutions to engineering problems
5. **PO5: Modern tool usage:** Ability to create, select and apply appropriate techniques, resources and modern engineering activities, with an understanding of the limitations
6. **PO6: The engineer and society:** Ability to 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
7. **PO7: Environment and sustainability:** Ability to demonstrate the knowledge of engineering solutions, contemporary issues understanding their impacts on societal and environmental contexts, leading towards sustainable development
8. **PO8: Ethics:** An ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
9. **PO9: Individual and team work:** An ability to function effectively as an individual, and as a member or leader in diverse teams and in multi- disciplinary settings
10. **PO10: Communication:** Ability to communicate effectively oral, written reports and graphical forms on complex engineering activities
11. **PO11: Project management and finance:** Ability to demonstrate knowledge and understanding of the engineering and management principles and apply those one's own work, as a member and leader in team, to manage projects and in multi-disciplinary environments
12. **PO12: Lifelong learning:** An ability to recognize the need for and having the preparation and ability to engage independent and life-long learning in broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

1. **PSO1:** Function as design consultants in construction industry for the design of civil engineering structures.
2. **PSO2:** Provide sustainable solutions to the Civil Engineering Problems.

MAPPING OF PEO's WITH MISSION STATEMENTS

S.No	Description of PEOs	Key Components of Mission			
		M 1	M 2	M 3	M 4
		To provide holistic development of student	To meet the ever changing needs of civil engineering industry	To be involved in forward looking research	To be involved in consultancy useful to society
PEO 1	Practice engineering in a broad range of industrial, societal and real-world applications.	√	√	√	√
PEO 2	Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.	√	√	√	√
PEO 3	Conduct themselves in a responsible, professional, and ethical manner.	√	√	√	√
PEO 4	Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.	√	√	√	√

MAPPING OF POs/PSOs with PEOs:

S. No.	Key Components of POs and PSOs	PEO			
		PEO 1	PEO 2	PEO 3	PEO 4
PO1	Ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems in	√		√	

	engineering.				
PO2	Ability to identify, formulate, research literature, analyze complex engineering problems in mechanical engineering using first principles of mathematics, natural sciences and engineering sciences	√			
PO3	Ability to design solutions for complex engineering problems and system component or processes that meet the specified needs considering public health & safety and cultural, societal & environment	√	√		
PO4	Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to obtain solutions to engineering problems	√			
PO5	Ability to create, select and apply appropriate techniques, resources and modern engineering activities, with an understanding of the limitations	√	√		
PO6	Ability to 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	√		√	√
PO7	Ability to demonstrate the knowledge of engineering solutions, contemporary issues understanding their impacts on societal and environmental contexts, leading towards sustainable development	√			
PO8	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice	√		√	√
PO9	Ability to function effectively as an individual, and as a member or leader in diverse teams and in multi- disciplinary settings	√	√		
PO10	Ability to communicate effectively oral, written reports and graphical forms on complex engineering activities	√	√		
PO11	Ability to demonstrate knowledge and understanding of the engineering and management principles and apply those one's own work, as a member and leader in team, to manage projects and in multi-disciplinary environments	√			
PO12	Ability to recognize the need for and having the preparation and ability to engage independent and life-long learning in broadest context of technological change			√	
PSO1	Function as design consultants in construction industry for the design of civil engineering structures.	√	√	√	

PSO2	Provide sustainable solutions to the Civil Engineering Problems	√			√
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ACADEMIC REGULATIONS

This document supplements the KLEF rules and regulations to aid all students. It is required that every individual must abide by these regulations.

Note: The regulations stated in this document are subject to change or can be relaxed / modified without prior notice at the discretion of the Hon'ble Vice Chancellor.

Terminology

Academic Council: The Academic Council is the highest academic body of the University and is responsible for the maintenance of standards of instruction, education and examination within the University. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises of two consecutive semesters i.e., Even and Odd semester.

Y21 Audited Course: It is a course of study which has zero credits and has a “Satisfactory” or an “Unsatisfactory” grade.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F).

Basic Sciences: The courses of foundational nature in the areas of Mathematics, Physics, Chemistry, Biology etc., are offered in this category.

Betterment: Betterment is a way that contributes towards improving the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies: Board of Studies (BOS) is an authority as defined in UGC regulations, constituted by Vice Chancellor for each of the department separately. They are responsible for curriculum design and update in respect of all the programs offered by a department.

Branch of Study: It is a branch of knowledge, an area of study or a specific program (like Civil Engineering, Mechanical Engineering, Electrical and Electronics Engineering etc.)

Certificate course: It is a course that makes a student gain hands-on expertise and skills required for holistic development. It is a mandatory, non-credited course for the award of degree.

Change of Branch: Change of branch means transfer from one's branch of study to other.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Course: A course is a subject offered by the University for learning in a particular semester.

Course Handout: Course Handout is a document, which gives complete plan of the course. It contains the details of the course viz. Course title, Course code, Pre-requisite, Credit structure, team of instructors, Course objectives, Course rationale, Course Outcomes and the relevant syllabus, textbook(s) and reference books, Course delivery plan and session plan, evaluation method, chamber consultation hour, course notices and other course related aspects. In essence, course handout is an agreement between students (learners) and the instructor.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week or two hours per week of tutorials/ self- learning/ practical/ field work during a semester.

Credit point: It is the product of grade point and number of credits for a course.

Credit Transfer: The procedure of granting credit(s) to a student for course(s) undertaken at another institution.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Degree: A student who fulfills all the Program requirements is eligible to receive a degree.

Degree with Specialization: A student who fulfills all the Program requirements of her/his discipline and successfully completes a specified set of Professional elective courses in a specialized area is eligible to receive a degree with specialization.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources.

Y20 Detention in a course: Student who does not obtain minimum prescribed marks in continuous in-semester evaluation and /or minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for the semester should do so in writing in a prescribed format before commencement of the semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective, Open Elective, Management Elective and Humanities Elective.

Engineering Sciences: The courses belonging to basic evolutionary aspects of engineering from Mechanical Sciences, Electrical Sciences and Computing like Engineering Mechanics, Data structures, Network Theory, Signal Analysis etc...

Evaluation: Evaluation is the process of judging the academic work done by the student in her/his courses. It is done through a combination of continuous in-semester assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are denoted by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Honors Degree: A student who fulfills all the Program requirements of her/his discipline and successfully completes a specified set of additional courses within the same program is eligible to receive an Honors degree.

Humanities Elective: A course offered in the area of Liberal Arts.

Industrial Training: Training program undergone by the student as per the academic requirement in any company/firm. It is a credited course.

Industrial Visit: Visit to accompany/firm as per the academic requirement.

Y21: Summative assessments used to evaluate student learning, acquired skills, and academic attainment during a course.

Y21 Make-up Test: An additional test scheduled on a date other than the originally scheduled date. (Describe elaborately)

Y21: An additional test scheduled on a date other than the originally scheduled date.

Management elective: A course that develops managerial skills and inculcates entrepreneurial skills.

Mini project: Mini Project is a credit-based course that a student has to undergo during his/her academic term, which involves the student to explore in a discipline belonging to their research interest within their program area.

Minor Degree: A student who fulfills all the Program requirements of her/his discipline and successfully completes a specified set of courses from another discipline is eligible to receive a minor degree in that discipline.

Multi- Section Course: Course taught for more than one section.

Open Elective: This is a course of interdisciplinary nature. It is offered across the University for all programs.

Over loading: Registering for more number of credits than normally prescribed by the Program in a semester.

Practice School: It is a part of the total program and takes one full semester in a professional location, where the students and the faculty get involved in finding solutions to real-world problems. A student can choose Project/Practice School during his/her 7th or 8th semester of his/her Academic Year to meet the final requirements for a degree.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Professional Core: The courses that are essential constituents of each engineering discipline are categorized as Professional Core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: A set of courses offered by the Department. A student can opt and complete the stipulated minimum credits to qualify for the award of a degree in that Program.

Program Educational Objectives: The broad career, professional, personal goals that every student will achieve through a strategic and sequential action plan.

Project: Course that a student has to undergo during his/her final year which involves the student to undertake a research or design, which is carefully planned to achieve a particular aim. It is a credit based course.

Project based laboratory: Project Based Laboratory is a student-centric learning methodology that involve students in design, problem-solving, decision making, and investigative activities; gives students the opportunity to work in teams, over extended periods of time; and culminate in realistic products or presentations

Re-Appearing: A student can reappear only in the semester end examination for the Theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester/ term of the Program.

Re-Registering: A student desiring to repeat a course is permitted to do so, subject to the regulations contained herein.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days including examination and preparation holidays. The odd Semester starts normally in July and even semester in December.

Semester End Examinations: It is an examination conducted at the end of a course of study.

Single Section Course: Course taught for a single section.

Social Service: An activity designed to promote social awareness and generate well-being; to improve the life and living conditions of the society.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioural.

Substitution of Elective course: Replacing an elective course with another elective course as opted by the student.

Summer term: The term during which courses are offered from May to July. Summer term is not a student right and will be offered at the discretion of the University.

Term Paper: A 'term paper' is a research report written by students that evolves their course-based knowledge, accounting for a grade. Term paper is a written original research work discussing a topic in detail. It is a credit-based course.

Under-loading: Registering for lesser number of credits than normally prescribed by the Program in a semester.

Withdraw from a Course: Withdrawing from a Course means that a student can drop from a course within the first two weeks of the odd or even Semester (deadlines are different for summer sessions). However he/she can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

B.Tech 2021-22 Admitted Category wise Courses,Credits and Contact hours Count					
Sl No	Course Category	Short Name	courses	Minimum Credits	Contact Hours
1	Humanities & Social Sciences	HSS	7	15.0	20
2	Basic Sciences	BS	8	22.5	40
3	Engineering Sciences	ES	6	22.5	34
4	Professional Core	PC	15	59.0	73
5	Flexi Core	FC	0	0.0	0
6	Professional Electives	PE	5	15.0	15
7	Project Courses	PR	10	19.0	76
8	Open Electives	OE	5	14.0	14
9	Mandatory Courses	MC	3	0.0	6
Total			59	167.0	278

B.Tech 2021-22 Admitted Students category wise Structure

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-requisite
1	20UC1101	Integrated Professional English	HSS	0	0	4	0	2	4	Nil
2	20UC1202	English Proficiency	HSS	0	0	4	0	2	4	Nil
3	21UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4	Nil
4	21UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4	Nil
5	21UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	2	Nil
6	21CE4102	Construction Planning & Project Management	HSS	3	0	0	0	3	3	Nil
7	20UC0007	Indian Heritage and Culture	MC	2	0	0	0	0	2	Nil
8	20UC0008	Indian Constitution	MC	2	0	0	0	0	2	Nil
9	20UC0009	Ecology & Environment	MC	2	0	0	0	0	2	Nil
10	21UC0011	Gender Sensitization	HSS	2	0	0	0	2	2	Nil
11	20MT1101	Mathematics for Computing	BS	2	2	0	2	4.5	6	Nil
12	21MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3	Nil
13	21MT2007	Probability, Statistics and Numerical Methods	BS	3	1	0	0	4	4	Nil
14	21PH1010	Mechanics (SE 1)	ES	3	1	0	0	4	4	Nil
15	21UC1203	Design Thinking and Innovation	BS	0	0	4	0	2	4	Nil
16	21PH1002	Engineering Physics	BS	2	0	2	0	3	4	Nil
17	21CY1001	Engineering Chemistry (SE-2)	BS	2	0	2	0	3	4	Nil
18	21UC3105	Problem Solving Skills-I	BS	0	0	2	2	1.5	4	Nil
19	21UC3206	Problem Solving Skills-II	BS	0	0	2	2	1.5	4	Nil
20	21SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	5.5	11	Nil
21	20ME1103	Design Tools Workshop – I	ES	0	0	4	0	2	4	Nil
22	21SC1209	Design Tools Workshop – II	ES	0	0	4	0	2	4	Nil

23	21SC1202	Design of Data Structures	ES	3	0	2	4	5	9	20SC1101
24	21CE1002	Engineering Graphics	ES	2	0	4	0	4	6	Nil
25	21CE2205	Geology	PC	3	0	2	0	4	5	Nil
26	21CE2101	Solid Mechanics	PC	3	0	2	0	4	5	Nil
27	21CE2102	Fluid Mechanics & Hydraulics	PC	3	0	2	0	4	5	Nil
28	21CE2103	Surveying	PC	3	0	2	0	4	5	Nil
29	21CE2201	Structural Analysis	PC	3	1	0	0	4	4	Nil
30	21CE2203	Construction Materials & Concrete Technology	PC	3	0	2	0	4	5	Nil
31	21CE2204	Environmental Engineering	PC	3	0	2	0	4	5	Nil
32	21CE2202	Building Planning, Drawing & Construction Management	PC	3	0	2	0	4	5	Nil
33	21CE2206	Geotechnical Engineering	PC	3	0	2	0	4	5	Nil
34	21CE3101	Design Of Reinforced Concrete Structures	PC	3	0	2	0	4	5	21CE2101
35	21CE3103	Transportation Engineering	PC	3	0	2	0	4	5	Nil
36	21CE3102	Water Resources Engineering	PC	3	1	0	0	4	4	Nil
37	21CE3201	Design Of Steel Structures	PC	3	1	0	0	4	4	Nil
38	21CE3202	Quantity Surveying and Estimation	PC	3	0	2	0	4	5	Nil
39	21CE4101	Comprehensive Exam	PC	0	0	6	0	3	6	Nil
40	PE-1	Professional Elective – 1	PE	3	0	0	0	3	3	Nil
41	PE-2	Professional Elective – 2	PE	3	0	0	0	3	3	Nil
42	PE-3	Professional Elective – 3	PE	3	0	0	0	3	3	Nil
43	PE-4	Professional Elective – 4	PE	3	0	0	0	3	3	Nil
44	PE-5	Professional Elective – 5	PE	3	0	0	0	3	3	Nil
45	OE	Open Elective – 1	OE	3	0	0	0	3	3	Nil
46	OE	Open Elective – 2	OE	3	0	0	0	3	3	Nil
47	OE	Open Elective – 3	OE	3	0	0	0	3	3	Nil

48	OE	Management Elective(OE-4)	OE	3	0	0	0	3	3	Nil
49	OE	Foreign Language Elective(OE-5)	OE	2	0	0	0	2	2	Nil
50	21IE2040	Social Internship	PR	0	0	0	4	1	4	Nil
51	21IE3041	Technical Internship	PR	0	0	0	4	1	4	Nil
52	21IE4042	Industry Internship	PR	0	0	0	4	1	4	Nil
53	21IE2046	Project Based Learning -1	PR	0	0	0	6	1.5	6	Nil
54	21IE2047	Project based learning -2	PR	0	0	0	6	1.5	6	Nil
55	21IE3043	Term paper	PR	0	0	0	4	1	4	Nil
56	21IE3044	Mid Grad Capstone Project – I	PR	0	0	0	8	2	8	Nil
57	21IE3045	Mid Grad Capstone Project – II	PR	0	0	0	8	2	8	Nil
58	21IE4048/ 21IE4051/ 21IE4050	Project / Internship - 1/ Practice School	PR	0	0	0	16	4	16	Nil
59	21IE4049 /21IE4052 /21IE4050	Project / Internship 2 /Practice School	PR	0	0	0	16	4	16	Nil
Total Credits								167		

LIST OF PROFESSIONAL ELECTIVES

Sl No	Course Code	Course Title	Specialization	L	T	P	S	Cr	CH	Pre-requisite
1	21CE3211	Advanced Structural Analysis	Structural Engineering	3	0	0	0	3	3	NIL
2	21CE3221	Advanced Design of Reinforced Concrete Structures		3	0	0	0	3	3	NIL
3	21CE3231	Prestressed concrete		3	0	0	0	3	3	NIL
4	21CE4141	Bridge engineering		3	0	0	0	3	3	NIL
5	21CE4151	Precast and Prefabricated structures		3	0	0	0	3	3	NIL
6	21CE3216	Projects& Contract management	Construction Technology and Management	3	0	0	0	3	3	NIL
7	21CE3226	Quality and Safety Management		3	0	0	0	3	3	NIL
8	21CE3236	Form Work		3	0	0	0	3	3	NIL
9	21CE4146	Construction Economics		3	0	0	0	3	3	NIL
10	21CE4156	Sustainable Construction Technology		3	0	0	0	3	3	NIL
11	21CE3212	Foundation engineering	Geotechnical Engineering	3	0	0	0	3	3	NIL
12	21CE3222	Ground improvement techniques		3	0	0	0	3	3	NIL
13	21CE3232	Design of earth retaining structures		3	0	0	0	3	3	NIL
14	21CE4142	Geotechnical earthquake engineering		3	0	0	0	3	3	NIL
15	21CE4153	Forensics in Civil Engineering		3	0	0	0	3	3	NIL
16	21CE3215	Intelligent transportation systems	Transportation Engineering	3	0	0	0	3	3	NIL
17	21CE3225	Pavement materials & design		3	0	0	0	3	3	NIL
18	21CE3235	Traffic engineering and management		3	0	0	0	3	3	NIL
19	21CE4145	Urban transportation systems planning.		3	0	0	0	3	3	NIL
20	21CE4155	Railway engineering airport planning and design		3	0	0	0	3	3	NIL
21	21CE3213	Sustainable engineering & technology	Environmental Engineering	3	0	0	0	3	3	NIL
22	21CE3223	Environmental impact assessment and life cycle analyses		3	0	0	0	3	3	NIL

23	21CE3233	Solid Waste Management and Landfills	3	0	0	0	3	3	NIL
24	21CE3214	River engineering	3	0	0	0	3	3	NIL
25	21CE3224	Urban water hydrology and hydraulics	3	0	0	0	3	3	NIL

**List of OPEN Electives, Management Electives and Foreign Language Courses for Y21
Admitted Students**

Sl No	Course Code	Course Title	L	T	P	S	Cr	CH	Pre-requisite
1	21BT40A1	IPR & Patent Laws	3	0	0	0	3	3	NIL
2	21BT40A9	Biomaterials	3	0	0	0	3	3	NIL
3	21BT40C5	Computer Aided Drug Design	3	0	0	0	3	3	NIL
4	21CE40A2	Environmental Pollution Control Methods	3	0	0	0	3	3	NIL
5	21CE40A3	Solid and Hazardous waste management	3	0	0	0	3	3	NIL
6	21CE40A4	Remote Sensing & GIS	3	0	0	0	3	3	NIL
7	21CE40A5	Disaster Management	3	0	0	0	3	3	NIL
8	21CS40A7	Fundamentals of Software Engineering	3	0	0	0	3	3	NIL
9	21CS40A6	Fundamentals of DBMS	3	0	0	0	3	3	NIL
10	21CS40A8	Fundamentals of IT	3	0	0	0	3	3	NIL
11	20ME40B4	Robotics	3	0	0	0	3	3	NIL
12	20ME40B5	Mechatronics	3	0	0	0	3	3	NIL
13	20ME40B6	Operations Research	3	0	0	0	3	3	NIL
14	20ME40B7	Hybrid Electric vehicles	3	0	0	0	3	3	NIL
15	20ME40B8	Industry 4.0	3	0	0	0	3	3	NIL
16	20ME40B9	Industrial Automation	3	0	0	0	3	3	NIL
17	20ME40C1	Logistics & Supply chain management	3	0	0	0	3	3	NIL
18	20ME40C2	Total Quality Management	3	0	0	0	3	3	NIL
19	20ME40C3	Smart Mobility	3	0	0	0	3	3	NIL
20	20ME40C4	Managerial Economics for Engineers	3	0	0	0	3	3	NIL
21	21EL40B1	Linux Programming	3	0	0	0	3	3	NIL
22	21EL40B2	E-Commerce	3	0	0	0	3	3	NIL
23	21GN40C1	Self Development	3	0	0	0	3	3	NIL
24	21GN40C3	Emotional Intelligence	3	0	0	0	3	3	NIL

25	21GN40C5	Behavioural Sciences	3	0	0	0	3	3	NIL
26	21GN40D1	National Caded Cops-1	2	0	2	0	3	4	NCC
27	21GN40D2	National Caded Cops-2	2	0	2	0	3	4	NCC
28	21GN40D3	National Caded Cops-3	2	0	2	0	3	4	NCC
29	21GN40D4	National Service Scheme-1	2	0	2	0	3	4	NSS
30	21GN40D5	National Service Scheme-2	2	0	2	0	3	4	NSS
31	21GN40D6	National Service Scheme-3	2	0	2	0	3	4	NSS
32	21MB4056	Resources Safety and Quality Management	2	0	0	0	2	2	NIL
33	21MB4051	Paradigms in Management Thought	3	0	0	0	3	3	NIL
34	21MB4052	Indian Economy	3	0	0	0	3	3	NIL
35	21MB4053	Managing Personal Finances	3	0	0	0	3	3	NIL
36	21MB4054	Basics of Marketing for Engineers	3	0	0	0	3	3	NIL
37	21MB4055	Organization Management	3	0	0	0	3	3	NIL
38	21MB4057	Economics for Engineers	3	0	0	0	3	3	NIL

COURSE WISE PO MAPPING

Sl No	Course Code	Course Title	Category	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	21CY1001	Engineering Chemistry (SE-2)	BS	3		2				2							
2	21PH1002	Engineering Physics	BS	3										3			
3	21UC1203	Design Thinking and Innovation	BS		1	1		2	1	2	1						
4	20MT1101	Mathematics for Computing	BS	2													
5	21MT2007	Probability, Statistics and Numerical Methods	BS					1				1		2	3	3	3
6	21MT2102	Mathematics for Engineers	BS	2													
7	21UC3105	Problem Solving Skills-I	BS		1			1									
8	21UC3206	Problem Solving Skills-II	BS						3					2			
9	21CE1002	Engineering Graphics	ES	2				1		2		2					
10	21PH1010	Mechanics (SE 1)	ES	2			3									3	
11	20ME1103	Design Tools Workshop – I	ES					2									
12	21SC1101	Computational Thinking for Structured Design	ES	2	2			2						3			
13	21SC1202	Design of Data Structures	ES	2		2											
14	21SC1209	Design Tools Workshop – II	ES			1	2	2									
15	20UC1202	English Proficiency	HSS								1	1			2		
16	21UC2103	Essential Skills for Employability	HSS		1			1									
17	20UC1101	Integrated Professional English	HSS									1	1				
18	21CE4102	Construction Planning & Project Management	HSS	1			2		2					3	1		2
19	21UC0010	Universal Human Values & Professional Ethics	HSS				2				2						
20	21UC0011	Gender Sensitization	HSS	2	2	2	2										
21	21UC2204	Corporate Readiness Skills	HSS			1		1									
22	20UC0007	Indian Heritage and Culture	MC	1							2			2			
23	20UC0008	Indian Constitution	MC												1		
24	20UC0009	Ecology & Environment	MC						1				2	2			
25	21CE2101	Solid Mechanics	PC	3	3				3						3	1	1
26	21CE2102	Fluid Mechanics & Hydraulics	PC	3	3		2										
27	21CE2103	Surveying	PC	2	3					3		3				1	1
28	21CE2201	Structural Analysis	PC	3	3					1						1	1
29	21CE2202	Building Planning, Drawing & Construction Management	PC			2			2					1			
30	21CE2203	Construction Materials & Concrete Technology	PC	2	2			1		1						2	2
31	21CE2204	Environmental Engineering	PC						2	3							

32	21CE2205	Geology	PC	1	2			3			2		3			
33	21CE2206	Geotechnical Engineering	PC	3	3							3			3	
34	21CE3101	Design Of Reinforced Concrete Structures	PC	3		3							3	1	1	
35	21CE3102	Water Resources Engineering	PC	3	2				1							2
36	21CE3103	Transportation Engineering	PC		2	2				3					2	2
37	21CE3201	Design Of Steel Structures	PC	2	2	2				2					1	1
38	21CE3202	Quantity Surveying and Estimation	PC	1	2							2				
39	21CE4101	Comprehensive Exam	PC		2					2						1
40	21CE3211	Advanced Structural Analysis	PE	2	2			2								
41	21CE3212	Foundation engineering	PE	3	3										3	
42	21CE3213	Sustainable engineering & technology	PE			2										
43	21CE3214	River engineering	PE	3		1						2				
44	21CE3221	Advanced Design of Reinforced Concrete Structures	PE	2	2	2									1	1
45	21CE3222	Ground improvement techniques	PE	3	1							2			2	
46	21CE3223	Environmental impact assessment and life cycle analyses	PE	1				2	2				3			
47	21CE3224	Urban water hydrology and hydraulics	PE		3		2			2						2
48	21CE3225	Pavement materials & design	PE	2	1	1	1							2	1	1
49	21CE3231	Prestressed concrete	PE	2	2							1			1	1
50	21CE3232	Design of earth retaining structures	PE	2	3										1	1
51	21CE3236	Form Work	PE	1					2							
52	21CE4141	Bridge engineering	PE	3		2									1	
53	21CE4142	Geotechnical earthquake engineering	PE	3	3										3	
54	21CE4145	Urban transportation systems planning.	PE			3		3	2	2				3		
55	21CE4146	Construction Economics	PE	1			2						3			1
56	21CE4151	Precast and Prefabricated structures	PE		2	1						2			2	
57	21CE4155	Railway engineering airport planning and design	PE				2		2			2	2		2	2
58	21CE4156	Sustainable Construction Technology	PE	2	2										1	1
59	21CE3215	Intelligent transportation systems	PE		2	2		2							2	2
60	21CE3216	Projects & Contract management	PE										2		3	

61	21CE3226	Quality and Safety Management	PE	1	2	3						3				
62	21CE3233	Solid Waste Management and Landfills	PE	2				1		3						
63	21CE3235	Traffic engineering and management	PE	3			2			3					2	2
64	21CE4153	Forensics in Civil Engineering	PE	2	2	2							2			
65	21IE2040	Social Internship	PR	1		1					1				1	
66	21IE2046	Project Based Learning -1	PR	3		3								2	2	
67	21IE2047	Project based learning -2	PR	3			3				3			2	2	
68	21IE3041	Technical Internship	PR	2			2				2			2	2	
69	21IE3043	Term paper	PR	3			3				3			2	2	
70	21IE3044	Mid Grad Capstone Project – I	PR	3			3				3			2	2	
71	21IE3045	Mid Grad Capstone Project – II	PR	3			3				3			2	2	
72	21IE4042	Industry Internship	PR	2			2				2			2	2	
73	21IE4048/ 21IE4051/ 21IE4050	Project / Internship - 1/Practice School	PR	3			3				3			2	2	
74	21IE4049/ 21IE4052/ 21IE4050	Project / Internship 2/Practice School	PR	3			3				3			2	2	
75	21CE40A2	Environmental Pollution Control Methods	OE	2				1		3			2			
76	21CE40A3	Solid and Hazardous waste management	OE	2		2				2						
77	21CE40A4	Remote Sensing & GIS	OE	1			2				3					
78	21CE40A5	Disaster Management	OE		2	2					2					

CO WISE CO-PO MAPPING

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			CO 5	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.	1														
4	21UC2204	Corporate Readiness Skills	CO 1	To distinguish product and process and quote them in speaking and writing activities													1		
			CO 2	To apply interpersonal skills													1		
			CO 3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.					1										
			CO 4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding			1												
5	21UC0010	Universal Human Values & Professional Ethics	CO 1	Realize and Understand the basic aspiration, harmony in the human being.				2											
			CO 2	Envisage the roadmap to fulfill the basic aspiration of human beings.				2											
			CO 3	Understanding the society and nature with the view of human values				2											
			CO 4	Understand the profession and his role in this existence.							2								
6	21CE4102	Construction Planning & Project Management	CO 1	Apply the fundamentals of construction management to plan and control the progress of the project.	1											3	1		
			CO 2	Analyse the project progress through scheduling and identifying critical activities.				2								3	1		
			CO 3	Analyse the resource allocation for the construction projects at optimal levels.				2								3	1		1

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			CO 2	Use analytical techniques for analyzing forces in statically determinate structures.				3										
			CO 3	Understanding the concepts of planar and non- planar system of parallel forces and analyzing them. Estimate moment of inertia of lamina and material bodies	2												3	
			CO 4	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems													3	
15	21UC1203	Design Thinking and Innovation	CO 1	Understand the importance of Design thinking process for contextualized problems		1				1								
			CO 2	Analyse, define, and ideate for solutions			1				1							
			CO 3	Develop and test the prototype made					2		2							
			CO 4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity					1			1						
16	21PH1002	Engineering Physics	CO 1	Understands the deformation of materials in response to action of load, for identification of materials having specific engineering applications.	1													
			CO 2	Understands the motion of electrons in microscopic	2													
			CO 3	level	3													
			CO 4	Understand the properties of light and engineering applications of lasers	2													
			CO 5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects	3													
17	21CY1001	Engineering Chemistry (SE-2)	CO 1	Describe some important design considerations in choosing a battery for a specific application.	1		2				3							
			CO 2	Predict potential complications from combining various chemicals or metals in an engineering setting	2		3											
			CO 3	Examine water quality and select appropriate purification technique for intended problem	3						2							
			CO 4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable physical properties	3						2							

			CO 5	An ability to analyze & generate experimental skills	1													
18	21UC3105	Problem Solving Skills-I	CO 1	To discuss and interpret English language skills necessary for placements	1												1	
			CO 2	To demonstrate skills to get selected in interviews and retain job												1		
			CO 3	To enhance the problem-solving skills of the students through the concepts of Menstruation, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency which will enable them to improve their problem- solving abilities which in turn improve their programming skills.					1									
			CO 4	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles		1												
19	21UC3206	Problem Solving Skills-II	CO 1	Analyze the business environment in order to identify business opportunities,												2		
			CO 2	Identify the elements of success of entrepreneurial ventures												1		
			CO 3	Consider the legal and financial conditions for starting a business venture												1		
			CO 4	Evaluate the effectiveness of different entrepreneurial strategies												2		
20	21SC1101	Computational Thinking for Structured Design	CO 1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm.	2	2												
			CO 2	Translate computational thinking into Logic Design for Solving real world problems.	2	2												
			CO 3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations.	2	2												
			CO 4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.				2										

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			CO 4	Estimate the transformation of stress in a plane and draw Mohr's circle, estimate stresses due to torsion for circular shafts and find buckling load for centric and eccentric columns	3	3					1					1	1
27	21CE2102	Fluid Mechanics & Hydraulics	CO 1	Apply fluid properties to solve engineering problems	2	2											
			CO 2	Analyze static, kinematic and dynamic states of fluids	3	2											
			CO 3	Analyze the flow through pipes and head losses	3	2											
			CO 4	Perform dimensional analysis for model simulation	2	3											
				Demonstrate the flow through Notches, pipes and open channels	3	3											
28	21CE2103	Surveying	CO 1	Understand basic concepts of surveying	2			2								1	1
			CO 2	Understand how to operate instruments required for surveying	2	2										1	1
			CO 3	Applying the surveying equipments required based on the functionality and nature of work		3					3		3			1	1
			CO 4	Apply field data to prepare a plan required for a given civil engineering project		3					3	1	3		3	1	1
29	21CE2201	Structural Analysis	CO 1	Find the deformation using energy theorems i.e. Castigliano's theorems, Betti's theorem and Maxwell's reciprocal theorem.	3	3									3	1	1
			CO 2	Students will be able to estimate the deflection of beams by various methods such as deflection curves, moment area method, conjugate beam method and unit load method	3	3										1	1
			CO 3	Able to analysis proper cantilevers and fixed beams for any type of loading using consistent deformation method and can analysis conjugate beam by Clapereyon's theorem of Three moments	3	3					1					1	1
			CO 4	Student will be able to analyze beams and frames for any type of loading using slope deflection method and moment deflection methods	3	3						3		1		1	1

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35	21CE3103	Transportation Engineering	CO 1	Know Versatile with history - current trends of transportation and Carry engineering surveys and can decide the alignment						2	2						2	2
			CO 2	Analyze and design highway geometric elements		2	2										2	2
			CO 3	Analyze and design of flexible, rigid pavements, Pavement Drainage		2	2						1				2	2
			CO 4	Handle pavement construction activities and also conduct quality control at site and Evaluate pavement condition and can identify and suggest remedial measures, understand traffic Rules, Analyze and design of traffic infrastructure			2		2	2	2	3					2	2
36	21CE3102	Water Resources Engineering	CO 1	Evaluate the different components of hydrological cycle	3			2			1							2
			CO 2	Estimate the ground water yield and requirement of water for the crops	3	2					1							2
			CO 3	Design the canal irrigation system based on discharge	3			3			1							2
			CO 4	Analyze stability and forces acting on Gravity dams and life of reservoir	3			2			1							2
37	21CE3201	Design Of Steel Structures	CO 1	Analyse and design bolted and welded connections	2	2	2										1	1
			CO 2	Design single and compound beams as per IS code	2	2	2										1	1
			CO 3	Design simple and built-up columns as per IS code	2	2	2										1	1
			CO 4	Design column base systems as per IS code, Calculate wind forces and design roof trusses	2	2	2					2					1	1
38	21CE3202	Quantity Surveying and Estimation	CO 1	Applying the methods of approximate estimate and detailed estimate to the buildings.	1	2									2			
			CO 2	Applying the methods of detailed estimates to R.C.C works, Roads and Canals	1	2									2			
			CO 3	Applying the specifications concept to for different items of work and performing rate analysis.	1	2									2			
			CO 4	Applying tenders and contracts concept to a project and carry out building valuation.	1	2									2			
			CO 5	Applying estimation concept to buildings, road works, canal works by using a software package (M.S Excel)	1										3			

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		Concrete Structures	CO 4	Differentiate types of rectangular water tanks and analyse as per IS code methods, select types of circular water tanks and analyse as per IS code methods	2	2	2										1	1
43	21CE3231	Prestressed concrete	CO 1	To introduce prestressing methods, principles and concepts	2	2											1	1
			CO 2	To determine losses in prestress	2	2											1	1
			CO 3	To Analyse PSC Sections both at transfer of prestress and Service load conditions	2	2							1				1	1
			CO 4	To design prestressed concrete beams as per IS Code, to design end block of PSC beams.	2	2											1	1
44	21CE4141	Bridge engineering	CO 1	Explain about various types of Bridges and IRC Specifications for road bridges													1	
			CO 2	Design deck Slab bridge and T-Beam Bridge as per IRC guidelines	3		2										1	
			CO 3	Design Abutment and Elastomeric Pad Bearings for bridges as per IRC guidelines	3		2										1	
			CO 4	Design Piers and Well Foundations for bridges as per IRC guidelines	3		2										1	
45	21CE4151	Precast and Prefabricated structures	CO 1	Analyze the prefabricated load carrying members.		2											2	
			CO 2	Analyze Behaviour of structural components and production technology of prefabrication.		2											2	
			CO 3	Design joints in precast construction.			1										2	
			CO 4	Design and detail precast structures.			1										2	
46	21CE3216	Projects & Contract management	CO 1	Understand the concept of construction laws and regulations.						2		2						2
			CO 2	Study the current trend toward alternative project delivery systems via contractual arrangements such as design-build and construction management at risk										2			3	
			CO 3	Investigate how to avoid the possibilities of construction disputes via alternative dispute resolution (ADR)						3		3					3	
			CO 4	Understand the Labour regulations and applications on review construction contracts and specifications						3					3		3	

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			CO 2	Understand & Apply the concept of effective stress principle, and porewater pressures and their distribution within a soil mass, determine the consolidation settlement , and determine soil strength parameters from soil tests for “drained” and “undrained” conditions.	3	3											3	
			CO 3	Determine the lateral earth pressure, stability of slopes and retaining walls, Understand the importance and methods of soil investigations and be able to plan a soil investigation	3	3											3	
			CO 4	Understand Terzaghi’s shear failure criteria for soils and their limitations and determine the bearing capacity and settlement of structures founded on soils using shallow and pile foundations.	3	3											3	
			CO 5	Analyze the index and engineering properties of soils from various laboratory tests and prepare the soil investigation report.			3	1	1				3	1			3	3
55	21CE4153	Forensics in Civil Engineering	CO 1	Apply forensic engineering to demonstrate structural and geotechnical failures	2	2	2								2			
			CO 2	Understand reinforced concrete Structures and steel structure failures through case studies	2	2	2								2			
			CO 3	Evaluate different geotechnical failures through case studies	2	2	2								2			
			CO 4	Analyze reasons for geo-environmental and fluid and hydraulic failures	2	2	2											
56	21CE3215	Intelligent transportation systems	CO 1	Understand the Objectives ITS		2	2			2							2	2
			CO 2	Understand the Importance of telecommunications in the ITS system		2	2			2				3		1	2	2
			CO 3	Understand Advanced Traffic Management Systems		2	2			2							2	2
			CO 4	Understand Integration of Automated Highway Systems			2			2					1		2	2
57	21CE3225	Pavement materials & design	CO 1	Characterize pavement materials and also carry the advance tests on bituminous mixtures	1			1									1	1
			CO 2	Thorough with stresses and strains of flexible and rigid pavements.	1	1									2	1	1	

			CO 3	Thorough with analysis and design of flexible highway and airport pavements	1		1					2				1	1		
			CO 4	Thorough with analysis and design of rigid highway and airport pavements	2		2									1	1		
58	21CE3235	Traffic engineering and management	CO 1	Apply the Concepts of Probability in traffic Engineering	3							3		3	2	2	2		
			CO 2	Know the Fundamental design concepts of Interchanges, Parking Facilities, Freeways			2								2	2			
			CO 3	Design Traffic Facilities include Un signalized Intersections (Rotary), Signalized Intersection (signal design)			3								2	2			
			CO 4	Know the Accident Situation in India, road safety measures, Understand Detrimental Effects of traffic on the environment						3	3					2	2		
59	21CE4145	Urban transportation systems planning.	CO 1	Learn the concept of travel demand and supply and modes available for transportation						2	2			3	3		2	2	
			CO 2	Understand the different types of Traffic Surveys used in planning					2							3	2	2	
			CO 3	Identify and analyze trips as a part of transport planning				3	3								2	2	
			CO 4	Plan Public Transport Systems, Utilize ITS in Transport Planning		2			2	2	2						2	2	
60	21CE4155	Railway engineering airport planning and design	CO 1	Understand about the Classification of Railways, Permanent Way & its components, functions.						2		3					2	2	
			CO 2	Analyze track alignment, geometric elements, Horizontal and Vertical curves, super elevation, and Negative Super elevation.				2						2	2			2	2
			CO 3	Understand about the various factors affecting Selection of site for Airport.						2							2	2	2
			CO 4	Geometric Design of Runway, Computation of Runway length, Correction for runway length, Understand the layout of port components and operation of navigational aids that involved in functions of ports.				2		2	2							2	2

61	21CE3213	Sustainable engineering & technology	CO 1	Understand the concept of sustainability, Challenges for Sustainable Development and Clean Development Mechanism			2											
			CO 2	Understand the sources, impacts of solid waste, Global environmental issues and Water Act, Air Act.			2											
			CO 3	Understand the Life Cycle Analysis, Procedures of EIA, green materials for building construction and Methods for increasing energy efficiency of buildings Sustainable cities			2											
			CO 4	Understand the Conventional and non-conventional of Energy sources and Sustainable Urbanization, industrialization and poverty reduction			2											
62	21CE3223	Environmental impact assessment and life cycle analyses	CO 1	Knowledge of Environmental Technology	1					2	2							
			CO 2	To attain assessment of Impacts of Development activities	1					2	2							
			CO 3	To attain Environmental Impact assessment on water and air	1					2	2							
			CO 4	To know the preparation of Environmental Audit Report	1					2	2							
63	21CE3233	Solid Waste Management and Landfills	CO 1	Identify the Hazardous solid waste	2						3							
			CO 2	Understand the Functional Elements of Solid Waste Management														
			CO 3	Applying a mathematical model of municipal solid waste Management	2				1		3							
			CO 4	Construct and operate sanitary landfill	2						3							
64	21CE3214	River engineering	CO 1	Understand the concept of river equilibrium														
			CO 2	Apply the concepts of sediment transport processes	3		1											
			CO 3	Apply the methods of river training works for river stabilization	3		1											
			CO 4	Application of physical river models and governing equations in river flow	3		1											
65	21CE3224	Urban water hydrology and hydraulics	CO 1	Analysis urban hydrological data for storm water management		3		2			2							2
			CO 2	Estimate the components of urban hydrological processes		2		2			2							2

			CO 3	Estimate runoff from highways, airports and urban areas		3		2			2						2
			CO 4	Plan and design of urban drainage systems for an urban area		3		2			2						2
66	21CE40A2	Environmental Pollution Control Methods	CO 1	Applying the modelling techniques used in Air Pollution	2				1		3						
			CO 2	Applying the Mathematical modelling techniques used for control of water Pollution	2				1		3						
			CO 3	Understanding the waste treatment unit processes													
			CO 4	Applying a mathematical model of municipal solid waste Management	2				1		3						
67	21CE40A3	Solid and Hazardous waste management	CO 1	Understand the importance types, sources and disposal methods of Solid waste.	2		2				2						
			CO 2	Summarize the importance of conversion and recycling of waste	2						2						
			CO 3	Associate about types, Sources of Hazardous waste	2						2						
			CO 4	Discuss the disposal and treatment methods of Hazardous waste	2		2				2						
68	21CE40A4	Remote Sensing and GIS	CO 1	Understanding the Basics concepts of Remote Sensing	1												
			CO 2	Understanding the Basic elements of image interpretation	1												
			CO 3	Understanding the concepts of GIS	1			2									
			CO 4	Understanding about the Land use /Land cover studies	1							3					
69	21CE40A5	Disaster Management	CO 1	Understand the types of disasters, related hazards and the causes for disasters		2	2										
			CO 2	The resilience and mitigation measures for various disasters by proper planning with respect to the kind of disaster that occurs		2	2										
			CO 3	Understand the disaster risk, reduction and the various organizations involved with related to disasters.		2					2						
			CO 4	Understand the disaster vulnerability with the help of case studies			2				2						

HUMANITIES AND SOCIAL SCIENCES

INTEGRATED PROFESSIONAL ENGLISH

Course code: 20UC1101

L-T-P-S: 0-0-4-0

Pre-Requisite: NIL

Credits: 2

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of grammar to improve communication, reading, and writing skills	PO10	2
CO2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context. Demonstrate ability to face formal situations / interactions.	PO9	2
CO3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices	PO9	2
CO4	Apply the concepts of writing to draft corporate letters, emails, and memos	PO10	3

Course Objective:

- To express themselves in English with greater fluency, accuracy and confidence
- To communicate with others in practical, business-oriented situations
- To handle variety of business contexts, from negotiating, to using telephone, making presentation.

Syllabus:

COMPETENCY: 1

A) Basic Grammar - Countable and uncountable nouns, present simple and continuous, past simple and continuous – classroom practice – Understand and interpret Texts and work place situations B) Structural Pattern - Present continuous for future arrangements State verbs, Regular and irregular verbs, Voice, Modal verbs – Reporting on going tasks in the corporate world C) Descriptive and Qualitative Patterns: Adjectives and Adverbs classroom practice) Time Expressions, Comparatives and superlatives, Pronouns, Conditionals, Phrases and clauses (Including Relative)

COMPETENCY: 2

- Formal contexts: Being a PA, describing changes in a company Taking orders over the phone
- Listening & Speaking: Participate in conversation with proper contextual language markers and turn taking. Classroom practice - Presenting context, reason, problem – Case analysis (short).
- Body Language: Dos and Don'ts of one to one interaction, Telephone interaction Video/ web conferencing. Culture specific practices.
- Work Etiquette- situation, ambience, team skills, time management and leadership ability.

COMPETENCY: 3

- a) Understand and assimilate main ideas and specific details. (250-300 words text of moderate difficulty)
- b) Read for general understanding, interpreting, factual or specific information, for grammatical accuracy and information transfer.
- c) Understand the general meaning of corporate context and office correspondence.
- d) Understand short reports of predictable nature.

COMPETENCY: 4

- a) Internal Correspondence. Making notes on routine matters, such as, taking/ placing orders
- b) Emails: Types of emails, salutations, vocabulary used in formal and informal (Including beginnings and endings)
- c) Writing straight-forward, routine letters of factual nature

Reference Books:

1. Business Benchmark Book- Preliminary- 2nd edition Cambridge Press 2019.
2. Business Benchmark Book- Pre Intermediate to Intermediate- 2nd edition Cambridge Press 2019

ENGLISH PROFICIENCY

COURSE CODE : 20UC1202

Pre-requisite: NIL

L-T-P-S: 0-0-4-0

Credits: 2

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	Apply the concepts of accurate English while writing and become equally at ease in using good vocabulary and language skills.	PO8, PO9, PO10	3
CO2	Understand the importance of pronunciation and apply the same day to day conversation.	PO8, PO9, PO10	3
CO3	Apply the concepts of ratios, percentages, averages and analyze the given information on the basis of comparative analysis of the data in the form of tabulation, bar graphs, pie charts, line graphs.	PO1, PO4	3
CO4	Apply the basic functionality of clocks and calendars to find the solutions for the problems. Analyze the given symbols to understand the hidden meaning of the given expression and find the solutions. Analyze the possible arrangements in linear & circular order.	PO1, PO5	4

Syllabus:

Writing Skills: How to Write a Definition, Defining Technical Terms, Product and Process Description.

Advanced Grammar Skills: Transformation of Sentences, Phrases, Clauses, Sentences Simple, Compound, Complex Sentences, Concord, Lexis 1:Synonyms, Antonyms, Analogies, Sentence Equivalence-One-Word Substitutes.

Language Laboratory Interactive: Debate, Blind-fold, Role Play, Situation Reaction Test--Build an Island nation.

Quantitative Aptitude: Data Interpretation, Data Sufficiency.

Reasoning: Symbols and Notations, Clocks and Calendars, Analytical Reasoning-II

Reference books:

5. Dictionary of Technical Terms
6. Dr. Meenakshi Raman and Dr. Sangeetha Sarma: Technical Communication. Oxford University Press: Delhi. 2016.
7. The Ultimate Verbal and Vocabulary Builder. Texas: Lighthouse Review. 2000.
8. Rajeev Vasisth: Interactive Vocabulary Drills. New Delhi: Arihant Publications Limited. 2011.
9. Language Laboratory Teacher Manual, KLEF

ESSENTIAL SKILLS FOR EMPLOYABILITY

COURSE CODE :21UC2103

L-T-P-S: 0-0-4-0

Pre-requisite: NIL

Credits : 2

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	Developing critical and analytical reading skills	PO5, PO6	2
CO2	Discovering different interpersonal skills to develop people skills	PO5, PO6	2
CO3	To enhance the problem-solving skills of the students through the concepts of Simple Equations, Ratio, Proportion & Variation, Percentages, Profit & Loss, Averages, Allegations, Simple & Compound Interest	PO5, PO6	2
CO4	Apply diagrammatic representation of the given data to find the possible outcomes in the topics of Deductions, Cubes, Venn Diagrams and Arrangements	PO5, PO6	3
CO 5	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.	PO 1	2

Syllabus:

COMPETENCY1: Grammar • Prepositions • Tenses • Voice • Speech • Sentence Improvement

COMPETENCY 2: Functional Grammar • Spotting Errors • Sentence Rearrangements • 300-word list • Cloze Test

COMPETENCY 3: • SWOC • Self-awareness • Attitude • Self-Confidence • Grooming • Etiquettes

COMPETENCY 4: Oral Communication Skills • Speaking from the script through JAM & Extempore • Product & Process Description through JAM & Extempore • Passage completion • Paragraph & Essay writing

Text Books:

1. Objective English for Competitive Examination by Hari Mohan Prasad and Uma Sinha. McGraw Hill Education, 2017.
2. English Language Communication Skills, Cengage, 2014
3. Soft Skills and Professional Communication Skills – Francis Peter S.J. Tata McGraw Hill Education Private Limited New Delhi 2012
4. Managerial Skills – K. Alex, S.Chand & Company Pvt. Ltd. New Delhi 2013

Reference Books :

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson

CORPORATE READINESS SKILLS

COURSE CODE :21UC2204

L-T-P-S: 0-0-4-0

Pre-requisite: NIL

Credits: 2

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	To distinguish product and process and quote them in speaking and writing activities	PO12	2
CO2	To apply interpersonal skills	PO12	2
CO3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their Problem solving abilities which in turn improve their programming skills.	PO 5	2
CO4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding	PO2	2

Course Objective:

- To demonstrate speaking, and writing skills
- To apply interpersonal skills
- To develop logical thinking skills for better thinking ability

Syllabus:

COMPETENCY-1: Verbal Ability

Speaking from the script, Product & Process Description, Presenting Arguments, Paragraph writing.

COMPETENCY-2: Soft Skills

Goal Setting, Team Building, Leadership, Time Management, Managing Stress

COMPETENCY -3: Quantitative Aptitude:

Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability

COMPETENCY -4: Reasoning

Clocks, Calendars, Binary logic, Number and letter series, Number and letter analogy, Finding the odd man, Coding-Decoding, Direction sense

Reference Books:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson
3. Quantitative Aptitude by R S Agarwal, S CHAND Publications.
4. Quantitative Aptitude by Abhijit Guha, Mc Graw Hills.
5. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, Schand Publications.
6. R S Agarwal, S.Chand , _A modern approach to Logical reasoning‘ GL Barrons, McGraw Hills.

Web References / MOOCs:

1. Online resource: cssklu.bolgspot.com
2. www.indiabix.com
3. www.freshersworld.com
4. www.managementparadise.com
5. www.coolavenues.com
6. www.indiaedu.com/entrance-exams/cat.../books.html
7. www.mycatprep.com

INDIAN HERITAGE AND CULTURE

COURSE CODE :20UC0007

Pre-requisite: NIL

L-T-P-S: 2-0-0-0

Credits: 0

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	To familiarize with various aspects of the culture and heritage of India through ages.	PO1	1
CO2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy	PO1	1
CO3	To understand the Social structure and the spread of Indian culture abroad	PO1	1
CO4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the great Indian scientists	PO1	1

Syllabus:

Introduction- Concept of Culture-Culture and Civilization-General Characteristics of Indian **Culture**-Importance of Culture-Unity in Diversity

History and Culture through the Ages – Fundamental Unity of Harappan and Vedic Culture – Jainism and Buddhism-Mauryan Period-Post-Mauryan Period-Gupta Period-Pallavas and Cholas

Advent of Islam in India-Islam and Sufism-Islamic Art and Architecture-Bhakti Movement-**Vijayanagar Period**-Art and Architecture and Literature

Rise of the West and its impact on India-Social and Religious reformers in the 18th and 19th centuries-Press and growth of modern Indian literature-Rise of Indian Cinema-Indian Independence

Reference books:

13. Facets of Indian Culture- Spectrum Publications
14. Ancient India: National Council of Educational Research and Training
15. Medieval India: Part I & Part II: National Council of Educational Research and Training.
16. Modern India: National Council of Educational Research and Training.
17. An Advance History of India: R.C. Majumdar, H.C. Raychaudhuri&KalikinkarDatt: Macmillan India Ltd.
18. The Wonder that was India : A.L.Bhasham

-INDIAN CONSTITUTION

COURSE CODE :20UC0008

Pre-requisite: NIL

L-T-P-S: 2-0-0-0

Credits:0

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	To understand Constitutional development after Independence	PO12	2
CO2	To learn the fundamental features of the Indian Constitution	PO12	2
CO3	To get a brief idea of the powers and functions of Union and State Governments	PO12	2
CO4	To understand the basics of working of Indian Judiciary and the Election Commission	PO12	2

Syllabus:

Making of the Constitution: A brief analysis of National Movement. Constitutional development with reference to Government of India Act-1909, 1919, 1935 and Indian Independence Act-1947. The Constituent Assembly of India.

Basic features of the Indian Constitution: the Preamble, Fundamental Rights, Directive Principles of State Policy – Fundamental Duties

Government of the Union : The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions, The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers and functions – the role of the Speaker.

Government of the State: The Governor – the Council of Ministers and the Chief Minister – Powers and Functions, The State Legislature – composition, powers and functions.

The Indian Judicial System: the Supreme Court and the High Court's – composition, Jurisdiction and functions, judicial review, judicial activism, Independence of Judiciary in India.

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners.

Reference books:

3. Indian Polity' by Laxmikanth
4. Indian Administration' by Subhash Kashyap
5. 'Indian Constitution' by D.D. Basu
6. 'Indian Administration' by Avasti and Avasti
7. 'Constitutional Law of India' by Seervai H.M.

ECOLOGY AND ENVIRONMENT

COURSE CODE :20UC0009

Pre-requisite: NIL

L-T-P-S: 2-0-0-0

Credits:0

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	Understand the importance of Environmental education and conservation of natural resources.	PO6	1
CO2	Understand the importance of ecosystems and biodiversity.	PO12	1
CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.	PO6	3
CO4	Understand the importance of Environmental education and conservation of natural resources.	PO6	1

Syllabus:

The Multidisciplinary nature of Environmental Studies, Natural Resources, Forest resources, Mining and its impact on environment

Water resources, Mineral resources, Energy resources, Land resources, Soil erosion, Ecosystems, Biodiversity and its Conservation Environmental Pollution

Soil waste management, Electronic waste management, and biomedical waste management

Disaster management, Environmental Legislation Environmental Impact Assessment Process.

Text books:

1. AnubhaKaushik, C.P.Kaushik, "Environmental Studies", New Age International, (2007).
2. Benny Joseph, "Environmental Studies", Tata McGraw-Hill companies, New Delhi, (2009).

UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

COURSE CODE :21UC0010

Pre-requisite: NIL

L-T-P-S: 2-0-0-0

Credits:0

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	Realize and Understand the basic aspiration, harmony in the human being.	PO4	2
CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.	PO4	2
CO3	Understanding the society and nature with the view of human values	PO4	2
CO 4	Understand the profession and his role in this existence.	PO8	2

Syllabus:

Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - The Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations.

Harmony in the Human Being: Understanding the Human Being as Co-existence of Self (‘I’) and Body, Discriminating between the Needs of the Self and the Body, The Body as an Instrument of ‘I’, Understand Harmony in the Self (‘I’), Harmony of the Self (‘I’) with the Body, Program to Ensure Sanyam and Svasthya.

Harmony in the Family and Society: Harmony in the Family - the Basic Unit of Human Interaction, Values in Human-to-Human Relationships, ‘Trust’ – the Foundational Value in Relationships, ‘Respect’ – as the Right Evaluation, Understand Harmony in the Society, Vision for the Universal Human Order.

Harmony in the Nature (Existence): Understand Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing ‘Existence is Co-existence’ at All Levels, The Holistic Perception of Harmony in Existence.

Implications of the Right Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models - Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. A Foundation Course in Human Values and Professional Ethics - R R Gaur, R Sangal and G P Bagaria, First Edition, Excel Books.
2. R R Gaur, R Sangal and G P Bagaria, —A Foundation Course in Human Values and Professional Ethics, 1st Edition, Excel Books.

BASIC SCIENCES

MATHEMATICS FOR COMPUTING

COURSE CODE :20MT1101

Pre-requisite: NIL

L-T-P-S: 2-2-0-2

Credits : 4.5

Course Outcomes (CO):

CO No:	Course out come	PO	BTL
1	Model a system of equations for real world applications in engineering, physical and biological sciences, computer science, finance, economics and solve them through matrix algebra	1	3
2	Model basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional & predicate logic	1	3
3	Model real world structures and their related applications using advanced discrete structures like graphs and trees.	1	3
4	Model the given Statistical data for real world applications in Engineering science, Economics and Management.	1	3
5	Demonstrate the Aptitude and Reasoning skills (Tests in skilling hours)	1	2

Syllabus:

Linear Algebra: Matrix Algebra: Introduction, Types of Matrices, Rank of matrix, Solutions of linear Equations by Gauss elimination and Gauss Seidel methods, Eigen values, Eigen vectors. Quadratic forms

Introduction to Discrete Structures & Discrete Computation: Relations: Closures of relations. Orders, Equivalence Relations, Functions, Finite-State Machines Lattices: Partial order relation, Hasse Diagrams, Properties of Lattices and applications.

Logic and Proofs: Propositional Logic, Rules of Inferences, Applications of Propositional, Propositional Equivalences, Predicates and Quantifiers, Predicate logic, Consequences, Introduction to proofs, Proof methods and strategy.

Counting Techniques: Permutations and Combinations Fibonacci series, Divide-and-Conquer Algorithms, Recursive definitions, Generating Functions. Solving Linear Recurrence Relations

Advanced Discrete Structures & Computation Graphs & Trees: Terminology, Types of Graphs, Bipartite graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path, Planar Graphs, Trees, Tree Traversal Applications of trees, spanning trees and Minimal spanning trees Modeling Statistical data for real world applications Axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Correlation, Regression and Curve fitting.

Skilling: {Tests in skilling hours} Arithmetic: Foundations in Arithmetic: Numbers, Ratio, Proportion, Variation, Averages, Percentages, Profit & loss, Time & Distance, Time & Work. **Applications of Number theory:** Fermat's theorem, Euclidean Algorithm. Geometry: Lines, Triangles, Quadrilaterals, Polygons,

Practical applications of common solids, irregular solids and their application in various engineering problems.

Logic & Reasoning: Sets and Venn diagrams Deductions, Logical Connectives, Linear and circular arrangements. Clocks, Calendars, Blood Relations, Cubes, Number and letter series, Coding and Decoding, Symbolic representations of given data, Binary Logic, Non-Verbal reasoning

Text books:

1. Basic Engineering Mathematics, John Bird, sixth Edition, Elsevier, ISBN:978-1-1380-5382-3
2. Kenneth, K. R., Discrete Mathematics and its Applications, 7thEd., Tata McGraw Hill

Reference books:

1. Probability and Statistics for engineers and scientist, R.E.Walpole, R.H.Myers, S.L.Myers, K.E.Je, Pearson learning
2. Mott, J.L., Kandel, A. and Baker, T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall India Pvt Ltd
3. Tremblay J P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill.
4. A Modern Approach to Verbal and Non-verbal Reasoning, R. S. Agarwal, Schand Publications.

MATHEMATICS FOR ENGINEERS

COURSE CODE :21MT2102

Pre-requisite: NIL

L-T-P-S: 2-1-0-0

Credits : 3

Course Outcomes (CO):

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the differential equations.	PO1	3
CO2	Demonstrate the Fourier series and Laplace transforms.	PO1	2
CO3	Describe probability, Random Variables	PO1	2
CO4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.	PO1	2

Syllabus:

Calculus:

Differential and Integral Calculus: Taylor's series for function of two variables, Maxima and Minima for functions of two variables, Evaluation of double and triple integrals, Change of order of Integration, Change of Variables, in polar, cylindrical and spherical coordinates.

Vector Calculus: Scalar and vector point functions, Gradient, Directional Derivative, Divergence and Curl, Evaluation of line integrals, Introduction to Greens and Stoke's theorems and their applications.

Ordinary Differential Equations: Solution of first order equations and their applications, Newton law of cooling, Growth and Decay, Solution of second and higher order Differential Equations.

Partial Differential Equations: Formation of PDE, Solution of first order linear equations – Lagrange's method, solution of second order PDE by separation of variables. Laplace's equation in two dimensions.

Introduction to Advanced Matrix Algebra: Decomposition, Complex Matrices

Laplace Transforms: Laplace and Inverse Laplace transforms and their properties.

Fourier Series: Definition, Dirichlet conditions, Fourier series for simple functions.

Complex Variables: Complex functions- Exponential, Logarithmic and Trigonometric functions, Analytic function, Cauchy - Riemann equations, Introduction to Milne Thomson method.

Probability and Random Variables: Probability , Addition, Multiplication and Baye's theorems. Random variables, Probability Distributions – Binomial, Poisson and Gaussian distributions, Introduction to Markov process.

Algebraic Structures: Introduction to Structure of Algebras, Semi groups, Monoids and Groups, Homomorphism's, Normal subgroups and congruence Relations, Rings.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Willey & Sons, 10th edition, 2010, New Delhi, India.

Reference Books:

1. R.E.Walpole, R.H.Myers, S.L.Myers, Keying Ye, Probability and Statistics for Engineers and Scientists, , Pearson's Publications , 9th edition, 2012, USA.
3. Mott, J.L., Kandel, A. and Baker, T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India Private Ltd, 1986, India.
4. Tremblay J P and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill publishers, 1st edition, 2001, India.

PROBABILITY, STATISTICS & NUMERICAL METHODS

COURSE CODE :21MT2007

L-T-P-S: 2-1-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Identify the basic concept of probability theory and types of random variables and also their applications in probability distributions.	1	3
2	Apply discrete and Continuous probability distributions to analyse the various real-world situations.	1	3
3	Illustrate the bivariate data using correlation and regression analysis and formulate the given phenomena as a linear programming problem and solve it by graphical method. and simplex methods.	1	3
4	Demonstrate the Big- M method, dual simplex method and obtain the solutions of non-linear programming problems using Pivot, Wolfe's algorithms and separable programming technique	1	3

Syllabus:

Probability and Statistics

Sampling theorems; Conditional probability; Descriptive statistics - Mean, median, mode and standard deviation; Random Variables – Discrete and Continuous, Poisson and Normal Distribution; Linear regression

Standard discrete and continuous distributions: Definitions and simple properties of Binomial, Poisson, Geometric, Hyper-Geometric, Uniform, Exponential, Weibull, and Normal distributions, Applications of the above distributions.

Correlation and Regression: Correlation coefficient for grouped and ungrouped data, Rank correlation. Linear and Non-Linear regression.

Linear Programming: Formulation of LPPs, Graphical solution of LPP, Simplex method, Big-M method, duality in LPP and dual simplex method.

Nonlinear programming: Convex sets and convex functions, Kuhn-Tucker conditions. Convex quadratic programming; Wolfe's and Pivot complementary algorithms. Separable programming.

Numerical Methods

Error analysis. Numerical solutions of linear and non-linear algebraic equations; Newton's and Lagrange polynomials; numerical differentiation; Integration by trapezoidal and Simpson's rule; Single and multi-step methods for first order differential equations.

Text books:

1. Ronald E. Walpole, Sharon L. Myers and Keying Ye, “Probability and Statistics for Engineers and Scientists”, 8th Edition, Pearson.
2. H A Taha, Operations Research: An Introduction, Prentice Hall Pub.

Reference books:

1. Richard A. Johnson, Miller & Freund’s Probability & Statistics for Engineers, 11th Edition PHI, New Delhi.
2. Jay L. Devore, Probability and Statistics for Engineers, CENEAGE learning.
3. S. C. Gupta and V. K. Kapoor, ”Fundamental of Mathematical Statistics” Sultan Chand & Sons Publication, 11th Edition.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley Pub.
5. S D Sharma, Operations Research, Kedar Nath Ram Nath & Co

MECHANICS (Science Elective)

Course code: 21PH1010

L-T-P-S: 3-1-0-0

Pre-Requisite: NIL

Credits: 4

Course Outcomes for

CO	Course Outcome	PO/PSO	BTL
CO1	Develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics	PO1, PO2	3
CO2	Analyze planar and spatial systems and analyze the forces in the members of trusses, frames.	PO1, PO2	4
CO3	Determine first moment and second moment for a given cross sections and problems related to friction	PO1, PO2	3
CO4	Analyze the motion characteristics of a body subjected to a given force system.	PO2	4

Syllabus:

Two-Dimensional Force Systems: Introduction, Basic concepts, Laws of motion, Principle of Transmissibility of forces, Resultant of a force system, force laws, Resultant of two dimensional concurrent and Non-Concurrent Force systems, Free body diagrams, Applications. Equilibrium of Rigid bodies– Equilibrium and Equations of Equilibrium, Lame’s theorem, Type of supports and their reactions, Moments and couples, Varignon’s theorem, Resultant moment and applications.

Spatial Force System & Trusses: Spatial force systems – Forces in space, resultant and equilibrium of spatial force system. Truss Analysis-Trusses -Assumptions involved in the Method of joints and sections.

Friction And Properties of Areas: Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Applications-ladder friction, wedge friction. Centroid And Moment of Inertia: Centroids, center of gravity, Moment of inertia - Area and Mass- polar moment of inertia, Parallel axis theorem.

Kinematics Of Rigid Body: Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational motion.

Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D-Alembert’s Principles and Dynamic Equilibrium.

Text books:

1. Engineering Mechanics-Statics and Dynamics by R. C. Hibbler / Pearson
2. Engineering Mechanics (in SI Units) / S. Timoshenko, D. H. Young, J.V. Rao/ Tata McGraw Hill.
3. Vector Mechanics for Engineers -Statics & Dynamics / F.P. Beer and E.R. Johnston/ Tata McGraw Hill.
4. Engineering Mechanics staticsand Dynamics /MeriamandKraige

Reference books:

1. Engineering Mechanics / S. S. Bhavikatti/ New Age.
2. Engineering Mechanics- NH Dubey/ Tata McGrawHill.

DESIGN THINKING AND INNOVATION

COURSE CODE : 21UC1203

Pre-requisite: NIL

L-T-P-S: 0-0-4-0

Credits: 2

COURSE OUTCOMES (CO – PO MAPPING):

CO No	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the importance of Design thinking process for contextualized problems	PO2, PO6	2
CO2	Analyse, define, and ideate for solutions	PO3, PO9	4
CO3	Develop and test the prototype made	PO4, PO9	3
CO4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity	PO10, PO11	2

Syllabus:

Design thinking an overview, Design Thinking for Contextualized Problem-Solving: Problem Selection/Definition Need for Cultural Relevance (Time, Space, and Environment).

Empathy: definition, Empathic research: framing interview questions, focus groups, Procedure to conduct skilled interviews, Insights from Empathetic research

Define: Developing user personas, nuggets from insights, laying customer journey maps, POV statements and POV questions to define user needs. Ideate: Techniques to generate, shortlist and evaluate Ideas: Rapid Estimation form and Solution concept form.

Prototyping and Testing: Products vs. Services, Rough Prototypes, Testing Techniques, User Experience High-Fidelity Prototypes

Entrepreneurial Innovation: Innovation Management, Business Model Basics, Financial Estimation, Pitch Decks, IPR Considerations.

Text Books :

1. David Lee: Design Thinking in Classroom. Ulysses Press: 2018
2. The Art of Innovation Lessons in Creativity from IDEO, America's Leading Design Firm by Tom Kelley : 2001

Reference books:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

ENGINEERING PHYSICS

COURSE CODE: 21PH1001

L-T-P-S: 2-0-2-0

Pre-requisite: NIL

Credits: 3

COURSE OUTCOMES (CO – PO MAPPING):

CO No	Course Outcome (CO)	PO/PSO	BTL
CO1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.	PO1	2
CO2	Understands the deformation of materials in response to action of load, for identification of materials having specific engineering applications.	PO1	2
CO3	Understands the motion of electrons in microscopic level	PO1	2
CO4	Understand the properties of light and engineering applications of lasers	PO1	2
CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects	PO1	3

SYLLABUS:

Crystal Physics: Space lattice, basis, unit cell, Seven Crystal systems, Bravais lattice system, Crystal directions – Planes and Miller indices – Crystal parameters (for SC, BCC and FCC), Diffraction of X-rays by crystal planes – powder photograph method – Imperfections in crystals.

Mechanical properties of solids: Stress-strain relationship – Hooke's law, Stress-strain diagram for various engineering materials – Ductile and brittle materials – Mechanical properties of Engineering materials (Tensile strength, Hardness, Fatigue, Impact strength, Creep) – Fracture.

Quantum mechanics: Inadequacies of Classical Mechanics – Duality nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle – Schrödinger's wave equation – Particle confinement in 1D box (Infinite Square well potential).

Lasers and Fiber Optics: Characteristics of Lasers – Lasing action – Working principle and components of Ruby, He-Ne laser, Applications.

Fiber Optics: Principle of Optical fiber – Acceptance angle and acceptance cone – Numerical aperture – Types of optical fibers (Material, Refractive index and mode) – Fiber optic communication – Fiber optic sensors.

TEXT BOOKS:

1. Callister William D., Material Science and Engineering - An Introduction,. 6th edition, 2007, Wiley India Pvt.Ltd, ISBN-13: 978-0470556733.
2. Arthur Beiser, Perspectives of Modern Physics - McGraw-Hill, 1968- Science. ISBN 0-07-115096-X.
3. Thyagarajan. K., Ajoy Ghatak, Lasers: Fundamentals and Applications, 2nd edition, ISBN -13-9781441964410.

REFERENCE BOOKS:

1. Kittel. C, Solid State Physics, Wiley student 8th edition, ISBN: 978-0-471-41526-8.
2. Irving h. Shames, Cozzarelli. Francis A., Taylor & Francis group, Elastic and Inelastic Stress Analysis, ISBN 10: 0132454653.
3. Dekkar. A.J, Solid State Physics, Macmillan publishers, ISBN : 0333918339.

PRACTICAL COMPONENT

List of Experiments supposed to finish in Open Lab Sessions:

Lab session no	List of Experiments	CO-Mapping
1	Determination of Lattice Constant	CO1
2	Determination of crystal planes from XRD spectra.	CO1
3	Determination of particle size of lycopodium powder using laser.	CO1
4	Determination of Young's modulus – Uniform bending method	CO2
5	Determination of Creep constant.	CO2
6	Determination of Planck's constant.	CO3
7	V-I characteristics of Photo cell.	CO3
8	Solar Cell Characteristics	CO3
9	Determination of energy band gap of a material	CO3
10	Determination of wavelength of Laser by Grating.	CO4
11	Determination of Acceptance angle and Numerical Aperture using fiber optic cable.	CO4
12	Determination of refractive index of various materials using hollow prism/solid prism	CO4

ENGINEERING CHEMISTRY (Science Elective)

COURSE CODE: 21CY1001

L-T-P-S: 2-0-2-0

Pre-requisite: NIL

Credits: 4

COURSE OUTCOMES (CO – PO MAPPING):

CO No	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Predict potential complications from combining various chemicals or metals in an engineering setting	PO1, PO3, PO7	2
CO2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena	PO1, PO3	2
CO3	Examine water quality and apply appropriate purification technique for intended problem	PO1, PO7	2
CO4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable physical properties.	PO1, PO7	2
CO5	An ability to analyze and generate experimental skills	PO1, PO4	3

Syllabus:

Electrochemistry: Single electrode potential and its measurement, Electrochemical cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells, Concentration cells, Reference electrodes-Determination of pH using glass electrode.

Gas Sensors: Capacitance Manometer and Mass Spectrometer. Batteries: Chemistry, construction and engineering aspects of Primary (mercury battery) and secondary (lead-Acid cell, Ni-Metal hydride cell, Lithium cells) and fuel cells– Hydrogen–Oxygen fuel cell, advantages of fuel cell

Energy and Chemistry: Energy Use and the World Economy, Defining Energy, Energy Transformation and Conservation of Energy, Heat Capacity and Calorimetry. Enthalpy, Hess's Law and Heats of Reaction, Energy and Stoichiometry.

CORROSION & ITS CONTROL: Causes and different types of corrosion and effects of corrosion. Theories of corrosion– Chemical, Electrochemical corrosion, Pitting corrosion, stress corrosion, Galvanic corrosion.

Factors affecting corrosion– Nature of metal, galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment- effect of temperature, effect of pH, Humidity, effect of oxidant. Cathodic protection, sacrificial anode, impressed current cathode, electroplating: WATER Technology: Introduction,

Hardness: Causes, expression of hardness – units – types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Alkalinity and estimation of alkalinity of water, numerical problems. Boiler troubles – Scale & sludge formation, caustic embrittlement, Boiler corrosion, priming & foaming. Softening of water: Internal and external treatments -Lime soda, Ion exchange process. Desalination-reverse osmosis and electro dialysis:

Chemical Kinetics: Ozone Depletion, Rates of Chemical Reactions, Rate Laws and the Concentration Dependence of Rates, Integrated Rate Laws, Temperature and Kinetics, Reaction Mechanisms, Catalysis, insight into Troposphere Ozone. Molecules and Materials: polymers- Types of polymerization-Mechanisms, Plastics – Thermoplastic resins and thermosetting resins - Preparation, properties and engineering applications of: polyethylene, PVC, Teflon, Bakelite, Urea Formaldehyde. Conducting Polymers: Polyacetylene, polyaniline, conduction, doping and applications. Carbon nano tubes and Applications.

Text Books:

1. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Company, New Delhi.
2. Engineering Chemistry, O G Palanna, The Tata McGraw Hill, New Delhi

Reference Books:

1. Chemistry in Engineering and Technology, Volume 2, J C Kuriacose & J Rajaram, Tata McGraw Hill, New Delhi.
2. Chemistry for Engineers Rajesh Agnihotri, Wiley, New Delhi.
3. Engineering Chemistry, B. Sivasankar, The Tata McGraw Hill, New Delhi.
4. A text book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co. New Delhi.
5. Engineering Chemistry, C Parameswara Murthy, C V Agarwal and Andra Naidu, B S Publications, Hyderabad.
6. Engineering Chemistry, Shikha Agarwal, Cambridge University Press

PROBLEM SOLVING SKILLS - I

COURSE CODE: 21UC3105

Pre-requisite: NIL

L-T-P-S: 0-0-4-0

Credits: 2

COURSE OUTCOMES (CO – PO MAPPING):

CO#	Course Outcome	PO/PSO	BTL
CO1	To discuss and interpret English language skills necessary for Placements	PO12	2
CO2	To demonstrate skills to get selected in interviews and retain job	PO12	2
CO3	To enhance the problem-solving skills of the students through the concepts of Mensuration, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency which will enable them to improve their problem-solving abilities which in turn improve their programming skills.	PO5	2
CO4	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.	PO2	2

COURSE OBJECTIVE:

- To identify different components of verbal ability and interview skills
- To apply the skills acquired in the placement tests to succeed.
- To develop logical reasoning for better thinking ability

SYLLABUS:

COMPETENCY-1:

- a) **Verbal Ability:** Sentence Completion, Idioms & Phrases, One Word Substitutes, Sentence Improvement, Sentence Equivalence, Analogies
- b) **Life Skills:** Attitude for Success, Connecting with People, Employment Communication (CV& Interview), Workplace Etiquette

COMPETENCY-2:

- a) **Attitude for Success:** Stimulus and Response, Choosing the Response, Determinisms, Changing the attitude for success, Proactive and reactive Attitude
- b) **Connecting with People:** Empathy, Assertiveness, Saying what you want to say, Saying what you do not want to say – saying 'No'

COMPETENCY-3: QUANTITATIVE APTITUDE

Mensuration, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency

COMPETENCY-4: REASONING

Connectives, Blood relations, Ranking and time sequence, Symbols and notations, Non-verbal reasoning (Picture puzzles), Data sufficiency

REFERENCE BOOKS:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson
3. Quantitative Aptitude by R S Agarwal, S CHAND Publications.
4. Quantitative Aptitude by Abhijit Guha, Mc Graw Hills.
5. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, Schand Publications.
6. R S Agarwal, S.Chand , _A modern approach to Logical reasoning‘ GL Barrons, McGrawHills.

WEB REFERENCES / MOOCS:

1. Online resource: cssklu.bolgspot.com
2. www.indiabix.com
3. www.freshersworld.com
4. www.managementparadise.com
5. www.coolavenues.com
6. www.indiaedu.com/entrance-exams/cat.../books.html7. www.mycatprep.com

ENGINEERING SCIENCES

ENGINEERING GRAPHICS

Course Code: 19CE1002
 Prerequisite: NIL

L-T-P-S: 2-0-4-0
 Credits:4

Mapping of Course outcomes with student outcomes: The students are able to

CO No.	Course Outcomes	PO	B T L
1	Understand the principles of drawing and use of drafting instruments and AutoCADD and Draw engineering curves, Geometrical Constructions	1, 10, 12	2
2	Draw orthographic views for the given objects	1, 10, 12	2
3	Draw Isometric views for the given orthographic views	1, 10, 12	2
4	Draw the projections of points, lines, planes and solids	1, 10, 12	2
5	Draw the total surface of solids by development of surfaces and the sections of Solids	1, 12	2

Syllabus:

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance- Drawing Instruments and their Use - Conventions in Drawing -Lettering - BIS Conventions, Basics of AutoCADD

Geometrical Constructions-Division of Lines, Angles, Polygons

Engineering Curves used in Engineering Practice & their Constructions:

Conic Sections: Ellipse, Parabola, Hyperbola and Rectangular Hyperbola – General and other methods.

Special Curves: Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projection in Third Angle Projection: Principles of Orthographic Projections Conventions - First and Third Angle, Projections of Points and Lines inclined to both planes, True lengths, traces. Transformation of Projections: Conversion of Isometric Views to Orthographic Views

Isometric Projections: Principles of Isometric Projection - Isometric Scale - Isometric Views Conventions - Isometric Views of Lines, Plane Figures, Simple and Compound Solids - Isometric Projection of objects having non- isometric lines, Isometric Projection of Spherical Parts, Transformation of Projections: Conversion of Orthographic Views to Isometric Views

Projections of Planes & Solids: Projections of regular Planes, auxiliary planes and Auxiliary projection inclined to both planes. Projections of Regular Solids inclined to both planes - Auxiliary Views

Section of solids and Sectional Views: -Right Regular Solids - Prism, Cylinder, Pyramid, Cone – Auxiliary views.

Development of Solids: Development of Surfaces of Right, Regular Solids -Prisms, Cylinder, Pyramid Cone and their parts.

Text Books:

1. N.D. Bhatt “Engineering Drawing” Charotar publishing House

Reference Books:

1. Engineering Drawing and Graphics, Venugopal / New age.
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Engineering Drawing, K L Narayana and Kannaiah / Scitech publishers.

DESIGN TOOLS WORKSHOP –I

COURSE CODE :20ME1103

L-T-P-S: 0-0-4-0

Pre-requisite: NIL

Credits: 2

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome	PO/PSO	BTL
CO1	Practice design thinking by developing artistic skills, Visualize and complete his/her innovative design by final drafting using 3D modeling	PO-3	2
CO2	Understand the concept of web page, web browser, web server, and able to create Static webpages	PO-4	3
CO3	Understand the concept of report writing using a markup language Latex	PO-5	3
CO4	Understand the concept of data visualization and creating data visualization dashboards, Understand the basic concept of VR/AR.	PO-4	3

Syllabus:

Introduction to Design tools: Introduction to design tools course, its objective, advantages

3D Modeling: - Conceptual Design, 2D Sketches to 3D Solid Model using AUTODESK FUSION 360.

HTML: Introduction to web browser and URL, Introduction to HTML, Creating a simple HTML page, HTML documents, Concept of tags, Basic structure of HTML document, Head, Body, Paragraph creation, line breaks, text, list, tables, Hyperlinks and images.

HTML5: Basic of HTML5, Special features of HTML5, Canvas, audio, video, Geo location, drag and drop.

CSS: Concept of CSS, Need of CSS, Creating style sheet, CSS properties, CSS styling (Background, text, format, controlling fonts), Styling with lists and tables, CSS Ids and class, CSS color, Creating page layouts and site design.

Data Visualization: Introduction to data visualization, Data, types, Importance of data visualization, Different tools for visualization and comparisons in brief. Excel data explanation, Creation of column Chart, stacked bar chart and Heat map, Creation of excel dashboard. Creation of Dashboards in Power BI. Creation of bar charts, date tables and pie charts in Power BI, creating slicers and maps in power BI.

Latex Report Writing: Understanding Latex compilation, Basic syntax, Writing equations, Tables, Figures handling, List of figures, List of tables, Generating index. Applications: Writing resume, Writing project reports.

Virtual Reality & Augmented Reality: Introduction to Virtual reality, Virtual 360 Environments, Creating basic 360 Virtual frame. Introduction to Augmented reality, Different types of AR, Platforms to create AR interfaces.

Text Books:

1. Complete Design Thinking Guide for Successful Professionals by Daniel Ling
2. Rapid Prototyping: Principles and Applications by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.
3. Learn HTML & CSS by John Duckett.
4. HTML5 and CSS3 All-in-One for Dummies
5. Mastering Microsoft Power BI Expert techniques for effective data analytics and businessintelligence by Brett Powell
6. LaTeX Tutorials: A Primer by Indian TeX Users Group by Indian TeX Users Group(<https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf>)

Web Links:

1. <https://www.coursera.org/learn/3d-model-creation-fusion-360>
2. <https://www.coursera.org/learn/html/home/welcome>
3. <https://www.udemy.com/course/become-a-good-latex-user-to-create-professional-documents/>
4. <https://www.udemy.com/course/microsoft-power-bi-latest-2020-beginner-to-expert-modules>

DESIGN TOOLS WORKSHOP –II

COURSE CODE :19SC1209

L-T-P-S: 0-0-4-0

Pre-requisite: NIL

Credits: 2

Mapping of Course Outcomes with PO/PSO:

CO No.	Course Outcome	PO/PSO	BTL
CO1	Practice the design ideology by artistic skill	PO-3	2
CO2	Visualize the design ideology by using VR technology	PO-4	3
CO3	Visualize the design ideology by incorporating VR technique	PO-5	3
CO4	Visualize and present his design idea by applying AR technique	PO-4	3

Syllabus:

Design Thinking in Modern Art & Ideas: Modern Art & Ideas, Transforming everyday objects, Abstract painting, clay modeling, poetry and literary.

Virtual Reality: Hardware and History, VR Applications, Psychology of VR: the three illusions, challenges in virtual reality, Future of Embodiment in VR, Realism, Graphics, Real-Time 3D Graphics in Games, Basic Concepts in 3D Computer Graphics, Realism Animation, Navigation, Nausea.

Room Scale VR, Holography, Mirror Reality: Setting up room scale VR, Simulation of virtual environment, Stereoscopic Vision, Perspective, Interference and Diffraction, Laser Viewable Holograms, Real and Virtual Images, Introduction to mirror reality.

Augmented Reality: Augmented Reality, characteristics of AR systems and main components of an AR architecture, Augmented Reality with Geolocation, Customizing an augmented reality game.

Text books:

1. “Complete Design Thinking Guide for Successful Professionals” by Daniel Ling
2. “Project Management” by K. Nagarajan, 7th Edition, New Age International Publishers.
3. “Augmented Reality and Virtual reality” by Timothy Jung, M.ClaudiaTomDieck, Springer.
4. “Rapid Prototyping: Principles and Applications” by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.
5. “Artificial Intelligence: A Modern Approach” by Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall.

DESIGN OF DATA STRUCTURES

COURSE CODE :21SC1202

L-T-P-S: 3-0-2-4

Pre-requisite: NIL

Credits: 5

Mapping of Course Outcomes to Program outcomes:

CO	Course Outcome	PO/PSO	BTL
CO1	Apply measures of efficiency on algorithms and Analyse different Sorting Algorithms.	PO1, PO2, PSO1, PSO2	4
CO2	Analyse and compare stack ADT and queue ADT implementations using linked list and applications.	PO1, PO4, PSO1, PSO2	4
CO3	Analyse the linked implementation of Binary, Balanced Trees and different Hashing techniques.	PO1, PO4, PSO1, PSO2	4
CO4	Analyse different representations, traversals, applications of Graphs and Heap organization.	PO2, PO4, PSO1, PSO2	4
CO5	Develop and Evaluate common practical applications for linear and non-linear data structures.	PO1, PO2, PSO1, PSO2	5

Syllabus:

Algorithm Analysis: Mathematical Background, Model, Analyse, Running Time Calculations, Lists.

Stacks and Queues: Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT.

Trees: Preliminaries, Binary Trees, The Search Tree ADT—Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees, Red black trees

Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing.

Priority Queues (Heaps): Model, Simple Implementations, Binary Heap, Applications of Priority Queues.

Sorting: Preliminaries, Insertion Sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting.

Graph Algorithms: Definitions, Topological Sort, Shortest-Path Algorithms, Minimum Spanning Tree.

Text books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2010, Second Edition, Pearson Education.
2. Ellis Horowitz, Fundamentals of Data Structures in C: Second Edition, 2015

Reference books:

1. A.V.Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint 2003.
2. Horowitz, Sahni, Anderson Freed, “Fundamentals of data structures in C”, Second Edition-2007.
3. R. F. Gilberg, B. A. Forouzan, “Data Structures”, Second Edition, Thomson India Edition, 2005.
4. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, “Data Structures& Program Design in C”, Fourth Edition-2007.

List of Lab Experiments:

1. Develop a set of programs to implement Linear and Binary searching techniques (both iterative and recursive)
2. Develop a set of programs to find the solution for the maximum subsequence sum problem with different time complexity solutions.
3. Develop a set of programs to implement below sorting techniques
 - a. Insertion Sort
 - b. Shell sort
 - c. Selection Sort
4. Develop a set of programs to implement below sorting techniques (Divide and conquer method)
 - a. Quick sort with median of three.
 - b. Merge Sort
5. Develop a Program to implement operations of doubly linked list
 - a. Create
 - b. Insert
 - c. Display
 - d. Delete
 - e. Search
6. Develop a program to perform operation on stack using linked list
7. Develop a program to perform operations on queue using linked list
8. Develop a program to implement Circular Queue using Array
9. Develop a program to implement Binary Search Tree with Traversal Operations
10. Develop a program to perform following operations on AVL tree
 - a. Insertion
 - b. Deletion
11. Develop a program to implement the following
 - a. Separate chaining for collision handling
 - b. Open Addressing Technique
12. Develop a program to implement Heap sort
13. Develop a program to implement
 - a. Breadth First Search
 - b. Depth First Search
 - c. Dijkstra's Algorithm
14. Program to implement Minimal Spanning by
 - a. Prim's algorithm
 - b. Kruskal's algorithm

COMPUTATIONAL THINKING FOR STRUCTURED DESIGN

COURSE CODE :21SC1101

Pre-requisite: NIL

L-T-P-S: 3-0-2-6

Credits: 5.5

Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm.	PO1,PO2	3
CO2	Translate computational thinking into Logic Design for Solving real world problems.	PO1,PO2	3
CO3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations.	PO1,PO2	4
CO4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.	PO4	4
CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems.	PO1,PO2, PO4	3

Syllabus:

Structured Programming Paradigm: Problem Solving Approach, Algorithms and Algorithm Analysis, Program Development Steps, Structure of C Program, Pre-Processor Directives, **Design of Building Blocks for solving real world problems:** Modularization: Functions, Scope of Variables and Storage classes.

Data Types: Primitive, Extended and Derived Including Pointers, Operators: Types of operators, Precedence, Associativity.

User I/O: Formatted I/O, Command line arguments, Redirecting I/O: Files and File Operations.

Logic Design for Computational Thinking:

Control Flow Statements:

Decision making using conditional statements, Definite and indefinite Iterative statements. Recursion, logic building using complex building blocks.

CRUD operations on Basic Data Structures:

Basic Data Structure: Arrays, 2-D Arrays, Dynamic Memory

Allocation Searching: Linear Search and Binary Search

Sorting: Bubble Sort

CRUD operations on Linear Data Structures: Stacks, Queues and Single Linked List.

Introduction to Trees.

Text Books:

1. Brian W. Kernighan, Dennis M. Ritchie, -The C Programming Language: ANSI C Version, 2/e, Prentice-Hall/Pearson Education-2005.
2. E. Balagurusamy, "Programming in ANSI C" 4th ed., Tata McGraw-Hill Education, 2008.
3. R. F. Gilberg, B. A. Forouzan, -Data Structures, 2nd Edition, Thomson India Edition- 2005.

Reference Books:

1. Mark Allen weiss, Data Structures and Algorithm Analysis in C, 2008, Third Edition, Pearson Education.
2. Horowitz, Sahni, Anderson Freed, -Fundamentals of Data structures in C, 2nd Edition- 2007.
3. Robert Kruse, C. L. Tondo, Bruce Leung, Shashi Mogalla, -Data structures and Program Design in C, 4th Edition-2007.
4. C for Engineers and Scientists – An Interpretive Approach by Harry H. Cheng, Mc GrawHill International Edition-2010.
5. Jeri R. Hanly, Elliot B. Koffman, -Problem Solving and Program Design in C, 7/e, Pearson Education-2004.
6. Jean Paul Trembly Paul G. Sorenson, -An Introduction to Data Structures with applications, 2nd Edition.

Web References / MOOCS:

- www.hackerrank.com
- www.codechef.com
- www.spoj.com

Independent Learning:

1. Computational Thinking with Beginning C Programming
<https://www.coursera.org/specializations/computational-thinking-c-programming>
2. CISCO NetAcad Course <https://www.netacad.com/courses/programming/c-programming-c>

PROFESSIONAL CORE

GEOLOGY

Course code: 21CE2205

L-T-P-S: 3-0-2-0

Pre-requisites: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No	CO	PO	BTL
1	Understand the significance of engineering geology, geological processes that modify the surface of the earth	1,8	2
2	Understand the basics of minerals and rocks, geological structures exhibited by rocks and their influence	1,8	2
3	Analyse the geological conditions to identify suitable site for civil engineering projects.	1,8	3
4	Analyse the geological conditions to identify potential sites for groundwater, sites for dam and reservoir and tunnels	1,5,8	3
5	Apply and analyse the geological conditions for suitability of the site for a major civil engineering project	2,11	4

SYLLABUS:

INTRODUCTION: Importance of geology from Civil engineering point of view.

PHYSICAL GEOLOGY: Introduction; Weathering Process, types of weathering and its importance in civil engineering; Soil formation, Soil profile, soil conservation measures; Geological action of Rivers, stages in a river system, features of river erosion and deposition.

EARTHQUAKES AND SEISMIC HAZARDS: Terminology; Classification, Causes and effects of earthquakes; seismic waves, measuring instruments, seismic zones of India, Seismic belts, seismic hazards in India; Civil Engineering considerations in seismic areas. A step towards urban earthquake vulnerability reduction.

LAND SLIDES: Classification; Causes and effects of Landslides; Preventive measures of Landslides.

MINERALOGY: Definition of mineral; physical properties of minerals. Study of common rock forming minerals - Quartz, Feldspar, Muscovite, Asbestos calcite, Talc, Kaolin

PETROLOGY: Introduction; Rock Cycle, major rock types, formation of Igneous rocks; Structures of Igneous rocks. Formation of Sedimentary rocks; Structures of Sedimentary Rocks. agents of metamorphism, Structures of Metamorphic rocks, distinguish the major rock types.

ENGINEERING PROPERTIES OF ROCKS: Different Engineering properties of rocks. Description of some important Rocks – Granite - Basalt – Dolerite – Sandstone – Limestone – Shale – Laterite - Granite gneiss – schist – Marble – Khondalite – Charnockite.

STRUCTURAL GEOLOGY: Introduction; Strike and Dip; Outcrop. Parts and classification of Folds; Faults; Joints; and their importance in Civil Engineering constructions.

SITE INVESTIGATION TECHNIQUES FOR CIVIL ENGINEERING PROJECTS:

Introduction, Different stages of site investigation, toposheets/topographic maps; Geological maps and their interpretation in site investigation; Geophysics in civil engineering, electrical resistivity investigations, seismic survey, remote sensing, Geographical information systems and their application.

GROUND WATER: sources of ground water, factors controlling ground water, water bearing properties of rocks and soils, types of aquifers, exploration of ground water **DAMS:** Suitable foundations for different types of dams, guidelines for major dam and reservoir investigations, water tightness and influence factors, case studies.

TUNNELS: terminology, Tunnels and underground excavations, methods of site selection, tunnel excavation in rocks and soft ground, case studies (Finish to start) networks, computation of float values and semi critical path calendaring networks.

TEXTBOOKS:

1. Engineering Geology by D. Venkat Reddy; Vikas Publishing House Pvt.Ltd., Noida
2. Engineering and General Geology by Parbin Singh; S. K. Kataria & Sons, New Delhi.

Reference Books:

1. Engineering Geology and Geo techniques by Krynine and Judd, Mc Graw – Hill Book Company.
2. Engineering geology by Subinoy Gangopadhyay: Oxford University Press



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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. 08645 - 350200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

SOLID MECHANICS

Course Code: 21CE2101

L-T- P-S: 3-0-2-0

Pre-requisite: Nil

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand and apply the concepts of stress, strain and mechanical properties of solids	2	4
2	Determine Shear force and Bending moment of the determinate beams	2	4
3	Determine the bending, Shear and Principal stresses in beams	2	4
4	Analyse buckling of columns, and torsional members	2	4
5	Demonstrate experimental verification of various material strengths	2	4

Syllabus:

Simple stresses and strains: Elasticity and plasticity; Types of stresses and strains; Hooke's law; stress strain diagram for mild steel and HYSD-bars Working stress; Factor of safety; Lateral strain, Poisson's ratio and volumetric strain; Elastic constants and the relationship between them Bars of varying section; composite bars; Temperature stresses. Resilience- Gradual, sudden, impact and shock loadings simple applications.

Shear Force and Bending Moment: Diagrammatic conventions for supports; Diagrammatic conventions for loading; Classification of beams; Concept of shear force and bending moment; relationship between load, shear force and bending moment, Shear force and bending moment diagrams for statically determinate beams.

Pure Bending and Shearing Stresses of Beams: The flexure formula; Computation of the moment of inertia; Remarks on the flexure formula. Flexural strength of composite Beams, Shearing stress formula for beams; Shear stress distribution for various sections; Unsymmetrical Bending and Shear centre.

Theories of Failure: Introduction-Variou theories of failure-maximum principal stress theory, Maximum principal strain theory, Strain energy and Shear strain energy theory (Von Mises Theory).

Analysis of Plane Stress: Equations for the transformation of plane stress; Principal Stresses; Principal planes; Maximum shearing stresses; Mohr's circle of stress; Construction of Mohr's circle of stress.

Torsion: Torsional deformations of a circular bar, circular bar of elastic materials, stresses and strain in pure shear, relationship between E and G.

Columns: Stability of equilibrium; The Euler's formula for columns with different end restraints; Limitations of the Euler's formulas; Generalized Euler buckling - load formulas; Rankine's empirical formula.

Text Books:



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1. Ferdinand P Beer, E. Russell Johnston, Jr. John T. Dewolf, David F. Mazurek, Mechanics of materials sixth edition, Mc Graw Hill education.
2. J.M. Gere, Thomsom brooks/Cole India edition, Mechanics of materials Sixth edition, 2006.

Reference Books:

1. Strength of materials by R. Subramanian, Oxford University Press.
2. S P Timoshenko. Strength of Materials Part I & II CBS Publishers and distributors, New Delhi, 3rd Edition.
3. Riley, Strurges and Morris, Mechanics of Materials John Wiley and Sons Inc. fifth Edition.
4. Andrew Pytel & F. L. Singer, Strength of Materials Harper Collin Publisher's Pvt. Ltd. New Delhi, Fourth edition.
5. Strength of materials by S.S.Ratan, Tata Mc Graw Hill Education Pvt Ltd.

List of Experiments:

1. Tests on Mechanical and Elastic properties of HYSD Bars
2. Tests on Wood and Aluminum Section Profiles
3. Hardness test on metals like Steel, Brass, Copper and Aluminum
4. Torsion test on steel reinforcement
5. Impact test on Steel Specimen - Charpy and Izod test
6. Test on Closely coiled helical springs.
7. Compression tests on concrete cubes
8. Bending test on cantilever beam and simply supported beam.



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FLUID MECHANICS & HYDRAULIC MACHINES

Course Code: 21CE2102

L-T-P-S:3-0-2-0

Pre-requisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Analyze the properties of fluid	PO1, PO2	4
2	Analyze fluid kinematic states	PO1, PO2	4
3	Analyze fluid dynamic states	PO1, PO2	4
4	Analyze dimensional analysis and model simulations	PO1, PO2	4
5	Analyze the flow through notches and pipes	PO1, PO2	4

Syllabus:

Fluid properties: Definition of fluid, classification of fluids, properties of fluid density, specific weight, specific gravity, viscosity, surface tension and capillarity, vapour pressure and cavitation. **Fluid statics:** Introduction, pressure, Pascal's law, hydrostatic law, measurement of pressure-simple and differential manometers, Total pressure and centre of pressure on vertical, horizontal and Inclined surfaces. **Fluid statics-buoyancy and floatation:** Buoyancy, centre of buoyancy, Meta-centre, Meta-centric height. **Fluid kinematics:** Introduction, types of fluid flow, Discharge, Continuity equation, Continuity equation in three-dimensional flow, velocity potential function and stream function **Fluid dynamics:** Introduction, Euler's equation of motion, Bernoulli's equation and applications, Venturimeter, Orificemeter, Pitot-tube, the coefficient of discharge, Introduction to orifices and mouth pieces, Notches -V and Rectangular. **Momentum equation:** Impulse-momentum equation, Force exerted by flowing fluid on pipe-bend. **Flow through pipes:** Introduction, major and minor energy losses, hagen-poiseuille law, Hydraulic gradient and total energy line, pipes in series, parallel and Water hammer.:

Hydraulics

Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology

Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

TEXTBOOKS:

1. Fluid Mechanics by John F. Douglas, Tata McGraw Hill publications
2. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
3. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi



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Reference Books:

1. Fluid Mechanics and machinery by Manish Kumar Goyal: PHI Publishers, Delhi.
2. Fluid Mechanics and machinery by C.S.P.Ojha: Oxford Higher Education Publishers, Chennai.
3. Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi.
4. Fluid Mechanics by G. S Sawhney, IK International Publishing house (P) Ltd. New Delhi
5. Fluid Mechanics by Edward J. Shaughnessy, Oxford University Press, USA.

Lab Experiments

1. Determination of coefficient of discharge of Rectangular notch.
2. Determination of coefficient of discharge of Triangular notch.
3. Determination of coefficient of discharge of Orifice.
4. Determination of coefficient of discharge of Mouth piece.
5. Determination of Meta-Centric height.
6. Determination of coefficient of discharge of Venturi meter.
7. Determination of coefficient of discharge of Orifice-meter.
8. Fluid flow analogy using Reynolds apparatus.
9. Verification of Bernoulli's theorem.
10. Determination of Darcy friction factor due to friction in a pipe flow.
11. Determination of minor losses due to sudden expansion and contraction in a pipe flow.



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SURVEYING

Course code: 21CE2103

L-T-P-S: 3-0-2-0

Pre-requisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No:	CO	PO/PSO	BTL
1	Apply the knowledge of plane surveying for computation of bearings in a traverse.	1,5/1	3
2	Calculate the difference in elevation by using differential leveling techniques and prepare a contour plan.	1,5/1	3
3	Compute area of the field and volume of earthwork.	1,5/1	3
4	Calculate the height of building by using theodolite and tacheometric survey, and total station surveying	1,5/1	3
5	Conceptualize the project by applying surveying techniques	11/1	3

SYLLABUS

Surveying: Introduction to surveying, Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications.

Distances and Direction - Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

Leveling and Contouring - Concept and Terminology, adjustments- method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys and their plotting.

Computation of Areas and Volumes - Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

Theodolite - Theodolite, description, uses and adjustments, measurement of horizontal and vertical angles. Principles of Electronic Theodolite, Trigonometrical leveling, Traversing.

Tachometric Surveying - Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position.

Curves - Types of curves, design and setting out of simple curves.

Total Station: Introduction – Accessories with description - Features of total station – Onboard software electronic data reading - Summary of total stations characteristics - Field procedure of total stations in topographic survey, Global positioning system, Introduction to Geographic information system (GIS).

Text Books:

1. Surveying and Levelling by R.Subramanian, Oxford University Press, 2nd edition, 2012



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2. Surveying Vol - I, II, III - Dr. B.C . Punmia Laxmi publications, Delhi-6

Reference Books:

1. Surveying and levelling part I & II by Kanetkar.T.P. & S.V.Kulkarni, Puna vidyarthi girha, Prakashan,23rd edition,1993.
2. Arora K. R, “Surveying Vol-I”, Rajsons Publications Pvt. Ltd, 10th Edition, 2008.

LIST OF EXPERMENTS

1. Determination of area of a polygon by a ranging and taking offsets.
2. Measuring distance between two stations by indirect ranging when they are obstacles.
3. Measuring of bearing of sides of the traverse and preparation of map.
4. Determination of elevation of various points with a level by (a) collimation method (b) rise & fall method
5. Measurement of horizontal and vertical angles using theodolite
6. Determination of a given area using total station.
7. Calculation of volume of earthwork using total station
8. Staking out the points in an area using total station
9. Measurement of height of the tower/building using total station
10. Measuring and plotting using Auto cad of a given area of land by total station



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STRUCTURAL ANALYSIS

Course Code: 21CE2201

L-T-P-S: 3-1-0-0

Pre-requisite: Nil

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Determine the deflection of determinate beams	2	4
2	Analyse the Propped cantilever and fixed beams	2	4
3	Analyse the Continuous beams and Portal frames using Theorem of three moment equation and Slope Deflection method	2	4
4	Analyse continuous beams and portal frames by moment distribution method.	2	4

Energy Theorems: Principle of superposition, Maxwell's reciprocal theorem, Betti's theorem, Principles of virtual work, Application of virtual work, Castigliano's theorems, Applications of Castigliano's theorem.

Deflection: Relation between curvature, slope and deflection, Deflection curves, Deflection of beams by Double integration, Macaulay's method, Moment area, conjugate beam method, unit load method.

Propped Cantilevers and Fixed Beams: Analysis of propped cantilevers with point load, partially loaded udl and uniformly varying load, fixed beam with point load, udl, Unsymmetrical concentrated load and varying load,

Analysis of Continuous beams: Clapeyron's theorem of three moments, analysis of beam with constant EI for all spans, varying EI for different span, sinking of supports.

Analysis of Structure by Slope Deflection Method: Difference between force method and displacement method. Advantage of displacement method. Analysis of indeterminate beams, Beams with uneven support settlement, rigid frames by slope deflection method.

Analysis of Structure by Moment Distribution Method: Advantage of moment distribution method, stiffness, carry over and distribution factor, analysis of indeterminate beams and rigid frames, uneven settlement of support for beam and rigid frame by moment distribution method.

Text Books:

1. Intermediate Structural Analysis by C. K. Wang, McGraw Hill Book Company, 2010.
2. Structural analysis by R.C. Hibbler, Pearson, New Delhi.
3. S.P. Timoshenko and D.H. Young, "Theory of Structures", 2nd Edition, 1965.

Reference Books:

1. Basic Structural Analysis by C S Reddy, Tata McGraw Hill publishing Company ltd. Delhi. 2nd edition 2010.
2. Fundamentals of Structural Mechanics and Analysis by M L Gambhir, PHI learning private limited, New Delhi, 2011.



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CONSTRUCTION MATERIALS AND CONCRETE TECHNOLOGY

Course Code: 21CE2104

L-T-P-S:3-0-2-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand and explain the characteristics, classification of Engineering materials	1,4	2
2	Understand and explain the specifications of lime, cement, aggregates and mortar.	1,4	2
3	Understand and explain the specifications, properties and uses of timber and paints	1,4	2
4	Understand and explain the manufacturing process, types, properties and testing of concrete. Apply the guidelines of BIS method of mix design	1,4	3
5	Demonstrate and apply knowledge experiments in the project-based laboratory	1,4	3

Syllabus:

Evolution of Stones, Bricks, Timber

Aerated Blocks: Properties, criteria for selection, manufacturing process

Light weight blocks: Properties, Tests on light weight blocks, manufacturing process

Bamboo: Bamboo as steel reinforcement, applications and advantages, test on bamboo

Cement: Cement Ingredients, Manufacturing process, Chemical Composition. Types and Grades Properties of cement and Cement mortar, Hydration, Standard tests of Cement (Fineness, Consistency, Setting Time, Compressive strength, soundness), Effects of cement properties on concrete and Industrial byproducts - Fly ash., Blast furnace slag

Admixtures: Importance of admixtures, types, Applications and usage, test on admixtures

Aggregates: General Classification of Aggregates (According to shape and Size), Natural stone aggregates, Good qualities of an ideal aggregate, Mechanical properties, Testes on Aggregates (Particle size, crushing strength, Impact strength, Flakiness Index, Elongation Index, Abrasion Resistance, Specific gravity, water absorption, and moisture content) and Bulking of Sand.

Water – Quality of water for use in concrete. Alternative Building Materials: Mineral Admixtures and Light Weight Aggregates.

Concrete: Concrete- Ingredients, Manufacturing Process, Mixing of Concrete, Batching plants, RMC, Properties of fresh concrete, Workability, Slump Flow and compaction Factor. Properties of hardened concrete -Compressive, Tensile and shear strength, Modulus of rupture Tests, Elasticity, Creep and shrinkage.

Proportioning of Concrete Mix: Principles of Mix Proportioning, Design Mix and Nominal Mix, BIS Method of Mix Design, Mix Design Examples. The durability of Concrete.



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Special Concretes: Lightweight concrete, lightweight aggregate concrete, Cellular concrete, No-fines concrete, Fiber-reinforced concrete, Polymer concrete, Types of Polymer concrete-Self-compacting concrete.

Text Books:

1. S. Mahaboob Basha, “Building Materials, Construction and Planning”, Anuradha Publishers,
2. Varghese, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2012.
3. Shetty, M.S. “Concrete Technology (Theory and Practice)”, S. Chand and Company Ltd., 2008.

Reference Books:

1. Jagadish, K.S, “Alternative Building Materials Technology”, New Age International, 2007.
2. IS456 2000: Indian Standard specification for plain and reinforced concrete, 2011
3. IS1542–1992: Indian standard specification for sand for plaster, 2009
4. Duggal, S.K. “Building Materials”, 4th Edition, New Age International, 2008.
5. Gambhir. M.L., & Neha Jamwal., “Building Materials, products, properties and systems”, Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
8. Gambhir, M.L. “Concrete Technology”, 3rd Edition, Tata McGraw Hill Education, 2004

List of Experiments

1. Determine the Specific gravity of cement
2. Determine the initial and final setting time of cement with Vicat’s apparatus
3. Determine the normal consistency of cement with Vicat’s apparatus
4. Determine the fineness modulus of fine aggregates
5. Determine the fineness modulus of Coarse aggregates
6. Determine the flakiness index and elongation index of the given aggregate
7. Determine the bulk density, Specific gravity, Void ratio and Porosity of fine aggregates
8. Determine the bulk density, Specific gravity, Void ratio and Porosity of Coarse aggregates
9. Workability of concrete by slump cone apparatus
10. Workability of concrete by compaction factor apparatus
11. Compressive strength of concrete cubes, Brick, AAC Block
12. Determine the split tensile strength of blocks, concrete



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ENVIRONMENTAL ENGINEERING

Course Code: 21CE2204

L-T-P-S:3-0-2-0-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	To apply the concept of forecast population and design of water treatment units	1,6,7	3
2	To apply the concept of Water distribution system by using Equivalent pipe method	6,7	3
3	To apply concept of sewage quantity and design of sewerage system and septic tank design.	1,6,7	3
4	To Understand the concept of Solid Waste Management methods and Noise pollution effects	6,7	2
5	To apply the testing of water & wastewater, design of water, wastewater treatment plant.	1,6,7	4

Syllabus:

Water Supply: Necessity of protected water supply. Role of Civil Engineer. Water demand, per capita consumption and factors affecting. Effect of variations of water demand. Design period – population forecasting, Sources of water - quality parameters and their significance. Drinking water quality standards in India. Intake structures design.

Water Treatment: Types and origin of impurities, Need for water treatment. Purpose, principles of operation and design considerations of plain sedimentation, sedimentation with coagulation, flocculation clarifier design. Design of filters. Disinfection methods.

Distribution systems -Design procedures- Hardy Cross and equivalent pipe methods– Layout of distribution system. Joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines.

Introduction to Sewerage system: Sewerage systems, Quantity estimation, Velocity in sewers, Storm water sewers-Storm water estimation by rational method. Sewerage system design, Objectives and extent of wastewater treatment, characteristics of sewage – examination of sewage – B.O.D. – C.O.D. equations.

Sewage Treatment: Purpose, principle and design considerations of Preliminary treatment -. Screens, grit chambers; Primary Treatment-Sedimentation – rectangular and circular tanks; Secondary treatment- Activated sludge process, Trickling filter and UASB. Septic tanks - design parameters and working principles.

Noise Pollution & Solid waste Management: Noise pollution, types, Impacts on environment and control measures. Solid Wastes - Types, sources and composition of solid wastes, Methods of collection and disposal

Air Pollution: Air Pollution-Types, Impacts on environment, and Principles of control techniques



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Text Books:

1. Wastewater Engineering Treatment, Disposal & Reuse by Met Calf & Eddy, Tata McGraw – Hill publishing Co. Ltd., New Delhi.
2. Environmental Engineering (Vol I), Water Supply Engineering, S. K. Garg, Khanna Publishers, New Delhi, Twelfth Revised Edition, 2010

Reference Books:

1. Environmental Engineering by Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Mc Graw-Hill International Editions, New York.
2. Water and Wastewater Technology, Mark. J Hammer and Mark. J Hammer, Eastern Economy Edition, PHI-Learning, New Delhi (2008).
3. Environmental Engineering by Davis Cornvel, McGraw Hill Book Co., New York. (2000).
4. Water and wastewater Engineering by G.M. Fair, J.C. Geyer, and Okun, John Wiley & Sons, New York (1998).
5. Wastewater Engineering by M.N Rao and A.K Dutta, Oxford & IBH Publishing Co. Ltd. (2000).
6. Environmental Engineering (Vol II), Sewage Disposal and Air Pollution Engineering, S. K. Garg, Khanna Publishers, New Delhi, Twenty-Second Revised Edition, 2010.

List of Experiments:

Determination of the following parameters present in the given water / wastewater sample:

1. a) pH b) Electrical Conductivity.
2. a) Turbidity b) Jar test.
3. Hardness.
4. a) Acidity b) Alkalinity.
5. Available chlorine and Residual Chlorine.
6. Fluoride.
7. Iron.
8. Total solids, Dissolved solids, Suspended solids & Settleable solids.
9. Dissolved Oxygen (DO).
10. Biochemical Oxygen Demand (BOD).
11. Chemical Oxygen Demand (COD).
12. Chlorides.



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BUILDING PLANNING, DRAWING & CONSTRUCTION MANAGEMENT

Course Code: 21CE2202

L-T-P-S: 3-0-2-0

Pre-requisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand about the different types of masonry and flooring	1,4	2
2	Understand about building bye-laws for construction of buildings, different types of buildings and walls	1,4	2
3	Understand the project management fundamentals and scheduling techniques	1,4	2
4	Understanding the resource and machinery management	1,4	2

Syllabus:

Brick Masonry: Technical terms; Types of bonds in brickwork and their suitability. **Stone Masonry:** Technical terms; Classification of stone masonry. Dampness and Damp Proofing: Introduction, Methods of preventing dampness; Damp proofing materials and their classification; Methods of providing DPC under different situations.

Floors: Technical terms; Different types of floors – concrete, mosaic, terrazzo, stone floors, ceramic tile floors, vinyl floors and wood floors. **Roofs:** Technical terms; Classification of roofs; Steel sloping roofs; Roof covering materials; Types of flat roofs. **Scaffolding, Shoring, Under Pinning and Form Work:** Types of scaffolding; Types of shoring; Methods of underpinning; Types of formwork; Centering

Building Planning: Introduction to Buildings, Classification of Buildings, National Building Code Building Planning: Selection of Site, Orientation, Ventilation, Furniture requirements, Roominess, Sanitation, Lighting, Space for equipment for air-conditioning, Space for machinery etc.; Aspect and prospect, Privacy, Elegance and economy; Climatic considerations; Materials selection, Wall thickness and Scales

Building Bye-Laws & Regulations: Objectives of Building Bye-Laws, Building regulations; Calculation of Plinth Area (PA), floor area and carpet area; Floor Area Ratio (FAR), Floor Space Index (FSI), Height of Buildings as per local code book

Construction Management: Introduction, Construction projects, Objectives of Construction management; Steps involved in Project management, Project failures. **Planning:** Steps involved in planning; Objectives of planning; Principles of planning; Advantages and Limitations of planning, Stages of planning. **Scheduling:** Scheduling, Methods of scheduling; Bar charts; Mile stone charts; Controlling; Job layout; Factors affecting job layout; Project work break down; Activities involved.

Project Management Through Networks: Objectives of network techniques; Fundamentals of network analysis; Events; Activities; Dummies; Advantages of network techniques over conventional techniques. **Program Evaluation and Review Technique (PERT):** Introduction; Time estimates; Earliest expected time; Latest allowable occurrence time; Slack; Critical path; Probability of completion time for a project.



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Critical Path Method (CPM) & Cost Control: Introduction; Earliest event time; Latest event time; Activity time; Float; Critical activities and critical path; Difference between CPM and PERT, Direct cost; Indirect cost; Total project cost

Resource Management (Man Power, Materials & Machinery):

Introduction; Resource smoothing; Resource Leveling, Establishing workers productivity; Objectives of material management; Functions of material management department; ABC classification of materials; Inventory of materials; Material procurement; Storage management

Construction Equipment: Classification of construction equipment; Concreting plant and equipment; Factors affecting the selection; Factors affecting cost of owning and operating the equipment.

Text Books:

1. Varghese P.C, "Building construction", Prentice hall of India (P) Ltd, New Delhi 2nd Edition 2008
2. Seetharaman.S, "Construction Engineering and Management", Umesh Publications, Nai Sarak, Delhi, 2008
3. Shah MG, "Building Drawing", Tata McGraw-Hill, New Delhi, 2006.

Reference Books:

1. Punmia B. C, "Building construction", Laxmi Publications, New Delhi 5th Edition
2. Sengupta.B & Guha.H "Construction Management & Planning", Tata McGraw – Hill Publishing Co. Ltd., New Delhi.
3. Peurifoy R. L, "Construction Planning, Equipment & Methods", McGraw – Hill International Book Company.
4. Srinath.L. S, "PERT & CPM Principles and applications" Affiliated East West press.

List of Experiments:

1. Draw the Sign Conventions for Engineering Materials, Water supply & Sanitary fixtures and Electrical Installations etc. using Auto cad.
2. Draw the English bond & Flemish bond for one, one and half brick walls using Auto cad.
3. Draw the Doors, Windows and Ventilators using Auto cad.
4. Draw the Residential Building and School Building line diagrams using Auto cad.
5. Draw the Commercial Building and Hospital Building line diagrams using Auto cad.
6. Draw the Sloped roof building with Load Bearing walls using Auto cad
7. Draw the Flat Roof Building with Framed construction using Auto cad
8. Draw the Stair Case Plan, Sectional elevations including T- Beam, Landing Beam & landing slab using Auto cad
9. Draw the Plan, section & elevation for given line plans of Single storied building using Auto cad
10. Draw the Plan, section & elevation for given line plans of Double storied building using Auto cad



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GEOTECHNICAL ENGINEERING

Course Code: 21CE2206

L-T-P-S:3-0-2-0

Prerequisite: Nil

Credits: 4

Course Objective:

To develop fundamental understanding of Soil Mechanics through rigorous theoretical discussions, analytical examples, practical applications and computational projects, such that these theories, physical and engineering properties of soils can be effectively used for the design of suitable foundation for any structural design and will able to choose the suitable field and laboratory tests required for any foundation design.

Course Rationale:

The purpose of this course is to the study of soil as construction material, its behaviour and its engineering properties under stress, this course is intended to cover some of the most essential aspects of soil as an engineering material, and its engineering properties. In this course, the student will learn, soil formation, different phases of soil, different interrelations between soil properties, estimation of Index and Engineering properties of soil, soil classification, compaction of soil, consolidation of soil, the permeability of soil, effective stress principle, and shear strength of the soil.

COURSE OUTCOMES (COs):

CO No	Course Outcome (CO)	POs/PSOs	Blooms Taxonomy Level (BTL)
CO1	Describe soils and determine their physical characteristics such as grain size, water content, and void ratio, and their inter-relations, classify soils, determine compaction of soils, soil permeability and seepage analysis.	PO1, PO2, PSO1	3
CO2	Understand the concept of effective stress, determine total and effective stresses and porewater pressures and their distribution within a soil mass, determine the consolidation settlement and time required for consolidation, understand the stress-strain behavior of soils, and determine soil strength parameters from soil tests for “drained” and “undrained” conditions.	PO1, PO2, PSO1	3
CO3	Determine the lateral earth pressure, stability of slopes and retaining walls, Understand the importance and methods of soil investigations and be able to plan a soil investigation	PO1, PO2, PSO1	3
CO4	Understand Terzaghi's shear failure criteria for soils and their limitations and determine the bearing capacity and settlement of structures founded on soils using shallow and pile foundations.	PO1, PO2, PSO1	3



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CO5	Analyze the index and engineering properties properties of soils from various laboratory tests and prepare the soil investigation report.	PO3, PO4, PO5, PO9, PO10, PSO1, PSO2	3
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SYLLABUS:

Introduction to the history of Geotechnical Engineering and its importance in Civil Engineering; ORIGIN OF SOIL & GRAIN SIZE: Rock Cycle, Soil formation due to weathering of rocks, Transported soils, soil classification based on size, clay minerals, Mechanical Analysis of soils, particle shape; WEIGHT – VOLUME RELATIONS: Phase diagrams, Simple definitions of Index Properties, Inter relations among index properties; PLASTICITY & STRUCTURE OF SOIL: Atterberg Limits, Liquidity Index, Activity, sensitivity, Plasticity Chart, structure of soil; SOIL COMPACTION: Laboratory tests on compaction test, Factors affecting compaction, Structure and engineering behavior of Compacted cohesive soils; PERMEABILITY: Permeability of stratified soil deposits, Indirect methods, Factors affecting permeability; SEEPAGE: Laplace Equation, Estimation of seepage using flownet;

INSITU STRESSES: Total stress, Pore Water Pressure, Effective Stress, seepage forces, quicksand condition; STRESSES IN A SOIL MASS: Vertical stress distribution using Boussing equation, Fadum Chart and Newmarks chart; COMPRESSIBILITY: Calculation of initial Settlement, consolidation settlement, laboratory consolidation test; Normally Consolidated Clay, Over Consolidated Clay, compressibility characteristics and estimation of primary consolidation Settlement and time – rate of consolidation; SHEAR STRENGTH OF SOIL: Determination of shear strength and shear strength parameters using Mohr–coulomb Failure Criterion, laboratory tests using Direct Shear, Unconfined Compression test, Vane Shear Test and Triaxial Shear Tests.

LATERAL EARTH PRESSURE: Types of Lateral earth pressure, Earth pressure at rest, Active and Passive pressure and estimation of lateral earth pressure using Rankine's theory, Coulombs wedge theory, and Culmann's graphical method; STABILITY OF SLOPES: Types of Slope failures, Factor of Safety against shear strength, cohesion and friction, Stability of an Infinite slope, Stability analysis by friction circle method, Taylor's Stability number; RETAINING WALLS – Types and Principles in the designing of a retaining wall; SUBSOIL INVESTIGATION: Depth of Exploration, Methods of Exploration, Borings for Exploration, Depth of Exploration, Methods of Exploration, Borings for Exploration, Field tests - Plate load test, Penetration test.

SHALLOW FOUNDATIONS: Types of foundations and choice of foundations, Bearing capacities, Terzaghi's bearing capacity theory, influence of water table on bearing capacity, safe bearing capacity of soil using IS Code; SETTLEMENT OF FOUNDATIONS: Settlement of shallow foundation, Allowable bearing pressure of granular soils based on standard penetration test value; PILE FOUNDATIONS: Types of piles, Necessity, pile driving, Load carrying capacity of piles – Static and dynamic formulae, Negative skin friction, Pile load tests, Load carrying capacity of group of piles.



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Text Books:

1. Principles of geotechnical Engineering by BM Das and K. Shobhan, Cengage Publications, 8th edition, 2010
2. Geotechnical Engineering by C. Venkatramaiah, New Age Int Publications, 3rd Edition, 2006
3. Geotechnical Engineering Lab Manual - KL.

Reference Books:

1. Soil Mechanics and Foundations by Muni Budhu, John Wiley and Sons Inc, 2010

List of Experiments:

The Lab will be conducted as project based lab, and each student has to complete the below two projects as a team of four member:

Project 1: Estimation of Safe Bearing Capacity of Sandy soil and preparation of soil investigation report with all index and engineering properties of soils

Project 2: Estimation of Safe Bearing Capacity of Clayey soil and preparation of soil investigation report with all index and engineering properties of soils



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DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code: 21CE3101

L-T-P-S:3-0-2-0

Prerequisite:

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	WSM: Design of Singly Reinforced Beam & Doubly Reinforced Beam, LSM: Introduction, Design of singly Reinforced Beam & Doubly Reinforced Beam	1,5	6
2	Design of Flanged Beams (T- Beam & L – Beam), Design concepts of shear, development length and torsion for beams	1,5	6
3	Design of Reinforced concrete slabs and columns	1,5	6
4	Design of isolated footings (Square, Rectangular & Circular)	1,5	6
5	Analysis and Design of Structures using software such as ETABS/Staad Pro/CYPE CADD etc.	11	

Syllabus:

Introduction to working stress method: Introduction, Design for bending, Analysis and design of singly reinforced and doubly reinforced beams.

Introduction to limit state design: Concepts of limit state design, Characteristic loads, Characteristic strength, Partial loads and Material Safety factors, Representative stress, Strain curves, Assumptions in limit state design, Stress block parameters, Limiting moment of resistance.

Singly and doubly reinforced beams: Limit state analysis and design of singly reinforced, doubly reinforced beams. **Flanged sections:** Limit state design of T and L beam sections.

Shear, torsion and bond: Limit state analysis and design of sections for shear and torsion, Concept of bond, anchorage and development length, I.S Code provisions. Design examples in simply supported beams.

Slabs: Design of one-way slabs, two-way slabs, Continuous slabs using IS coefficients.

Columns: Short and long columns Uni axial loads Uni - axial bending and bi-axial bending I.S code provisions.

Footings: Footings: Different types of footings–Design of isolated, square, rectangular and circular footings.

Text Books:

1. P.C. Varghese “Design of Reinforced Concrete Design.
2. Pillai & Devdas Menon, “Reinforced concrete design”, 3rd Edition, Tata McGraw Hill, New Delhi, 2009.
3. A.K. Jain, “Reinforced Concrete Design”, 5th Edition, Charotor Publications, 2010.

Reference Books:



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1. N.C. Sinha and S.K Roy, “Fundamentals of Reinforced Concrete”, 4th Edition, S. Chand publishers, 2002
2. N. Krishna Raju and R.N. Pranesh, “Reinforced Concrete Design”, 8th Edition, New age International Publishers, New Delhi, 2004.
3. M.L. Gambhir, “Design of Reinforced Concrete Structures” 6th Edition, PHI, Delhi, 2013.

List of Experiments:

1. Introduction and Analysis and Design of a Singly Reinforced Beams in Staad.Pro
2. Analysis and Design of a Doubly Reinforced Beam in Staad.Pro
3. Analysis and Design of Flanged Beams in Staad.Pro
4. Analysis and Design of Axial column in Staad.Pro
5. Analysis and Design of Uni - Axial column in Staad.Pro
6. Analysis and Design of Bi-Axial column in Staad.Pro
7. Analysis and Design of One-way Slab in Staad.Pro
8. Analysis and Design of Two-way Slab in Staad.Pro
9. Design and Detailing of a Multi Storeyed Structure in Staad.Pro
10. Design and Detailing of a Multi Storeyed Structure in Staad.Pro
11. Project



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WATER RESOURCES ENGINEERING

Course Code: 21CE3102

L-T-P-S: 3-1-0-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO/PSOs	BTL
1	Evaluate the different components of hydrological cycle	1,4	5
2	Estimate the ground water yield and requirement of water for the crops	1,2	4
3	Design the canal irrigation system based on discharge	1,4	6
4	Analyze stability and forces acting on Gravity dams and life of reservoir	1,4	6

Syllabus:

Introduction - Hydrologic cycle, Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, raingauge network, mean precipitation over an area, Abstractions from precipitation - evaporation process, interception, depression storage, infiltration, infiltration indices. Runoff - runoff volume, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, derivation of unit hydrograph, S-Curve and method of superposition methods.

Ground water and well hydraulics - forms of subsurface water, saturated formation, aquifer types and properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifer, Pumping tests. Water requirement of crops-, duty and delta, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

Canal irrigation and classification of canals, alignment of canals, canal losses, Design of channels- alluvial channels, Kennedy's and Lacey's theory of regime channels. Water logging: causes, effects and remedial measures. Lining of canals, types of lining.

Dams - embankment dams: Classification, design considerations, control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis and spillways, Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Textbooks:

1. Irrigation Engineering and Hydraulic Structures Vol 2. by Santosh K. Garg; Khanna Publishers, Delhi.
2. Irrigation Water Resources and Water Power Engineering Edition 11th by, P. N. Modi, Standard book house, New Delhi.

Reference Books:

1. Engineering hydrology Edition 4th by K. Subramanyam; Tata McGraw Hill, New Delhi.
2. Elementary Hydrology by V. P. Singh, PHI Publishers, New Delhi.



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TRANSPORTATION ENGINEERING

Course Code: 21CE3103

L-T-P-S:3-0-2-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	understand the Current road projects including highway project preparation	1	2
2	Design highway cross section elements	2	4
3	Design flexible and rigid pavement	1	4
4	Analyse the components of traffic stream parameters	2	3
5	Identify the suitable road construction materials following IRC codes	11	3

Syllabus:

Highway Network Planning: Different modes of transportation, role of highway transportation, classification, network patterns, planning surveys, preparation of plans, final report, master plan, evaluation by saturation system, 20 year road development plans, salient features, determination of road lengths, introduction to highway economics.

Highway Alignment And Geometric Design: Principles of highway alignment, requirements, controlling factors, engineering surveys, importance of geometric design, design controls and criteria, cross section elements, pavement surface characteristics, camber, carriageway, kerbs, road margins, formation, right of way, typical cross sections, sight distance, stopping sight distance, overtaking sight distance, sight distance at intersections, design of horizontal alignment, super elevation, transition curves, design of vertical alignment, gradients, vertical curves.

Pavement Materials and Mix Design: Types of pavement structures, functions of pavement component layers, materials used in pavements, basic soil properties relevant to pavement applications, properties of aggregate, blending of aggregates, tests on bitumen, grading of bitumen, bituminous mix design using Marshall method.

Design of Pavements: Stresses in flexible pavements: layered system concepts, stress solution for one, two and three layered systems, fundamental design concepts; variables considered in pavement design: axle types, standard and legal axle loads, ESWL, EWLF, vehicle damage factor, ADT, AADT, growth factor, lane distribution factor, directional distribution factor, tyre pressure, contact pressure, design life; design of flexible pavement using IRC method; stresses in rigid pavements: Westergaard's theory and assumptions, stresses due to curling, stresses and deflections due to loading, frictional stresses, design of joints; design of rigid pavement using IRC method.

Traffic Engineering Principles: Traffic characteristics; components of traffic stream: flow-speed Density, measurement and analysis, q-k-v relationships, design hourly volume, concept of EPCU, capacity and level of service, parking studies and road safety



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Text Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

Reference Books:

1. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
3. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
4. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

CODES:

1. IRC 37 – 2012: Guidelines for the design of flexible pavements, Indian Road Congress Publications, New Delhi.
2. IRC 58 – 2011: Guidelines for the design of plain jointed rigid pavements for highways, Indian Road Congress Publications, New Delhi.
3. MORTH - Specifications for Road and Bridge works, Indian Road Congress Publication, New Delhi, Latest Edition
4. IRC 67 – 2001: Code of Practice for Road Signs, Indian Road Congress Publication, New Delhi
5. IRC 35 – 1997: Code of Practice for Road Markings, Indian Road Congress Publication, New Delhi

LIST OF EXPERIMENTS:

- 1 To determine toughness of aggregate by using aggregate impact testing machine
- 2 To determine strength of the aggregate by using crushing value test.
- 3 To determine hardness of aggregate by using Los Angeles abrasion test
- 4 Shape tests
- 5 To determine specific gravity and water absorption of aggregate by using Buoyancy Balance
- 6 To determine grade of the bitumen by using penetrometer.
- 7 To determine elasticity of the bitumen by using ductility machine
- 8 To determine softening point of the bitumen by using Ring and ball apparatus.
- 9 To determine flash and fire point of the bitumen by using Pensky martin closed cup apparatus.
- 10 To determine percentage of bitumen by using Bitumen extractor.
- 11 To determine stability of bituminous mix by using Marshall Stability apparatus.



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QUANTITY SURVEYING ESTIMATION & VALUATION

Course Code: 21CE3201

L-T-P-S 3-0-2-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand the fundamentals of estimation and provide hands on experience on estimation of quantities of building.	1,5	2
2	Prepare detailed estimate of quantities and costs for R.C.C structures, Roads, Canals	1,5	2
3	Prepare detailed specifications and provide exposure to rate analysis for different items of work.	1,5	2
4	Recognize the P.W.D working procedures, Contracts and tenders of a project and carry out building valuation.	1,5	2
5	Practical estimations of buildings, road works etc. by using a software package (M.S Excel)	11	3

SYLLABUS:

Procedure of Estimating: Methods of estimating; Main items of work; Deduction for openings; Degree of accuracy. **Methods of Building Estimates:** Individual wall method; Centre line method; Arch masonry calculation. **Estimate of RCC works:** Estimate of RCC slab; RCC beam and RCC column with foundation. **Road Estimating:** Estimate of earthwork; Estimate of pitching of slopes; Estimate of earthwork of road from longitudinal sections; Estimate of earthwork in hill roads. **Canal Estimate:** Earthwork in canals—different cases; Breached sections/Breach closures **Specifications:** Purpose and method of writing specifications; Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R. R. Stone Masonry. **Analysis of Rates:** Preparing analysis of rates for the following items of work: i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering. preparing lead statements. **PWD accounts and procedure of works:** Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate, cash flow allocations yearly. **Contracts:** Contract: types of contracts, Contract Law, EMD, Tenders, Acceptance of Contract, Breach of Contract, Cancellation of Contract, arbitration, Retendering – work order, running payment, Final Bill, Completion Certificate **Valuation:** Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for estimating cost depreciation; Valuation of building.



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TEXT BOOKS:

1. Estimating & Costing in Civil Engineering by B.N. Dutta; U. B. S. Publishers & Distributors, New Delhi.
2. Valuation of Real properties by S. C. Rangwala; Charotar Publishing House, Anand.

REFERENCE BOOKS:

1. Estimating & Costing by M. Chakraborty, S Chand Publishing House.
2. Estimating and Tendering for Construction Work, By Martin Brook, Elsevier Ltd., Burlington, MA - 2004

List of Experiments

1. Estimation of a building using centre line method
2. Estimation of a building using individual wall method
3. Estimation of a building (with varying sections) using centre line method
4. Estimation of building (with varying sections) using individual wall method
5. Estimation of a r.c.c roof slab
6. Estimation of a r.c.c beam
7. Estimation of a r.c.c column with foundation
8. Estimation of earthwork in roadways
9. Estimation of earthwork in an irrigation channel
10. Rate analysis



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DESIGN OF STEEL STRUCTURES

Course Code: 21CE3202

L-T-P-S: 3-1-0-0

Prerequisite: NIL

Credits: 4

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Design of connections and tension members	1,6	3
2	Design of compression members and beams	1,6	3
3	Design of beam-column connections	1,6	3
4	Design of roof truss	1,6	3

Syllabus:

Welded and bolted connections: Introduction, Advantages and disadvantages of welding-Strength of welds and bolts. Permissible stresses IS Code requirements. Design of bolted and welded connections subjected to moment acting in the plane and at right angles to the plane of the joints.

Tension members: General design of members subjected to direct tension.

Compression members: Effective length of columns, Slenderness ratio permissible stresses, Design of compression members, Struts etc. **BUILT UP COLUMNS:** Design of built up compression members Design of lacings and battens. Design Principles of eccentrically loaded columns and splicing of columns.

Beams: Introduction to plastic analysis, Design requirements as per IS Code Design of simple and compound beams-Curtailment of flange plates, check for deflection, shear, buckling and bearing, for laterally supported and unsupported beams. Web buckling strength and Web crippling strength.

Introduction to Beam-Column connections: types of beam-column connections

Design of column bases: Design of slab base and gusset base. Column bases subjected to moment.

Roof trusses: Different types of trusses, Design loads, Load combinations, IS Code:800-2007 recommendations, structural details. Design of simple roof trusses involving the design of purlins.



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IS Codes:

1. IS -800:2007, "Codes of Practice for General Construction in Steel", BIS, 2007
2. IS 875 Part III, "Codes of Practice for Design Loads" (other than Earthquake, for Buildings and Structures), 1987.
3. Steel Tables.

Text Books:

1. Bhavikatti, "Design of Steel Structures", 6th Edition, University Press. Hyderabad, 2010.
2. S.K. Duggal, "Limit state design of steel structures", 1st Edition, TMH publication, 2011
3. N. Subramaniyan, "Design of Steel structures", 1st Edition, Oxford university press, 2008.

Reference Books:

1. B.C. Punmia, "Comprehensive Design of Steel structures", 10th Edition, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi, 2007.
2. P. Dayaratnam, "Design of Steel Structures", 2nd Edition, S. Chand Publishers, 2009.
V.L. Shah, Prof. Veena Gore, "Limit State Design of Steel Structures", 1st Edition, Structures Publications, 2009



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PROFESSIONAL ELECTIVES



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ADVANCED STRUCTURAL ANALYSIS

Course Code: 21CE3211

L-T-P-S: 3-0-0-0

Prerequisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Analyze the determinate structures for various loads and load combinations	1,5	3
2	Analyze the indeterminate structures using matrix methods	1,5	3
3	Analyze Three hinged and Two hinged arches	1,5	3
4	Analyze indeterminate beams and frames using Plastic Analysis	1,5	3

Syllabus:

Basic concepts: Structural elements, joints and supports. Shear force, bending moment. Static indeterminacy, kinematic indeterminacy. Direct loading actions on the building, indirect loading actions on the building. Force-displacement relations. Applications of principle of virtual work and displacement-based and force-based energy principles. Approximate Analysis of Multi storeyed building subjected to lateral loads.

Influence Line Diagrams for Determinate Structures: Influence line for reactions of simply supported beams and overhang beams. Influence Line Diagram for shear force in cantilever and simply supported beams. Influence Line Diagram for bending moment in cantilever, overhang and simply supported beams. Position and magnitude of maximum shear force and bending moment for concentrated load and uniformly distributed load, series of concentrated loads. Absolute maximum shear force and bending moment. Influence Line Diagram for framed Structures.

Analysis of Structure by Flexibility Matrix Method: Matrix; vector; basic matrix operations; Concept of flexibility coefficients, analysis of truss, indeterminate beams and rigid frames by Flexibility Matrix method.

Analysis of Structure by Stiffness Matrix Method Concept of degrees of freedom, degree of indeterminacy and stiffness coefficients, analysis of truss, indeterminate beams and rigid frames by Stiffness Matrix method.

Analysis of Hinged Arches: Types of arches, analysis of one hinge arch, analysis of two hinge arch, analysis of three hinged arch.

Plastic Analysis of Structures Idealized stress-strain diagram, Plastic Moment of resistance, plastic modulus, shape factors for different sections, load factor, Plastic hinge and mechanism, plastic analysis of indeterminate beams and frames



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Text Book:

1. Advanced Structural Analysis by Devdas Menon, Narosa Publishing House Pvt. Ltd. - New Delhi, 2009
2. Theory of Structures by S. Ramamrutha, 6th Edition, Dhanpat Rai Publishing CO.

Reference Books:

1. Basic Structural Analysis by C S Reddy, Tata McGraw Hill publishing Company Ltd. Delhi. 2nd edition 2010.
2. Intermediate Structural Analysis by C. K. Wang, McGraw Hill Book Company, 2010
3. Structural analysis, A Matrix Approach by Pandit & Gupta, Tata McGraw Hill publishing Company Ltd. New Delhi. 2008



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ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code: 21CE3221

L-T-P-S: 3-0-0-0

Prerequisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Design of flat slabs and combined footing.	PO3,PSO1, PO1,PO2	5
CO2	Design of pile foundations and deep beams	PSO1,PO1, PO2,PO3	5
CO3	Design concepts of precast construction and design of elevated water tanks	PO3,PSO1, PO1,PO2	5
CO4	Design of Retaining walls and concepts of Ductile detailing	PSO1,PO1, PO2,PO3	5

Syllabus :

Flat Slabs: Introduction, Benefits, Punching Shear, Shear in Flat slabs Analysis, Design and detailing of flat slabs. Combined footings: Introduction, Design of combined rectangular footings, combined rectangular footings with central beam, MAT foundation, Reinforcement detailing and bar bending schedule.

Structural Design of Pile Foundations: Types of piles, Load carrying capacity of piles, Group action in piles, Structural design of RC piles, Design of pile cap for 2 or 3 piles, Reinforcement detailing and bar bending schedule.

Deep Beams: General features, parameters influencing the design, Flexural bending stresses, Shear stress in deep beams, IS Code Provisions and Design examples.

Precast construction: Introduction to Precast construction, Precast techniques, Material properties; Design concept and design considerations, precast limitations; design of composite precast pre-stressed components

Elevated Water tanks: Types of over head water tanks, Intz type water tank, design example of Intz type water tank, conical or funnel shaped tank, example of funnel shaped over head tank.

Retaining Walls: Introduction – Types of retaining walls –Active and passive earth pressure-Design principles of cantilever retaining walls with horizontal back fill –With sloping back fill. Design principles of Counter fort retaining walls with horizontal back fill. Reinforcement detailing and bar bending schedule.

Ductile detailing: Ductile Detailing for Earthquake Resistant R C Structures (beams, columns, beam column joints).



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Text Books :

1. Reinforced Concrete Design by S.Unnikrishna Pillai and Devdas Menon, Tata McGraw-Hill, Education Private Limited, New Delhi, Third Edition-2009.
2. IS 456-2000- Code of Practice for Plain and Reinforced Concrete 3. IS 875-1987 Part I to part V - Code of practice for Design Loads (other than Earthquake loads) for buildings and structures
4. IS 2950-1981 part I – Raft foundation- Code of practice for Design and Construction of Raft foundations
5. IS 2911- 2010 part I – Code of Practice for Design and Construction of Pile foundation
6. IS 2911- 1980 part III – Code of Practice for Design and Construction of Under reamed Piles
7. IS 1893-2002 PART-1 – Criteria for Earthquake Resistant Design of Structures
8. IS 15916 – 2010 - Code of Practice for Building Design and Erection using Prefabricated concrete
9. SP-16 – Design aids of IS 456 10. IS-13920 (1993) Ductile Designing of Reinforced Concrete Structures subjected to Seismic Forces

Reference Books :

1. Limit State theory & Design of reinforced concrete by V. L. Shah and Dr. S. R. Karve, Structures Publications, Pune, Fourth Edition-2003.
2. Precast Concrete Structures by Kim Elliot, Elsevier publications second edition-2002.
3. Multi-Storey Precast Concrete Framed Structures, Kim S. Elliott, Colin Jolly , Wiley-Blackwell publications, second edition-2013, Wiley-Blackwell.



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PRESTRESSED CONCRETE

Course Code: 21CE3231

L-T-P-S:3-0-0-0

Prerequisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Basic terminology and concepts of prestressing, Need for High strength steel and high strength concrete; as material for prestressed concrete, pre-tensioning & post tensioning	1,5	2
2	Analysis of Prestress and Bending Stresses, Losses of Prestress	1,5	4
3	Short term deflections of un-cracked members; Effect of tendon profile on deflections, design of prestressed concrete beam	2,5	4
4	Design of end blocks: Transmission of prestress in pretensioned members, bursting tensile force stresses in end blocks-Methods	2,5	4

Syllabus:

Basic terminology and concepts of prestressing: Need for High strength steel and high strength concrete; as material for prestressed concrete Advantages of prestressed concrete. Prestressing Systems: pretensioning; Post tensioning; Thermoelectric prestressing; chemical prestressing.

Analysis of Prestress and Bending Stresses: Resultant stresses; Pressure (Thrust) line and internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment.

Losses of Prestress: due: to elastic deformation, shrinkage, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

Deflections: Factors influencing deflections; Short term deflections of un-cracked members; Effect of tendon profile on deflections. Ultimate flexural strength of simple sections using simplified IS code Recommendations.

Design of Prestressed Concrete Beam: Design of sections for flexure - stress condition - minimum section modulus - stresses at transfer - service loads - prestressing force - eccentricity - check for stresses - initial and final conditions - limit state of collapse in flexure - shear. IS Code recommendations: Ultimate shear resistance. Design of shear reinforcement.

Design of end blocks: Transmission of prestress in pretensioned members; Transmission Length; Anchorage stress in post tensioned members; Bearing stress and bursting tensile force stresses in end blocks-Methods. IS-Code provision for the design of end block reinforcement.

Design of Prestressed Precast Hollow Core Slabs: Application of Prestressing to poles, piles and sleepers.



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Text Books:

1. N. Krishna Raju; Prestressed Concrete Tata McGraw - Hill Publishing Company Limited, New Delhi.
2. T.Y. Lin and Ned H. Burns Design of pre-stressed concrete structures - John Wiley & Sons, New York.
3. IS 1343:2012, “Code of practice for prestressed concrete”, Bureau of Indian standards, New Delhi.

Reference Books:

1. N. Rajagopalan; Prestressed concrete, Narosa Publishing House.
2. P. Dayarathnam: Pre-stressed Concrete- Oxford and IBH Publishing Co.
3. N.C. Sinha & S.K. Roy Fundamental of pre-stressed concrete-



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BRIDGE ENGINEERING

Course Code: 21CE4141

L-T-P-S:3-0-0-0

Pre-requisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Explain about various types of Bridges and IRC Specifications for road bridges		2
2	Analyze the Solid Slab and T-Beam Bridges as per IRC guidelines	1,3,5	4
3	Examine the internal forces in Abutment and Elastomeric Pad Bearing subjected to loads as per IRC guidelines	1,3,5	4
4	Investigate the stresses induced in Piers and Well Foundations subjected to loads as per IRC guidelines	1,3,5	4

Syllabus:

Classification: Various types of bridges; IRC Specifications for road bridges.

Culverts: Design of RC slab culvert.

Deck Slab Bridge, T-Beam Bridge and Composite Bridge (Steel and PSC Girders):

Pigeaud's method for computation of slab moments; courbon's method for computation of moments in girders;

Sub Structure for Bridges: Pier and abutment caps; Materials for piers and abutments' Design of pier; Design of abutment; Backfill behind abutment; approach slab.

Bearings for Bridges: Importance of bearings; bearings for slab bridge; bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing.

Joints for Bridges: - Expansion Joints.

Foundations for Bridges: Scour at abutments and piers; Grip length; Design of well foundation.

Text Books:

1. Essentials of Bridge Engineering by Dr. Johnson Victor; Oxford & IBH publishing Co. Pvt. Ltd.
2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 1996.

Reference Books:

1. Design of Bridge Structures by T. R Jagadeesh, M.A Jayaram, Prentice Hall of India Pvt. Ltd.
2. Phatak D.R., "Bridge Engineering", Satya Prakashan, New Delhi, 1990.
3. Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006.



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PRECAST & PREFABRICATED STRUCTURES

Course Code: 21CE4151

L-T-P-S:3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Analyze the prefabricated load carrying members.	PO2	4
2	Analyze Behaviour of structural components and production technology of prefabrication.	PO2	4
3	Design joints in precast construction.	PO3	5
4	Design and detail precast structures.	PO3	5

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.



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TEXT BOOKS

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
4. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokka L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.



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PROJECT AND CONTRACT MANAGEMENT

Course Code: 21CE3216

Prerequisites: - NIL

L-T-P-S: 3-0-0-0

Credits: 3

Course Objective:

The objective of the course is to expose students in understanding of fundamentals of construction projects and construction scheduling techniques. The students will be also exposed to contract laws and regulations so that adequate knowledge on formulating and managing construction contracts is gained. Course includes the elements of concluding and administering contracts also it will make student achieve awareness on arbitrations and legal procedures. Students will be gaining knowledge of labour regulations and their impact on managing of contracts

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Understand the concept of construction laws and regulations.	6,8	2
2	Study the current trend toward alternative project delivery systems via contractual arrangements such as design-build and construction management at risk	11	2
3	Investigate how to avoid the possibilities of construction disputes via alternative dispute resolution (ADR)	6,8	3
4	Understand the Labour regulations and applications on review construction contracts and specifications	6,1 1	3

Syllabus:

UNDERSTANDING PROJECT MANAGEMENT:

Project manager, organization structures, Organizing and staffing the project office and team, stages and phases involved in project management, techniques involved in project management

CONSTRUCTION SCHEDULING

scheduling procedures, scheduling tools, construction activities in a project and their relationships, NETWORK ANALYSIS - Critical Path Method and Program Evaluation & Review Technique (PERT)

Construction Contracts

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document– Law of Torts.

Tenders

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential



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Contractual Problems – World Bank Procedures and Guidelines – Andhra Pradesh Transparency in Tenders Act.

Arbitration

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.

Legal Requirements

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.

Labour Regulations

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Andhra Pradesh Factory Act – Child Labour Act - Other Labour Laws.

Textbooks

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India,
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001.
3. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, TataMcGraw-Hill Publishing Company, New Delhi, 1998.

References:

1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
2. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985. M.M.Tripathi Private Ltd., Bombay, 1982. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.



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QUALITY AND SAFETY MANAGEMENT

Course Code: 21CE3226

Prerequisites: - NIL

L-T-P-S: 3-0-0-0

Credits: 3

Course Objective: This course provides complete understanding on quality planning, quality assurance, quality control and safety management. The fundamental reason for the course is to impart knowledge and skill for the construction students to achieve success in quality management system (QMS) by understanding and evaluating quality management principles as a formalized system that has documents, processes, procedures, and authorities, responsibilities and for achieving quality policies and objectives

Course Outcomes (CO): students will be able to

CO No:	CO	PO	BTL
1	Understand the concepts of quality management and the factors influencing construction quality	1,3,4	2
2	Understand quality planning and programs in construction industry	3,4	2
3	Acquire knowledge of quality management systems and ISO 9000 family of standards.	1,3,4	2
4	Understand and evaluate safety management principles in construction	2,4	5

Syllabus

CO1:

Quality Management: Introduction – Definitions and objectives – Factors influencing construction quality –Responsibilities and authority – Quality plan – Quality Management Guidelines – Quality circles.

Quality Systems: Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification.

CO2:

Quality Planning: Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures -Processes and products – Total QA / QC programmed and cost implication.



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CO3:

Quality Assurance And Quality Improvement Techniques: Objectives – Regularity agent, owner, design, contract and construction oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, –Stability methods and tools, optimum design – Reliability testing, Reliability coefficient and reliability prediction - Life cycle costing – Value engineering and value analysis. Quality Improvement Tools and Techniques.

CO4:

Safety Management Systems: Fundamental of safety management, construction safety, safety in scaffolding and working platform, welding and handling, excavation work, concreting and cementing work. Building construction, TAC and NBC rules, High rise building. Evolution of modern safety concept- Safety policy - Safety Organization. Safety survey, safety inspection, safety sampling, Safety Audit. Concept of an accident, Reportable and non reportable accidents, unsafe act and condition principles of accident prevention, Overall accident investigation process. Risk management

References:

1. Hutchins.G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 1994.
2. James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 1997.
3. John L. Ashford, The Management of Quality in Construction, E &F.N.Spon, 1989.
4. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001.
5. Kwaku.A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., 1985.
6. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longm.



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FORM WORK

Course Code: 17CE4101

L-T-P-S:3-0-0-0

Prerequisite: NIL

Credits: 3

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO	(BTL)
CO1	To understand theoretical knowledge of formwork and it's materials	PO8,PO11	2
CO2	To understand the theoretical knowledge of formwork for walls, columns, slab, beam, and special structures	PO11,PO8	2
CO3	To understand the theoretical knowledge of formwork for bridge structures, flying deck, slip forms, shoring, and scaffolding.	PO8,PO11	2
CO4	To understand the theoretical knowledge of formwork for pre-cast concrete, multi-story Building Construction, and its issues.	PO8,PO11	2

Syllabus : i. Formwork for RC Structures: Formwork as Temporary Structure, Requirements for Formwork, Selection of Formwork. ii. Formwork Materials: Timber, Plywood, Steel, Aluminium, Plastics, Form Coatings and Mould Linings, Form Anchors, Tie System, Spreaders and Spacers, Form Lining Materials. iii. Formwork Design Concepts: Loads on Formwork, Assumptions Made in Formwork Design, Estimating Permissible Stresses, Maximum Bending Moment, Shear Force, and Deflection. iv. Formwork for Foundations: Conventional Formwork for Foundations, Design of Formwork for Foundations. i. Formwork for Walls: Conventional Formwork for Walls, Proprietary Wall Formwork Systems, Large Area Wall Forms, Climbing Formwork, L&T Wall Formwork. ii. Formwork for Columns: Conventional Formwork for columns, Proprietary Column Formwork Systems, L&T column Formwork. iii. Formwork for Slab and Beam: Traditional Slab and Beam Formwork, Details about L&T, PERI, Mivan Formworks. iv. Formwork for Special Structures: Formwork for Shells, Domes, Folded Plates, Overhead Water Tanks, Cooling Towers, Nuclear Reactors CO3 i. Formwork for Bridge Structures: Formwork for Caissons, Formwork for Piers and Pier Caps, Formwork for Bridge Superstructure, Lessons from the Failure of Formwork. ii. Flying Deck Formwork: Some examples of Flying Deck Formwork, iii. Slip Forms: Assembly, Sliding, and Dismantling of Slip Formwork. iv. Shoring and Scaffolding, CO4 i. Formwork for Pre-Cast Concrete ii. Formwork for Multi Storey Building Construction iii. Pre-Award Formwork Management Issues iv. Post-Award Formwork Management Issues.



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Text Books :

1. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
2. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd., Delhi, 2004.
3. Neville, A.M., Properties of Concrete, Longman, 1995.

Reference Books :

1. Metha P.K. and Montreio P.J.M., Concrete Structure Properties and Materials, Prentice Hall, 1998.
2. Gupta.B.L. and Amit Gupta, Concrete Technology, Standard Publishers Distributer, New Delhi, 2004.



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CONSTRUCTION ECONOMICS

Course Code: 21CE4146

L-T-P-S: 3-0-0-0

Prerequisites: - NIL

Credits: 3

Course Objective: The objectives of this course are to:

- introduce students to the concept of project and idea formulation;
- enhance the understanding of students on project management and appraisal

COURSE OUTCOMES (COs):

CO No	Course Outcome(CO)	PO	Blooms Taxonomy Level (BTL)
CO1	Apply the fundamentals of financial management to prepare the cashflow statements.	1, 11, 12	3
CO2	Evaluate potential major project budgets using capital budgeting techniques.	2, 11, 12	5
CO3	Apply financial methodologies to efficiently evaluate and manage construction projects .	2, 11, 12	3
CO4	Apply the fundamentals of construction finances to enable decision making based on project type	1, 6, 11, 12	3

Syllabus:

Project Formulation

Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required

Project Costing

Project Cash Flows – Time Value of Money – Cost of Capital

Project Appraisal

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice

Project Financing

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios

Private Sector Participation

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer



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Textbooks:

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation, Review, Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan, India Ltd., 1992.

References:

1. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987.
2. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.



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SUSTAINABLE CONSTRUCTION TECHNOLOGIES

Course Code: 21CE4156

L-T-P-S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand the construction basics of a Common building construction methods conventional	7,11	1
2	Understand the modern construction methods basics of construction Modular Construction Precast concrete.	7,11	1
3	Understand the sustainable construction materials technologies and project management strategies	7,11	1
4	Understand the LEED for New Construction rating system	7,11	1

Syllabus:

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods conventional walls and slabs; conventional framed structure with blockwork as infill walls;

Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges;

Identification of cutting edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

Examination of the current LEED for New Construction rating system, and case study analysis of highly successful recent "green construction projects" through student team assignments and presentations. Preparation for the LEED Green Associate professional licensing exam.

Text Books:

1. Sustainable construction; green building design and delivery by Charles J. Kibert edition 4
2. Sustainability in engineering construction by J K Yates 2015

Reference:

1. Sustainable Engineering Practice ASCE Publication 2010.
2. Hagger Sustainable Industrial Design and Waste Management, Techniz Book 2010.
3. Helmut Rechberger, Practical handbook of Material Flow Analysis, Taylor & Francis. 2010.
4. Michael Z. Hou, Heping Xie, Jeoungseok Yoon Underground Storage of CO₂ and Energy Taylor & Francis, 2010.
5. LEED for India: Reference Guide, 2011.



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FOUNDATION ENGINEERING

Course Code: 21CE3212

L-T- P-S: 3-0-0-0

Pre-requisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

C.O. No.	Course outcome	Mapped PO	BTL
CO 1	Carry out geotechnical field investigation and can prepare field reports and Thoroughly understand different geotechnical investigation methodologies and can handle individually	1,2,5	2
CO2	Can compute stress distribution using different techniques and can carry settlement analysis in different soil types	1,2,5	3
CO3	Compute bearing capacity of shallow and deep foundations in laboratory and field using different methods	1,2,5	3
CO 4	Can analyze stability of slopes for finite and infinite in different soil conditions and methods, Carry earth pressure analysis and can design retaining walls	1,2,5	4

Syllabus:

Site Investigations: Various geotechnical field investigations, geotechnical field report.

Bearing Capacity Of Shallow Foundations: Introduction, Basic definitions, Principal modes of soil failures, Terzaghi's bearing capacity theory/ equation and its modifications for square, rectangular and circular foundation, Skempton's bearing capacity analysis for clays, Meyerhof's analysis, Hansen's bearing capacity theory, Vesic's bearing capacity theory, IS code recommendations for bearing capacity, Bearing capacity of granular soils based on SPT value and Static cone resistance, Bearing capacity of footings on layered soils, Factors influencing bearing capacity, Allowable bearing pressure. General requirements of foundations, Factors affecting location and depth of foundation, Choice of type of foundations, Steps involved in the proportioning of footings.

Pile Foundations: Use of piles, Types of piles, Construction, Selection of pile type, Types of foundations to suit subsoil conditions, Pile load capacity, Static formulae, Dynamic formulae, Load tests, on piles, Group action of piles, Load carrying capacity of pile groups, Negative skin friction, Piles subjected to uplift loads.

Well Foundations: Types of wells and caissons, components of well foundation, shapes of wells, depth of a well foundation, forces acting on a well foundation, lateral stability of well foundation, construction and sinking of a well.

Settlement Analysis: Consolidation settlement, immediate settlement, Corrections to settlement due to consolidation, Settlement in different soil types/Settlement from field tests, Allowable settlement, Settlement of pile group.

Stability Of Slopes: Infinite slopes and translational slides, Definitions of factor of safety, Finite slopes-Forms of slip surface, Limiting equilibrium method and Critical stages in stability, Total stress and effective stress methods of analysis, $\phi_u = 0$ Analysis (total analysis),

c ϕ analysis - method of slices, Location of the most critical circle, Friction circle method, Taylor's stability number.

Earth Pressure And Retaining Walls: Effect of wall movement on earth pressure, Earth pressure at rest, Rankine's theory of earth pressure, Coulomb's theory of earth pressure, Coulomb's equation for $c = 0$ back fills, Cullman's graphical method, Passive earth pressures- Friction circle method, Design considerations retaining walls.

Text Books:

By Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics New Age International Publishers, Second Edition, 2007.

Reference Books:

1. J.E. Bowles, Foundation Analysis and Design MacGraw Hill, 1996.
2. V. N. S. Murthy, Soil Mechanics and Foundation Engineering CBS Publishers & Distributors, New Delhi.
3. Donald P. Coduto, Man-Chu Ronald Yeung and William A.Kitch, Geotechnical Engineering Principles and Practices PHI Learning Pvt. Ltd., Second Edition.
4. W. C. Teng, Foundation Design Prentice hall



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GROUND IMPROVEMENT TECHNIQUES

Course Code: 21CE3222

L- T- P-S: 3-0-0-0

Pre-requisite: Nil

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Analyze the ground modification by vibro replacement, stone columns, preloading and prefabricated drains	1	4
2	Analyze the reinforced earth structures	1,3	4
3	Analyze different properties of geotextiles, geogrids, geonets, geomembranes, geotubes.	1,3	4
4	Analyze different grouting, deep mixing, PVDs, vacuum consolidation techniques.	1,3	4

Syllabus:

Analyze the ground modification by vibro replacement: Introduction, ground modification by vibro replacement, stone columns, preloading and prefabricated drains,

Analyze the reinforced earth structures: Reinforced earth structures, Introduction to geotextiles and geomembranes, applications of geotextiles,

Analyze different properties of geotextiles, geogrids, geonets, geomembranes, geotopes: Design methods using geotextiles, geogrids, geonets, geomembranes, geotubes.

Analyze different grouting, deep mixing, PVDs, vacuum consolidation techniques: Grouting, deep mixing, PVDs, vacuum consolidation.

Text Books:

1. Principles and Practice of Ground Improvement by Jie Han
2. Ground Improvement Techniques by P. Purushothama Raj
3. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
4. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy.



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DESIGN OF EARTH RETAINING STRUCTURES

Course Code: 21CE3232

L- T- P-S: 3-0-0-0

Pre-requisite: Nil

Credits: 3

Syllabus:

Retaining walls – Different types - Gravity, Cantilever-counterfort, and Crib types. Basement or foundation retaining walls. Design principles of retaining walls, Design and Construction of Reinforced Soil Walls, Reinforced Soil Wall (A Case Study), Geosynthetics for Warehouse Grade Slab and Retaining Wall, Geogrid-Reinforced Retaining Walls, Restoration of Wharf Road by Geosynthetic Reinforced Soil Wall, Abutments and wing walls and allowable bearing capacity settlement tilting. Safety against general slip failure. Type of Failures of Retaining Walls – Stability Requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

Braced cuts – Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts.

Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and fixed earth support methods – Row's moment Reduction method – Location of anchors, Forces in anchors.

Soil reinforcement – Reinforced earth - Different components – their functions – Mechanics of reinforced earth – Failure Modes-Failure theories – Design of Embankments on problematic soils.

Cofferdams – types, suitability, merits and demerits – Design of single-wall Cofferdams and their stability aspects – TVA method and Cummins' methods.

TEXTBOOKS:

1. Soil Mechanics and Foundation Engineering Dr.K.R.Arora, Standard Publishers Distribution, Sixth Edition, 2003
2. Gopal Ranjan and A.S.R. Rao "Basics and Applied soil mechanics", New age International Publishing, second edition, 2007
3. G Venkatapparao P.K. Banerjee, J.T.Shahu, G.V. Ramana By Geo-Synthetics-New Horizons - 2004
4. P.C.Varghese Foundation Engineering Prentice-Hall of India Pvt Ltd, New Delhi – 2006

REFERENCE BOOKS:

1. Principles of foundation engineering by Braja M. Das, PWS-KENT Publishing company, Boston
2. Foundation analysis and design- Bowles, JE- McGraw Hill
3. Analysis and design of foundation and retaining structures, Prakash, Saritha Prakashan, Meerut



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GEOTECHNICAL EARTHQUAKE ENGINEERING

Course Code: 21CE4142

L- T- P-S: 3-0-0-0

Pre-requisite: Nil

Credits: 3

Syllabus:

Seismology and Earthquakes: Seismic Hazards, seismic waves, internal structure of earth, Continental drift and plate tectonics, faults, elastics rebound theory, geometric notations, location of earthquakes, size of earthquakes.

Strong Ground Motion: Strong ground motion measurement, ground motion parameters, estimation of ground motion parameters.

Seismic Hazard Analysis: Identification and Evaluation of Earthquake Sources, deterministic seismic hazard analysis, probabilistic seismic hazard analysis.

Wave Propagation Waves in unbounded media, waves in a semi – infinite body, waves in a layered media, attenuation of stress waves.

Artificial Ground Motion Generation: Modification of actual ground motion records, time domain generation, frequency domain generation.

Dynamic Soil Properties Representation of stress conditions by Mohr circle, measurement of dynamic soil properties using field and laboratory tests, stress strain behavior of cyclically loaded soils, strength of cyclically loaded soils.

Ground Response Analysis: One– Dimensional Ground response Analysis – Linear and Non-Linear Approaches. **Local Site Effects:** Effect of local site conditions on ground motion, design parameters, development of design parameters.

Liquefaction Flow liquefaction, cyclic mobility, evaluation of liquefaction hazards, liquefaction susceptibility, initiation of liquefaction, effects of liquefaction.

Soil Improvement for Remediation of Seismic Hazards: Densification techniques, Reinforcement Techniques, Grouting and Mixing techniques, Drainage techniques.

TEXTBOOK:

1. Geotechnical Earthquake Engineering by Steven L. Kramer, prentice Hall

REFERENCE BOOK:

1. Geotechnical Earthquake Engineering Handbook by Robert W. Day, McGraw-Hill



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FORENSICS IN CIVIL ENGINEERING

Course Code: 21CE4153

L- T- P-S: 3-0-0-0

Pre-requisite:

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Apply forensic engineering to demonstrate structural and geotechnical failures	1,2,3	4
2	Understand reinforced concrete Structures and steel structure failures through case studies	1,2,3	4
3	Evaluate different geotechnical failures through case studies	1,2,3	4
4	Analyze reasons for geo-environmental and fluid and hydraulic failures	1,2,3	4

Syllabus:

INTRODUCTION

Definition of a Forensic Engineer, Typical Clients, Types of Damage, Civil litigation, Important legal terms, Causes of failure, Preliminary information about failure, Data collection, Hierarchy of forensic investigation.

A FORENSIC STRUCTURAL INVESTIGATION

Load tests, Instrumentation, Dimensional measurements, concrete and masonry tests, Metal tests, Wood tests, Weld tests, water and air penetration tests, Heat loss tests.

FORENSIC GEOTECHNICAL INVESTIGATION

Bore hole logs, Penetration tests (SPT, CPT), Test Pits, In-place strength tests, Instrumentation, Dimensional Measurements, Seismic tests.

REINFORCED CONCRETE STRUCTURES CASE STUDIES

Skyline Plaza in Bailey's Crossroads, Bombing of the Oklahoma City Murrah Federal Building, The Pentagon Attack, Harbour Cay Condominium

STEEL STRUCTURES CASE STUDIES

The World Trade Center Attacks, Pittsburgh Convention Center Expansion Joint Failure, Minneapolis I - 35W Bridge Collapse, Hartford Civic Center Stadium Collapse

GEOTECHNICAL CASE STUDIES

Leaning tower of Pisa, Teton Dam, Vaiont Dam Reservoir Slope Stability Failure, Excavation failure, Reclamation bund failure, High way failure

GEO-ENVIRONMENTAL CASE STUDIES

Love Canal, Valley of the Drums, String fellow Acid Pits, Kettleman Hills Waste Landfill, North Battleford, Saskatchewan Water Treatment Failure



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FLUID MECHANICS AND HYDRAULICS CASE STUDIES: Johnstown Flood, Malpasset Dam, Schoharie Creek Bridge, New Orleans Hurricane Katrina Levee

Text Books:

- [T1] Robert, W. D., *Forensic Geotechnical and Foundation Engineering*, Second Edition, McGraw-Hill, NY, US, 2011.
- [T2] Delatte, N. J., *Beyond Failure –Forensic case studies for Civil Engineers*, ASCE, US, 2009.

Reference Books:

- [R1] Kenneth, L. C., *Forensic Engineering*, CRC Press, 2nd Edition, NY, US, 2000
- [R2] Rao, V.V.S. and Babu, G. L. S., *Forensic Geotechnical Engineering*, Developments in Geotechnical Engineering series, Springer, SG, 2016.
- [R3] Paul, A.B., Pamalee, A. B., Norbert, J. D. and Kevin, M. P., *Failure case studies in civil Engineering-Structures, Foundations and Geoenvironment*, 2nd Edition, ASCE, Virginia, US, 2013



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INTELLIGENT TRANSPORTATION SYSTEMS

Course code: 21CE3215

L-T-P:3-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand the Objectives ITS	1	1
2	Understand the Importance of telecommunications in the ITS system	1	1
3	Understand Advanced Traffic Management Systems	1	2
4	Understand Integration of Automated Highway Systems	1	2

Syllabus:

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location(AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Center (TMC). Vehicle – Road side communication – Vehicle Positioning System; ITS functional areas – Advanced Traffic Management Systems (ATMS),

Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS); ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management; Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed

countries, ITS in developing countries.

Text Books:

1. Intelligent Transportation Systems – Problems and Perspectives (Studies in Systems, Decision and Control) by Aleksander Sladkowski , Wieslaw Pamula

Reference Books:

1. Advanced Technologies for Intelligent Transportation Systems (Intelligent Systems Reference Library) by Marco Picone , Stefano Busanelli , Michele Amoretti , Francesco Zanichelli , Gianluigi Ferrari

PAVEMENT MATERIALS AND DESIGN

Course code: 21CE3225

L-T-P:3-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand the Soil Classification and characteristics & properties and tests on bitumen	1	1
2	Understand the characteristics of bituminous mixes & IRC and IS specifications and tests	1	1
3	Understand the Types and component parts of pavements & Understand the Stresses and deflections in homogeneous masses	1	2
4	understand the Pavement behaviour under transient traffic loads & Design the Pavements as per IRC	2	1

Syllabus:

Soil - Classification, characteristics, compaction, evaluation of soil strength; stabilized pavement materials; Aggregates: requirements, properties and tests on road aggregates for flexible and rigid pavements.

Bitumen: Origin, preparation, properties and tests, constitution of bituminous road binders; requirements; Criterion for selection of different binders. Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests.

Bituminous Mixes: Mechanical properties: Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes. bituminous mix design methods and specifications. Weathering and Durability of Bituminous Materials and Mixes. Performance based Bitumen Specifications; Superpave mix design method: design example problems. Cement Concrete for Pavement Construction: Requirements, and design of mix for CC pavement, IRC and IS specifications and tests, joint filler and sealer materials.

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and Deflections in Flexible

Pavements: Stresses and deflections in homogeneous masses. Burmister's two-layer theory, three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behaviour under transient traffic loads. Flexible Pavement Design Methods for Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC; Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses; general considerations in rigid



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pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC

Text Book:

1. Characterisations of Base Course Materials for Flexible Pavements Paperback – by Komsun Siripun ,Hamid Nikraz , Peerapong Jitsangiam 4 Jan 2011.
2. Principles of pavement design – Yoder & Wit Zorac – John Wiley & Sons
3. Kadiyalai, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers.
4. Partha Chakraborty, 'Principles of Transportation Engineering, PHI Learning,

Reference Book:

1. Highway Engineering: Pavements, Materials and Control of Quality Hardcover – by Athanassios Nikolaidis 28 Nov 2014.
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
3. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
4. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.



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TRAFFIC ENGINEERING AND MANAGEMENT

Course code: 21CE3235

L-T-P:3-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand about the Traffic Forecast	1	1
2	Understand about the Demand relationships, methods for future projection in transit development	2	2
3	Analysis of individual accidents and statistical data using mathematical tools	2	3
4	Understand the Formulation of system models	2	1

Syllabus:

Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection; Design Hourly Volume for Varying Demand

Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept; Highway Capacity: Factors affecting capacity, level of service;

Capacity studies - Capacity of different highway facilities including unsignalized and signalized intersections. Problems in Mixed Traffic flow; Case studies; Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions; Traffic Flow

Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects of Traffic

Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications; Simulation: Fundamental principle, application of simulation techniques in traffic engineering - formulation of simulation models, Case studies. Formulation of system models.

Text Books:

1. Partha Chakraborty, 'Principles of Transportation Engineering, PHI Learning,
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway
3. Engineering and Traffic Analysis', 4th Edition, John Wiley

Reference Books:

1. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
2. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.



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URBAN TRANSPORTATION SYSTEMS PLANNING

Course code: 21CE4145

L-T-P:3-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understand the role, purpose of urban transportation planning and systems.	1	1
2	Estimate the Trip generation and distribution concepts model	1,5	2
3	Understand the concepts of Modal split and traffic assignments.	1	1
4	Gain knowledge about the concepts of public transport planning and Intelligent Transportation Systems	1	1

Syllabus:

Transportation Planning: Introduction to transportation planning; systems approach to transportation planning; types of models; concept of travel demand and supply; socio-economic, land use, network, and transport system characteristics affecting transportation planning. **Transportation Survey:** Study area definition, zoning principles, cordon and screen lines, data collection through primary and secondary sources, sampling techniques. **Sequential modeling approach:** Four-stage sequential modeling approach; trip generation; trip distribution; modal split; trip assignment. **Planning For Public Transport:** Public transport planning, Fares and Subsidies Introduction to Intermediate Public Transport Type and Characteristics of IPT Modes in India, Integration of different modes. **Urban and intelligent transportation systems:** ITS, first generation of ITS and it's applications, ITS in Various Countries, Mature ITS Applications, Safety and Liability, Second Generation of ITS

Text Book:

1. Principles and practices of highway Engineering by Dr. L. R. Kadiyali & Dr. N. B. Lal Khanna publishers, 2003.
2. Introduction to Transportation Planning – M.J. Bruton; Hutchinson of London Ltd

Reference Book:

1. Principles of Transportation Engineering by Partha Chakroborty and Animesh Das. Prentice Hall of India, New Delhi, 2003.
2. Introduction to Urban System Planning – B.G. Hutchinson; McGraw Hill
3. Metropolitan transportation planning – John W. Dickey, Tata McGraw Hill, New Delhi, 1975.



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RAILWAY, AIRPORT DOCK AND HARBOUR ENGINEERING

Course code: 21CE4155

L-T-P:3-0-0

Pre-requisites: 19CE3103

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Versatile with history and various Components of Railway Engineering.	1	2
2	Understand about the Railway Track Geometric Elements and Turnouts	2	2
3	Understand the geometric elements of Airport Runway and Taxiway	2	2
4	To study about the types and components of docks and harbours	1	2

Syllabus:

Railway Engineering: Historical Development of Railways in India, Advantages of Railways, Classification of Railways, Permanent Way & its components, functions. Track volume and Track capacity. Rail Joints, Welding of rails and Creep of rails;

Track Geometric Design - Gradients, Horizontal and Vertical curves, super elevation, Negative Super elevation, Coning of Wheels. Turnouts: Left/ Right Hand Turnout, Track Junctions, Points and crossings, Tracks Drainage, Railway Stations and Yards, Signaling.

Airport Engineering: Factors affecting Selection of site for Airport – Aircraft Characteristics- Geometric Design of Runway- Computation of Runway length – Correction for runway length – Orientation of Runway –geometric design of taxiway, Wind Rose Diagram – Runway Lighting system.

Dock & Harbour Engineering: Layout of Port components – Functions – Classification of Ports – Site selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational aids. Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses.

Text Book:

1. Railway Engineering by S.C. Saxena & S. Arora
2. Airport Engineering: Planning, Design and Development of 21st Century Airports
Hardcover by Norman J. Ashford, Saleh Mumayiz, Paul H. Wright fourth edition

Reference Book:

1. Railway Engineering by Rangwala.
2. Airport Systems, Second Edition: Planning, Design and Management by Richard L. De Neuville, Amedeo R. Odoni, Peter Belobaba, Tom G. Reynolds, Second Edition.

SUSTAINABLE ENGINEERING & TECHNOLOGY

Course Code: 21CE3213

L- T- P-S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Understand the concept of sustainability, Challenges for Sustainable Development and Clean Development Mechanism	3	2
2	Understand the sources, impacts of solid waste, Global environmental issues and Water Act, Air Act.	3	2
3	Understand the Life Cycle Analysis, Procedures of EIA, green materials for building construction and Methods for increasing energy efficiency of buildings Sustainable cities	3	2
4	Understand the Conventional and non-conventional of Energy sources and Sustainable Urbanization, industrialization and poverty reduction	3	2

Syllabus:

Sustainability - Introduction, Need and concept of sustainability, Social environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.

Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.

Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) - Procedures of EIA in India.

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.

Energy sources: Basic Concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy.

Green Engineering, Sustainable Urbanisation, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Reference Books:

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley, A. S; Adebayo, A. O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K. M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS). Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios publication

ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES

Course Code: 21CE3223

L- T- P-S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Knowledge of Environmental Technology	3	2
2	To attain assessment of Impacts of Development activities	3	2
3	To attain Environmental Impact assessment on water and air	3	2
4	To know the preparation of Environmental Audit Report	3	2

Introduction: Basic Concept of EIA – Initial Environmental Examination (IEE) and Environmental Impact Assessment – Initial Environmental examination (IEE) – Important Steps in EIA – Systematic Approach for using EIA as a Planning Tool for Major Project Activities.

EIA Methodologies: Introduction – Criteria for the Selection of EIA Methodology – EIA Methods – Ad-hoc Methods – Matrix Methods – Network Methods – Overlay Methods – Cost / Benefit Analysis.

Assessment of Impact of Developmental activities and Land Use: Methodology for the Assessment of Soil and Groundwater – Delineation of Study Area – Identification of Activities – Description of Existing Soil / Groundwater Resources Soil Characteristics- Procurement of Relevant Soil Quantity – Assessment of Impact Significance.

Environmental Impact Assessment on Water and Air: Introduction – Projects which Create Impact Concerns for the Surface Water Environment – Systematic Methods for Evaluation of Impact of Various Developmental Activities on surface water Environment – Identification of Surface Water Quality or Quality Impacts- Description of Existing Surface Water Resources Conditions – Procurement of Relevant Surface Water Quality – Impact Prediction – Interpretation of Impact Significance.

Prediction and Assessment of Impacts on the Air Environment – Basic Information on Air Pollution–Air Pollution Sources – A Generalized Approach for Assessment of Air Pollution Impact.

Environmental Audit: Objectives of Environmental Audit – Advantages of Environmental Audit – Waste Audit – Energy Audit – Compliance Audit –A Management Audit - Audit Protocol - Audit Procedure. Stages of Environmental Audit – Program Planning – On Site Activities – Evaluation of Audit Data and Preparation of Audit Report.

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers



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Reference Books:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katania &. Sons Publication, New Delhi
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi



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SOLID WASTE MANAGEMENT & LANDFILLS

Course Code: 21CE3233

L- T- P-S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Understand the sources, types and Properties of solid wastes	3	2
2	Understand the Current Scenario and Challenges Engineered Systems for Solid Waste Management:	3	2
3	Understand the Conversion of Solid wastes and Recovery	3	2
4	Understand the Land Filling of Municipal Solid Wastes and MoEF rules, CPCB guidelines for hazardous waste land filling.	3	2

Syllabus:

Municipal Solid Wastes: Types of solid wastes, Sources of Municipal and Hazardous wastes, Properties of solid wastes-Physical and Chemical composition.

Solid Waste Management: An Overview, Introduction – Reduction, Reuse and Recovery, Waste Disposal Options, Current Scenario and Challenges Engineered Systems For Solid Waste Management: Functional Elements, Solid waste generation, On-site handling, Storage and Processing, Collection of solid wastes,

Transfer and Transport, Processing of Solid wastes, Ultimate disposal. Conversion of Solid wastes and Recovery: Mechanical processing and Material recovery systems. Biological Conversion-Composting, Anaerobic Digestion. Thermal Conversion- Combustion, Incineration, Gasification, Pyrolysis, Refuse Derived Fuel, Energy recovery systems.

Landfills for Municipal Solid Wastes: Land Filling of Municipal Solid Wastes, Site selection, Planning, Design and Operation. Landfill Gas- composition, Collection. Leachate-environmental effects, Leachate collection systems, Treatment of leachate, MoEF rules, CPCB guidelines for hazardous waste land filling.

Text Books:

1. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous (1985), Environmental Engineering, Mc Graw-Hill International Editions, NewYork.

Reference Books:

1. Solid waste Engineering by P. Aarne Vesilind, William Worrell and Debra Reinhart, (2004), Cengage Learning India Private Limited, New Delhi.
2. Environmental Science and Engineering by J.Glynn Henry, Gary W.Heinke,(2004),Low Price Edition, Pearson Education Inc, Singapore.
3. MoEF (2000) Municipal Waste Management and Handling Rules, Govt. of India.
4. CPCB (2001) Criteria for Hazardous Waste Landfill(HASWAMS/17/2000-01)



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5. Solid and hazardous waste management by M.N. Rao and Razia Sultana, BS Publications, Hyderabad.
6. Venkatappa Rao. G and Sasidhar. R.S. (2009), Solid waste management and Engineered Landfills, Sai Master Geoenvironmental Services Pvt.Ltd, Hyderabad



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RIVER ENGINEERING

Course Code: 21CE3214

L- T- P=S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Understand concept of river morphology	1,3	1, 2
2	Understand river regulation systems	1,3	1, 2
3	Understand sediment transport processes	1,3	1, 2
4	Understand various hydraulic modeling	1,3	1, 2

Syllabus:

River Morphology: Plan form variations and river channel pattern; Meandering and braided stream characteristics; River equilibrium, river dynamics and adjustments to stream power.

River Training Techniques: Principles of Stabilization and rectification of rivers, river bank stability analysis, spur / groyne, stream bank armouring, guide banks, submerged vanes, porcupine and jack jetty systems, gabions; Bandalling, surface and bottom panels.

Inland Navigation Channel Development: Fairway dimensions and maintenance, canalization, navigation locks and terminals.

Sediment Transport Processes: Incipient motion of sediment particles; Regimes of flow; Resistance to flow and velocity distribution in alluvial streams; transport of bed, suspended and total load. Flood control planning, flood plain zoning and other non – structural measures.

River Models: Mathematical modelling - types, mathematical formulation, numerical procedures, calibration and validation; Scale modelling – types, principles of similitude and dimensional analysis, model verification, limitations.

Text Books:

1. Chow, V.T. Open Channel Hydraulics. McGraw-Hill.
2. Garde, R.J., Raju, K.G.R. Mechanics of Sediment
3. Yang, C.T. Sediment Transport: Theory and Practice. McGraw-Hill.

Reference Books:

1. Garde, R.J., Raju, K.G.R. Mechanics of Sediment Transportation and Alluvial Stream Problems. (2nd Edition) Wiley Eastern Ltd.
2. Ashworth, P., Bennett, S., Best, J., McLelland.
3. Coherent Flow Structures in Open Channels. John Wiley and Sons.



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URBAN WATER HYDROLOGY AND HYDRAULICS

Course Code: 21CE3224

L- T- P=S: 3-0-0-0

Pre-requisite: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able

CO No.	Course Outcomes	PO	BTL
1	Understand the urban hydrological cycle & hydraulic process	1,3	1,2
2	Estimate the components of urban hydrological processes	1,3	3,4
3	Estimate runoff from highways, airports and urban areas	1,3	3,4
4	Plan and design of urban drainage systems for an urban area	1,3	3,4

Syllabus:

Urban hydrological cycle and components; Impact of urbanization on hydrological cycle; Anomalies & characterization of rainfall; Time and scale effects; Urban hydrological data requirements and analysis; Storm water runoff generation; return period; hydrologic risk; frequency analysis – IDF relationships.

Open channel flow in urban watersheds; interception storage, infiltration, depression storage; estimation of runoff rates from urban watersheds; flow routing; storm water drainage structures; storm water detention; structural and non-structural control measures; urban watershed modelling.

Overland and drainage channel flows; hydraulics of storm-drain systems and culverts; determination of design flow; runoff for highways, airports, and urban areas.

Planning and design aspects of storm water/drainage infrastructure; design of drainage gutters, channels, sewer networks, and culverts and storm water management.

Text Books:

1. Hall, M.J., Urban Hydrology, Elsevier, 1984.
2. Optimal Design of Water Distribution Networks, P. R. Bhawe, Narosa Publishing House, 2003.
3. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 20004.

Reference Books:

1. Leonard, O.J. & Sherrif, J. Scope for the Control of Urban Runoff. Report 124, CIRIA, 1992.
2. DOE/NWC Design and Analysis of Urban Storm Drainage. The Wallingford Procedure. Dept. of the Environment, Standing technical Committee Report 28, 1981.
3. Shaw, E.M. Hydrology in Practice. 3rd Edn., Chapman & Hall, 1994



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Comprehensive Exam

Course code : 21CE4101

L-T-P-S: 0-0-6-0

Pre-requisite : NIL

Credits: 3

Syllabus:

Mechanics

System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses

Structural Analysis

Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis

Concrete Structures

Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams

Steel Structures

Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Construction Materials and management

Construction Materials: Structural Steel - Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

Soil Mechanics

Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.

Foundation Engineering

Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Fluid Mechanics

Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag



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Irrigation

Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structure

Water and Waste Water

Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment. Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Transportation Engineering

Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Traffic Engineering

Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity

Surveying

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey Total station; Horizontal and vertical curves. Photogrammetry - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

Text Books

1. Gate 2022 -Pearsons Publications 5th Edition
2. Gate Civil Engineering – IES Masters – 4th edition

CONSTRUCTION PLANNING & PROJECT MANAGEMENT

Course code: 21CE4102

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No	CO	PO	BTL
1	Apply the fundamentals of construction management to plan and control the progress of the project.	3	3
2	Analyse the project progress through scheduling and identifying critical activities.	3	4
3	Analyse the resource allocation for the construction projects at optimal levels.	3	4
4	Apply the management techniques to provide quality and safety at construction sites.	3	3

SYLLABUS

Construction Projects - Construction project types and features, phases of a project, agencies involved and their methods of execution

Construction Project Planning- stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail, process of development of plans and schedules, work breakdown structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data.

Techniques of Planning- Bar charts, Networks: basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, Preparation of CPM networks: activity on link and activity on node representation and analysis of single relationship (finish to start) networks, computation of float values and semi critical path calendaring networks.

PERT- Assumptions underlying pert analysis data mining free time estimates analysis computation calculation of probability of completion

Resource scheduling- Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation smoothing and levelling

Planning and Organizing construction site and resources- Site: site layout, developing site organization, record keeping at site, manpower planning, organising, staffing, motivation, Materials: concept of planning, procurement and inventory control, Equipment: Basic concepts of planning and organising, Funds: cash flow, sources of funds.

Construction Cost: classification of costs, time cost trade off in construction project compression and decompression.



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Monitoring And Control Supervision: Record keeping, Periodic progress reports, Periodical progress meeting, updating of plans: purpose, frequency and methods of updating, Common cause of time and cost overruns and corrective measures, Quality control: concept of quality, quality of constructed structure, use of manuals and checklist for quality control, role of inspection, basics of statistical quality control, safety and health on project site: accidents causes and effects cost of accidents, occupational and health problems in construction organising for safety and health.

TEXT BOOKS:

1. Construction Engineering and Management by Dr .S .Seetharaman; Umesh publications, Nai sarak, Delhi.
2. Chitkara, K. K. (1998). Construction project management. Tata McGraw-Hill Education.
3. Fundamentals of PERT/CPM and Project Management by S. k. Bhattacharjee; Khanna Publishers, Nai Sarak; Delhi.

Reference Books:

1. Construction Management and Planning by B.Sengupta and H.Guha; Tata Mc Graw- Hill Publishing co. ltd, New Delhi.
2. Construction planning, Equipment and Methods by Peurifoy R.L; Mc Graw – Hill International Book Company



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OPEN ELECTIVES



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IPR & PATENT LAWS

Course code: 21BT40A1

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Intellectual Property Rights Patents and intellectual property rights (IPR): Definition, History of intellectual property; Types of intellectual property rights, copy rights, trade marks, geographical indication, Industrial design rights, patents. Sources of patent information, patent application procedures.

Principles, Scope and Functions Of GATT&WTO GATT- Historical perspective, objectives and fundamental principles, impact on developing countries. WTO-Objectives, scope, functions, structure, status, membership and withdrawal, dispute settlement, impact on globalization, India-tasks and challenges.

Regulatory Affairs Indian contest-requirements and guidelines of GMP, understanding of Drugs and cosmetic act 1940 and rules 1945 with reference schedule M,U & Y. Related quality systems-objectives and guidelines of USFDA,WHO & ICH; Introduction to ISO series.

Documentation and Protocols Documentation: Types related to pharmaceuticals industry, protocols, harmonizing formulation development for global fillings, NDA, ANDA, CTD, Dealing with post approval changes-SUPAC, handling and maintenance including electronic documentation.

Case Studies on Patents

Case Studies on - Patents (Basumati rice, turmeric, Neem, and related medicinal plants and by products)

Textbooks:

1. S. H. Willig, Good manufacturing practices for Pharmaceuticals, Informa Healthcare (Oct 2000).

Reference books:

1. Industrial Property Rights: Vol. III-4, Kogan Pate, Kogan Pate, Kogan Page (May 1998).



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ENVIRONMENTAL POLLUTION CONTROL METHODS

Course code: 21CE40A2

L-T-P: 3-0-0

Pre-requisite: Nil

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Applying the modelling techniques used in Air Pollution	1,5,7	3
2	Applying the Mathematical modelling techniques used for control of water Pollution	1,5,7	3
3	Understanding the waste treatment unit processes		2
4	Applying a mathematical model of municipal solid waste Management	1,5,7	3

Syllabus:

Air pollution: Sources, Types, and effects and Fate of air pollutants. Meteorological factors and their impacts on pollutants dispersal. Sampling and measurement of air pollutants. Air quality standards. Air pollution control methods for particulates and gaseous pollutants. Emission Control equipments for particulate and gaseous matter. Mathematical modelling of Air pollutant

Water pollution: Sources, Types and Effects of Water pollutants. Measurement of pollution loads: DO, BOD, COD, TOC - Water quality and Effluent discharge standards. Mathematical modelling of water pollution control Role of Microorganisms in wastewater treatment. Bacterial population dynamics- growth kinetics. Pre treatment, primary treatment, secondary and tertiary treatment of wastewater. Advance wastewater treatment Methods

Solid waste: Sources and types of Solid wastes – Disposal methods: Land filling - Composting - Incineration – Pyrolysis. Reclamation of polluted and degraded soil by Bioremediation- Phyto-remediation. A mathematical model of municipal solid waste management **Noise Pollution:** Human acoustics, Sound and its general features- Noise and its measurement - Noise pollution hazards -Control methods.

Textbooks:

1. Environmental Pollution Control Engineering by C.S.Rao (2006), New Age International (P)Limited Publishers, New Delhi.
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe and George Tchobanoglous(1985), McGraw-Hill International Editions, New York.



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SOLID AND HAZARDOUS WASTE MANAGEMENT

Course code: 21CE40A3

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course outcome	PO	BTL
1	Understanding about Solid Waste	1	2
2	Understanding about Conversion and recovery	1	2
3	Understanding about Hazardous Waste	2	2
4	Understanding about Physico-chemical processes	2	2

SYLLABUS

Solid wastes: Sources, Types, reasons for increase in generation, composition and properties of solid waste, Collection and on-site handling, Separation and processing. Solid waste disposal methods, Land filling, methods of land filling, Design of Landfills, gas production, Leachate and its control.

Conversion and recovery: Incineration, Pyrolysis, Composting methods, merits and demerits, Energy recovery, Bio methanation, use of refuse derived fuels (RDF).

Hazardous Waste, Definition, Sources, Classification, Hazardous wastes rules, and Nuclear waste, Biomedical wastes, Chemical wastes, disposal methods, Waste minimization. Treatment methods, Physico-chemical processes, Biological methods, Stabilization and Solidification, Thermal methods, Disposal methods Land disposal. Remedial technologies.

TEXTBOOKS:

1. Solid waste Engineering by P.Aarne Vesilind, William Worrell & Debra Reinhart, Cengage Learning India Pvt. Ltd, New Delhi
2. Environmental pollution control Engineering by C. S. Rao; New age International Publishers, New Delhi.

REFERENCE BOOKS:

1. Venkatappa Rao. G and Sasidhar. R.S.(2009), Solid waste management and Engineered Landfills, Sai Master Geoenvironmental Services Pvt.Ltd, Hyderabad
2. World Health Organization, *Global Water Supply and Sanitation Assessment 2000* (Geneva 2000).
3. Environment and Pollution Laws: Universal, Universal Law Publishing Co. Pvt.Ltd, Ed 2011.

REMOTE SENSING AND GIS

Course code: 21CE40A4

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understanding the Basics of Remote Sensing	2	2
2	Understanding the Basic elements of image interpretation	3	2
3	Understanding about the GIS	2	2
4	Understanding about Land use /Land cover studies	3	2

SYLLABUS

Remote sensing basic definition and process, Passive and active remote sensing. Electromagnetic Spectrum, Resolution, Characteristics of Various sensors and satellites, Fundamentals of Image Processing. Map as a model, Spatial elements and terminology, Map scale, Spatial referencing system, Computers in map production, General software's in map production. Types of data products; Image interpretation strategy, Levels of interpretation keys; Topography, Types of Drainage Pattern and Texture, Erosion, ; Basic elements of image interpretation. Overview on visual image interpretation equipment. -

A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels/scales of measurement. The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing. Stages of GIS data modeling; Raster and Vector data representation, Spatial data models; Data editing, Detecting and correcting errors, Data reduction and generalization Edge matching and Rubber sheeting, Components of data quality, Sources of error in GIS.

Land use /Land cover studies, slope mapping, preparation of structures map, Ground water prospects mapping, Watershed management and Action plan, Water quality modeling, Salt Water intrusion models, pipeline alignment studies, Solid and hazardous waste disposal site selection, Landslides mapping, Urban planning and Management, GPS applications.

TEXT BOOKS:

1. Remote Sensing and Image Interpretation- 5th Edition by Lillesand, Kiefer and Chipman, Published by John Wiley and Sons, Inc, New York, 20072.
2. Text book of Remote sensing and GIS – 3rd Edition by M. Anji Reddy, BS Publications, Hyderabad, 2010.

Reference Books:

1. Geoinformatics for Environmental management” by M. Anji Reddy, B.S Publications, Hyderabad
2. Remote Sensing and GIS- by B. Bhatia Published by Oxford University Press, 2009



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DISASTER MANAGEMENT

Course code: 21CE40A5

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No.	Course Outcomes	PO	BTL
1	Understanding the Concept of Disaster Management	2	2
2	Understanding the Landslide Hazard Mitigation	3	2
3	Understanding the Tropical Cyclone	2	2
4	Understanding the Disaster Management Cycle	3	2

SYLLABUS

Introduction and Concept of disasters and hazards related to Earthquakes, Tsunami, Volcanic eruption, Cyclones, Floods, Drought, Landslides, Forest fires, Avalanches and Pest infestation. Prediction and perception of hazards and adjustments to hazardous activities; Rates of natural cycles and residence time. Landslide: causes, prevention and correction. Landslide hazard mitigation. Earthquakes: intensity and magnitude of earthquakes; geographic distribution of earthquake zones; precursors to the earthquakes, seismic waves, travel-time and location of epicentre; nature of destruction; ground subsidence; protection from earthquake hazards; do's and don'ts during earthquake; Tsunamis causes and consequences. Floods: Causes, nature and frequency of flooding; nature and extent of flood hazard; urban floods, environmental effects of flooding; flood mitigation methods. Tropical cyclone- formation and consequences. Coastal erosion; sea level changes and its impact on coastal areas. Drought: Nature and effect on plant and animal systems. Study of pattern and mitigation of forest fires. Geological and environmental investigations for the construction of dams, bridges, highways and tunnels. Impact of major geotechnical projects on the environment. Disaster Management: Capability- Vulnerability- risk- preparedness and mitigation- Disaster management cycle; Disaster Risk Reduction and Resilience; Disaster Management Act and Policy. Disaster Management case studies.

Text books:

1. Environmental Hazards by Smith, K., Routledge, London, 1992.
2. Geological Hazards by Bell, F.G., Routledge, London, 1999.

Reference books:

1. Principles of Engineering Geology by Krynine, D.S. and Judd, W.R., CBS, New Delhi, 1998.
2. Natural Hazards by Bryant, E., Cambridge University Press. London, 1985.
3. Landslide Disaster – Assessment and Monitoring Nagarajan, R., Anmol Publications, New Delhi, 2001.
4. Environmental risks and hazards by Cutter, Susan L., Prentice Hall of India, New Delhi, 1999.



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5. Bill Mc Juire, Ian Mason and C. Killburn (2002) Natural hazards and Environmental change, Oxford University Press, New York.
6. Gupta, Harsh K. (2003) Disaster Management, Universities Press (India) Pvt. Ltd
7. Coppola, Damon P. (2006) Introduction to International Disaster Management, Butterworth -Heinemann
8. Jha, Madan Kumar (2010) Natural and Anthropogenic Disasters: Vulnerability, Preparedness and Mitigation, Springer.
9. Glade, Thomas, Malcolm G. Anderson, Michael J. Crozier (2005) Landslide Hazard and Risk, edited Springer
10. Singh, Surendra, Leszek Starkel, Hiambok Jones Syiemlieh (2008) Environmental Changes and Geomorphic Hazards, Bookwell.



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FUNDAMENTALS OF DBMS

Course code: 21CS40A6

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types, **Data Modeling:** ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. **SQL:** Data Definition and other languages in SQL, Creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, Embedded SQL- Writing functions and procedures with PL/SQL, Relational Model, Relational Algebra, Operators in relational algebra. **Normalization:** Guidelines for good database design, Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th and 5th normal forms. File storage, Index structures, Indexing and hashing (Basics) Query Processing: Issues in query processing **Transaction Processing:** Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log, Concurrency control techniques: binary locks, exclusive locks, Lock based techniques, Timestamp based techniques,.

TEXT BOOK:

- 1.Elmasri and Navathe, 'Fundamentals of Database Systems', 2008, 4th edition, Pearson Education. ‘

REFERENCE BOOKS:

- 1.Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts:, 2003, Fifth Edition, Tata McGraw-Hill.
- 2.Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 2004, second Edition, Tata McGraw Hill.



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FUNDAMENTALS OF SOFTWARE ENGINEERING

Course code: 21CS40A7

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Software and Software Engineering: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths. Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process. Agile development: Agility, agile process, extreme programming. Design issues : Software architecture, architectural styles, architectural design. Use cases, Classes, Relationships, common Mechanisms and their diagrams. Interfaces, Modeling techniques for Class & Object Diagrams. Behavioral Modeling :Interaction diagrams. Activity Diagrams. Software testing: A strategic approach to software testing, strategic issues, test strategies for conventional software, Black-Box and White-Box testing, validation testing, system testing. Software Process Improvement, SPI, The SPI process, The CMMI.

Text Books:

1. Roger S.Pressman ,”Software Engineering – A Practitioner’s Approach 7th Edition, Mc Graw Hill,(2010).
2. Ian Sommerville, ‘Software Engineering’, Sixth Edition,Pearson Education,(2001).
3. Jim Arlow, Ila Neustadt, “UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design”, 2nd Edition, Pearson, (2005).

Reference Books:

1. Craig Larman, “Applying UML and Patterns: An introduction to OOAD and design and interface deployment”, Pearson, (2002).
2. Alan Dix, Janet Finlay, Gregory d Abowd, Russel Bealel,“Human Computer Interaction”, 3rd edition, Pearson education, (2008).
3. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited,(2007).



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FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course code: 21CS40A8

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

Fundamentals of Computers: Introduction, Architecture, organization of a small computer, center Processing Unit, Execution cycle, Instruction categories, measures of CPU performance, Memory, Input/output devices, BUS-addressing modes.

System Software: Assemblers, Loaders and linkers, compilers and interpreters.

Operating System: introduction, memory management schemes, Process management, scheduling, threads.

Programming Fundamentals: Problem solving with algorithms, Programming styles, coding Standards and Best practices, Introduction to C Programming, Testing and Debugging. Code reviews.

System Development Methodologies: Software development Models.

User Interface Design: introduction, the process, Elements of UI design & reports.

RDBMS: Introduction, Data processing, the database technology, Data models

ER Modeling: Concept, Notations, Extended ER features, Logical database design **Normalization:** Functional Dependency, Normal Forms.

SQL: DDL statements, DML statements, DCL statements, writing Simple queries.

SQL tuning techniques: Embedded SQL, OLTP.

Object oriented concepts: Object oriented programming, relationship, Inheritance, Abstract classes, polymorphism, UML Diagrams, Object Oriented Design Methodology.

Rational Rose Tool: Application of OOC using Rational Rose Tool.



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TEXT BOOKS

1. Andrew S. Tanenbaum, Structured Computer Organization, PHI, 3rd ed., 1991
2. Siberschatz and Galvin, Operating System Concepts, 4th ed., Addison-Wesley, 1995
3. Dromey R.G., How to solve it by Computers PHI, 1994
4. Kernighan, Ritchie, ANSI C language PHI, 1992
5. Wilbert o. Galitz essential Guide to user interface design john, wiley, 1997
6. Alex Berson, Client server Architecture, McGraw Hill International, 1994
7. Rojer Pressman, Softer Engineering-A Practitioners approach, McGraw Hill 5th ed., 2001
8. Alfred V Aho, EHopcroft, Jeffrey D Ullman, Design and Analysis of computer
9. algorithms, Addison Wesley publishing Co., 1998
10. Henny F korth, Abraham Silbefschatz, Database System concept, 2nd. McGraw- Hill



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IMAGE PROCESSING

Course code: 21EC40A9

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

INTRODUCTION: Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.

DIGITAL IMAGE FUNDAMENTLS: Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations.

DIGITAL IMAGE TRANSFORMS:Image Transforms – The Discrete Fourier Transform, The FFT, Walsh, Hadamard, Discrete Cosine Transform, The Haar Transform, And The Slant Transform,

IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Some basic Grey level transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters.

IMAGE ENHANCEMENT IN FREQUENCY DOMAIN: Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters.

IMAGE RESTORATION: Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Inverse Filtering, Wiener Filtering, Least mean square Filtering.

IMAGE COMPRESSION: Fundamentals – Image Compression models – Error Free Compression, Lossy Compression.

IMAGE SEGMENTATION: Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

IMAGE REPRESENTATIONS AND DESCRIPTION: Representation schemes, Boundary Descriptors, Regional Descriptors

Text books:

1. Rafael C Gonzalez, Richard E Woods,” Digital Image Processing”, Second Edition, Pearson Education Asia, 2002. (Chapter 1, 3, 4, 5, 6, 7, 8, 9)
2. Jorg Arndt, “ DSP Algorithms for Programmers”(Chapter 3)
3. Gonzalez. R & Woods B.E.,” Digital Image Processing”, Addison Wesley Longman Pearson Education, 2000.

REFERENCE BOOKS

1. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, SecondEdition, 2001.
2. William J Prati, “Digital Image Processing”, John Wiley & sons
3. Tinku Acharya, Ajoy K Ray, “Image Processing Principles and Applications Principles and Applications”, Wiley- Inter science.



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LINUX PROGRAMMING

Course code: 21EM40B1

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Linux Utilities-File handling utilities, Security by file permissions, Process utilities ,Disk utilities Text processing utilities, and Backup utilities Sed- scripts, operation, addresses, commands, applications, Awk execution, field and records , scripts, operation, patterns, actions functions using system commands in awk.

Working with Bourne again Shell (bash) responsibilities, here documents , running shell script, Shell as a programming language, shell meta characters, Control structures, arithmetic in shell, examples Interrupt processing, functions, debugging shell scripts.

Files : file Concept , File System Structure, I nodes, File Attributes, File types Library functions ,standard and formatted I/O in C, stream errors Kernel support for files ,System calls, file descriptors, low level file access File structure related system calls (FILE APIS), file and record locking File and directory management-Directory file APIS, Symbolic links and hard links

Process concept, Kernel support for process, process attributes, process creation , waiting for a process, Process termination ,Zombie process, orphan process, Process APIs Introduction to signals, signal generation and handling ,Kernel support for signals, signal function, unreliable signals , reliable signals Kill ,raise, alarm, pause, abort, sleep functions

Introduction to IPC , pipes, FIFOs- Introduction to three types of IPC-message queues, semaphores and shared memory -Kernel support for messages, Unix system V APIs for messages- Client /Server example

Text Books:

1. Unix and Shell Programming , B. A. Forouzan and R.F Gilberg, Cengage learning
2. Unix Concept and Applications, 4thedn. SumitabhadasTMH
3. Beginning Linux programming 4thedn. N. Matthew , R stones Wrox Wiley India edn.

Reference Books:

1. Linux system Programming , Robot Love, O;Reilly, SPD
2. Unix Network Programming , W.R. Stevens , PHI
3. Unix Internals , U Vahalia , Pearson Educaiton

E-COMMERCE

Course code: 21EM40B2

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Electronic Commerce: Revolution. E-Commerce Business models and concepts: The Internet and World Wide Web: E-commerce infrastructure. Building an E-commerce web site, online Security and payment systems, E-Commerce Marketing concepts, , Ethical, Social and Political issues in E-Commerce, Retailing on the Web, Online Service industries, B2B E-Commerce: Supply chain management and collaborative commerce. E-Commerce Marketing communications, Internet Resources for Commerce: Technologies for Web Servers, Internet Applications for commerce, Internet Charges, Internet Access and Architecture, Searching the Internet

Text Books:

1. Kenneth C.Laudon, Carol G.Traver , E-Commerce, (Pearson Education)

Reference Books:

1. Daniel Minoli, Emma Minoli, 'Web Commerce Technology Handbook', (TMG)
2. Elias M.Awad 'Electronic Commerce' (PHI)



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RENEWABLE ENERGY RESOURCES

Course code: 21EE40B3

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Extraterrestrial solar radiation, terrestrial solar radiation, solar thermal conversion, flat plate and concentrated solar thermal collectors, solar ponds, solar heating/cooling technique, solar distillation, photovoltaic energy conversion, solar cells – 4 models.

Planetary and local winds, vertical axis and horizontal axis wind mills, principles of wind power, maximum power, actual power, wind turbine operation, yaw control, pitch control and stall control mechanisms, derivation of power coefficient. Ocean temperature differences, principles of OTEC plant operations, wave energy, devices for energy extraction, tides, simple single pool tidal system.

Origin and types, Bio fuels, classification, direct combustion for heat and electricity generator, anaerobic digestion for biogas, biogas digester, power generation.

Biomass energy conversion technologies, Biogas generation – classification of Biogas plants. Micro hydro electric systems- different types of turbines.

Text books:

1. Godfrey Boyle “Renewable Energy”, Oxford Publications, Second edition.
2. G. D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, First edition.

Reference books:

1. Roger H. Charlier, Charles W. “Ocean Energy- Tide and Tidal Power” ISBN: Library of Congress Control Number: 2008929624_c Springer-Verlag Berlin Heidelberg 2009.
2. John Twidell & Tony Weir: E&F.N. Spon, “Renewable Energy Sources”, Taylor & Francis New York, 2nd edition.
3. John F. Walker & N. Jenkins, “Wind Energy Technology”, John Wiley and Sons Chichester, U.K – 1997

ROBOTICS

Course code: 21ME40B4

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Introduction to Robotics, Major components of a Robot, Robotic like devices, Classification of Robots – Classification by coordinate system and by control method, Specifications of Robots, Fixed versus flexible automation, economic analysis.

ROBOT END EFFECTORS: Introduction, End effectors, interfacing, types of End effectors, grippers and tools, considerations in the selection and design of remote centered devices.

ROBOTIC SENSORY DEVICES: Objective, Non-Optical position sensors – Potentiometers, Synchros, inductosyn, optical position sensors – opto interrupters, Optical encoders (absolute & incremental).

PROXIMITY SENSORS: Contact type, non-contact type – reflected light scanning laser sensors.

TOUCH & SLIP SENSORS: Touch sensors – proximity Rod & Photodetector sensors, Slip sensors – Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors.

TRANSFORMATIONS AND KINEMATICS: Objectives, homogeneous coordinates, basic transformation operations, forward solution – DenavitHartenberg procedure, Simple problems involving planar manipulators, inverse or backward solution – problems involved, techniques.

Introduction to Trajectory Planning, the manipulator jacobian.

ROBOT APPLICATIONS: Industrial Applications – Material Transfer, material handling, Loading and unloading, processing, spot and continuous arc welding, spray painting, grinding, Assembly and Inspection and Non-Industrial Applications.

ROBOT LANGUAGES: Introduction, AL, AML, VAL, RAIL

TEXT BOOK

1. Robotic engineering by Richard D. Klafter, Prentice Hall India
2. Industrial robotics by MikellP.Groover, Mcgraw Hill Publications

REFERENCE BOOKS

1. Robotics – K.S. Fu, Gonzalez & Lee, Mcgraw Hill Publications
2. Robotics For Engineers by YoramKkoren, Mcgraw Hill Publications
3. Introduction to Robot Technology, - P.Coiffet and M.Chairenze / Kogam Page Ltd. 1983 London.



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MECHATRONICS

Course code:21ME40B5

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

INTRODUCTION TO MECHATRONICS: Introduction, Elements of Mechatronic system, Applications.

SENSORS AND TRASDUCERS: Introduction, Classification of Sensors, selection of sensors. Classification of transducers - strain gauges, displacement transducers, capacitive and inductive transducers, LVDT, oscillation transducer, piezoelectric, potentiometric, velocity transducers, temperature transducers, optical transducers.

SIGNAL CONDITIONING: Introduction, data acquisition –Quantizing theory, Analog to Digital conversion, Digital to Analog conversion.

DATA PRESENTATION SYSTEMS: Data presentation elements, Data acquisition systems, systems measurement, Testing and calibration.

ACTATION SYSTEMS: Pneumatic and hydraulic actuation systems, Stepper and Servo Motors

SYSTEM MODELS: Modeling of one and two degrees of freedom Mechanical, Electrical, fluid and thermal systems. Block diagram representations for these systems.

SYSTEM RESPONSE: Introduction, Transfer function, Time response and Frequency response analysis mechanical systems and electrical systems.

CLOSED LOOP CONTROLLERS: *Continuous and discrete processes, control modes, Two-step, proportional, Derivative, integral, PID controllers.*

DIGITAL LOGIC: Logic gates, Boolean algebra, Karnaugh maps.

PLC: Introduction, basic structure, I/P ,O/P processing, programming, ladder diagrams, Timers, Internal relays and counters ,data handling, Analogue Input and Output, selection of a PLC. **DESIGN:** Mechatronics system Design, possible design solutions.

CASE STUDY: pick and place Robot, CNC Machine.

TEXT BOOKS:

1. W.Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" , 3rd Edition, Pearson education,2007.
2. David G. Alciatore, Michael B. Hstand ,," Introduction to mechatronics and measurement systems", 2nd Edition, McGraw-Hill Professional, 2002.

REFERENCE BOOKS:

1. A.K.Sawhney, "A course in Electrical and Electronic Measurement and Instrumentation"- Dhanpat Rai & Sons - 1991.
2. NitaigourPremchandMahalik, "Mechatronics", Tata McGraw-Hill, 2003.



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OPERATIONS RESEARCH

Course code: 21ME40B6

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Introduction to Operation Research: Introduction, Modeling in Operations Research, Phases of OR study, Scope and application of OR. Linear Programming and its Applications: Linear Programming Problem – Graphical solution of LP Problem. Simplex method, Big M method, two phase method, multiple solution, infeasible solution, unbounded solution, degeneracy, Dual Simplex method. Transportation: Introduction – Methods of basic feasible solution, Optimality test, Degeneracy in transportation problem, unbalanced transportation Problem, Assignment Problems: Hungarian method for assignment problem, Traveling salesman problem. Theory of Games: Introduction, to solve the rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, solution of a two person zero sum 2Xn game, Graphical method for 2Xn and nX2 games.

Inventory Control: Introduction – EOQ with uniform rate of demand, Economic lot size with finite rate of replenishment, Quantity discounts, Deterministic model with Shortages, ABC analysis of inventory. Dynamic Programming: Introduction, Bellman's principle of optimality, application to shortest route problem, linear programming, tabular method. Queuing Theory: Introduction, single channel, Poisson arrival, exponential service time with finite population and infinite population, Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control. Project Management by PERT/CPM: Introduction, simple network techniques, construction rules of drawing, Fulkerson's rule, Critical path method (CPM)- floats, critical path, project duration, PERT: Introduction, different Time estimates, expected time, variance, expected project duration and probability of completion. Crashing: Introduction, crashing of network, problem

Text Books:

1. Operations Research - Hamdy Taha
2. Operations Research – Hiller & Liberman.

Reference Books:

1. Quantitative Techniques – A.P. Natarajan
2. Operations Research – S.D. Sarma



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NANO MATERIALS AND TECHNOLOGY

Course code: 21PH40B7

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Introduction: Evolution of science and technology, Introduction to Nanotechnology, Nanotechnology- Definition, Difference between Nanoscience and Nanotechnology, Feynman predictions on Nanotechnology, Moore's law, Bottom up and top down approaches, challenges in Nanotechnology .

Nano materials: History of materials, Nanomaterials-Definition, Classification of Nanostructured materials, causes of interest in nanomaterials, some present and future applications of nanomaterials, Bio-Medical Applications-Drugs, Drug Delivery, Photodynamic therapy, Molecular motors, Neuro-Electronic Interfaces, Protein Engineering, Nanoluminescent tags.

Synthesis and processing of nanoparticles, thin films: Nanoparticles: Processes for producing ultrafine powders-mechanical milling, wet chemical synthesis, gas condensation process, chemical vapour condensation, laser ablation.

Thin Films: Synthesis techniques- Physical Vapor Deposition: Evaporation, Molecular beam epitaxy, Sputtering. Comparison of evaporation and sputtering.

Special nanomaterials, characterization and tools : Carbon nanotubes, nano composites, carbon fullerenes-An overview over preparation, properties, applications. Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy– X ray Diffraction. MEMS: – Introduction, types of MEMS:- Mechanical, Thermal, Magnetic MEMS; Fabrication of MEMS.

TEXT BOOKS

- 1.Nano structures & Nano materials by Guozhongcao, Imperial college press.
- 2.Micro manufacturing and Nano Technology by N.P.Mahalik.

REFERENCE BOOKS

1. Nano Technology by Mark Ratner & Danier Ratner, Prentice Hall
2. Nano materials by A S Edelstein& R C Cammarata, Institute of physics publishing, Bristol and Philadelphia.

SUBSEA ENGINEERING

Course code: 21PE40B8

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Overview of subsea engineering, subsea field development, distribution systems, subsea surveying positioning and foundation, installation of subsea equipment, subsea control, power supply, subsea hydraulics, subsea corrosion and scale, subsea connections and jumpers, subsea well heads and X-trees, subsea drilling risers, subsea production risers, subsea pipelines, subsea risk and reliability.

REFERENCE BOOKS

1. Yong Bai, Qiang Bai, “Subsea engineering handbook”, Gulf publishers, (2010)
2. Yong Bai, Qiang Bai, “Subsea pipeline and risers”, Gulf publishers, (2005)
3. Boyun Guo, Shanhong Song, Jacob Chacko, Ali Ghalambor, “Offshore Pipeline”, Gulf publishers, (2005)



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OIL AND GAS MANAGEMENT

Course code: 21PE40B9

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of the course outcomes with student's outcomes.

CO No.	Course outcome's	Mapped PO	BTL
CO 1	Understand the global oil and gas market	2,5,7	1
CO 2	Understand the E&P activities, marketing and transportation of oil and gas	2,5,7	1
CO 3	Understand the refining activities, estimating the future of oil and gas industry	2,5,7	1

SYLLABUS

Global Oil and Gas: Value Chain and Geopolitics of Oil

The Upstream: Exploration, Development, and Production

The Midstream: Markets and Transportation

The Downstream: Refining and Marketing

The Future Oil and Gas Industry

REFERENCE BOOKS

1. Adedeji B. Badiru Samuel O. Osisanya, "Project Management for the Oil and Gas Industry", CRC Press, 2013.
2. Use Internet sources for present trends.



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PHOTOGRAPHY

Course code: 21GN40C1

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

History of Photography –Cameras. Film Speed – Shutter Speed – Aperture – Figuring Focus – Depth Definitions – Camera: Types, Structure & Features. Specialized of Field – Exposure Types of Lenses – Normal lens, Wide angle, Telephoto, Fish eye & Close up lenses, Macro and Zoom Lens – Focal Length - Angle of View.

Photographic equipment and types of photography, Digital and film photography., Digital images and their characteristics, Pixels and resolutions, Digital Camera and their types, Storage and memory issues of digital images, Scanners and their applications.

Basic Lightings – Outdoor Lightings- Indoor Portrait Lighting - Flashbulbs – Electronic Flash units – Flash Techniques - B/W & Color Filters – Filter Factor Composing Effective Photographs: Picture Purpose – Centre of Interest , Rule of Third, Backgrounds, Angles – Framing – Varying Format, Focus for Effect – Good Timing – Color Consideration – Imagination. Photography under Special Conditions.

Different types of photography, Introduction to Digital Photography & Its Fundamentals. –Digital Image Sensor – Resolution - Storage Medium – File Formats – Digital Printing Technology.

References:

3. Tom Grimm, *The Basic book of Photography*, New York, Plume, 1979
4. George Haines, *learning photography*, Hamlyn Publishing Group, London 1992
5. Michael Langford , *Basic photography* , focus press London 1986
6. JhonHedgeco, *New Book of photography* , Dorling Kindersley book Lonon1994
7. Leslie D Stroebel, and Richard D Zakia, *Basic photography materials and process-*
8. John Hedgecoe, *The Photography's Handbook*, -1992
9. Chris George, *Mastering Digital Flash Photography*-2008.



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SELF DEVELOPMENT

Course code: 21GN40C4

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Orientation, Discussion on Values : Understanding Values, Behavior and Attitudes, Application of Values and Universal Values,

Philosophy of Yoga : God, Self and Ultimate goal of yoga, Brief Introduction to various types of yoga and Integration of values in Yoga,

Study of major Religions : Identify commonality, condition of its origin or intention vs. current state,

Art of Meditation : Observation, Introspection, Contemplation, Meditation and Concentration, Schools of Meditation,

Systematic Practice of Meditation: Theories of life, Need for Meditation, Natural Path, Integration **Personal Responsibility:** Stress Management, Tips for Self-Management, Choices we make, Excellence.

TEXT BOOK

1. Self development modules from Heartfulness Institute (www.heartfulness.org)

REFERENCE BOOKS

1. Complete works of Swami Vivekananda
2. Jonathan –Livingston - Seagull
3. The Monk Who Sold His Ferrari_Robin S. Sharma
4. You can win by shiv khera
5. Many lives Many Masters
6. The road less travelled – Scott Peck
7. As a man thinketh
8. Journey of the Soul
9. The Bhagavad-Gita
10. King James version of the Holy Bible
11. Holy-Quran



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EMOTIONAL INTELLIGENCE

Course code: 21GN40C5

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Course Objective: The main objective of the course is to enable the students understand meaning and importance of emotional intelligence.

Emotional Intelligence: The Concept, dimensions of emotions; Theories of Multiple intelligences; importance of emotions; emotions and the brain; The Role of Emotions in Organizations; Self-Awareness and Self-Control; Empathy; Social Expertness; Personal Influence.

Emotional Intelligence and Personality: relationship between EQ and IQ; human mind; consequences of low and high EQ; EQ development; Emotional Skills; emotional factors: Emotional Competency, Emotional Maturity, and Emotional Sensitivity.

Levels of EI: Models of Emotional Intelligence; emotional intelligence competencies; emotional intelligence and leadership behavior; emotional intelligence and stress management; art of influencing people.

The Role of Emotional Intelligence in Professional Success: Emotional Intelligence and the Complexity of Work; Emotional Intelligence and High IQ Professions; Emotional Intelligence and Leadership; manage emotional upsets; Emotional 'Winner'.

EQ in the Indian Perspective; EQ and Managerial Effectiveness; the soft art of being a tough leader.

Textbook(s):

1. Dalip Singh - Emotional Intelligence at Work: A Professional Guide – Response Books – 2006.

Reference Books:

1. Daniel Goleman, Emotional Intelligence, Bantam Books, 2006.
2. Moshe Zeidner, Gerald Matthews, and Richard D. Roberts, What We Know About Emotional Intelligence – How It Affects Learning, Work, Relationships, and Our Mental Health, The MIT Press, 2009.
3. James Bradford Terrell and Marcia Hughes, A Coach's Guide to Emotional Intelligence: Strategies for Developing Successful Leaders, Wiley, 2008.
4. Dr. Jeanne Segal, The Language of Emotional Intelligence, McGraw-Hill, 2008.



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BEHAVIORALSCIENCES

Course code: 21GN40C6

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Course Objective :

The objective of the course is to increase the students' knowledge of behavioral aspects of individuals and interactions among the individuals and the groups.

SYLLABUS

Introduction to Behavioural Science; Foundations of Individual Behavior: Personality- Personality determinants; Personality traits: The Big Five Model, Major personality attributes influencing OB; Theories of personality; Values – Types of Values.

Learning- Theories of learning; Principles of learning; Attitudes – Source of attitudes; Types of Attitudes, Attitudes and consistency – Cognitive Dissonance theory.

Perception- Perceptual process; Factors influencing **Perception;** perceptual distortion; Linkage between perception and individual decision making; Motivation – Theories of Motivation – Hierarchy Needs Theory – Two-Factor Theory – Expectancy Theory; Applications of Motivation.

Foundations of Group Behavior: Groups – Nature of groups; Types of groups; Stages of Group Development; Group Cohesiveness; Teams vs Groups

Leadership – Nature; Leadership Styles; Theories of leadership: Trait Theories, Behavioral Theories and Contingency Theories.

Text Book(s):

1. Aswathappa, **Organizational Behaviour**, Himalaya Publishing House, 2010.

Reference books:

1. Robbins, Stephen, Timothy, A & Sanghi, S. **Organizational Behavior**, 13th Edn, Pearson Education. 2009.
2. Fred Luthans, **Organizational Behaviour**, Prentice Hall, 2007.
3. Udai Pareek, **Organizational Behavior**, Oxford Publishers, New Delhi, 2008.



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MANAGEMENT ELECTIVES



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PARADIGMS IN MANAGEMENT THOUGHT

Course code: 21MB4051

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

Management Introduction - Early management thought - Management Concept – Nature - Management as art, science, profession - Scope and functions of Management - Levels of Management - Importance of management.

Classical Approach to Management: (a) Scientific Management- The advent of Scientific Management – Frederick W Taylor's contributions, - Contribution by Henry L Gantt - Contribution by Frank, Lillian Gilberth.

General Administrative Approach: Henry Fayol's contributions towards general management – Max Weber's Bureaucracy Approach.

Quantitative Approach: Important contributions – TQM – implications in today's management – Six sigma.

Behavioral Approach: Organizational Behaviour – Contributions of Elton Mayo's – Hawthorne studies – contributions of Mary Parker Follett – Chester Bernard.

Contemporary Approach: Systems Theory – Contingency Theory – Chao's Theory -Peter F Drucker Contributions – C K Prahlad's Contribution – Porter's theory – Worker Management – Employee Engagement – People Capability Maturity Model.

Text Book(s):

1. Management by Stephen P Robbins, Mary Coulter, Neeharika Vohra – Pearson – 10th edition

Reference Books:

1. Management by Stoner, Freeman, Gilbert – PHI – 7th edition.
2. Management A Global & Entrepreneurial Perspective – Weihrich, Cannice, Koontz – Mc Graw Hill – 13th Edition.
3. The evolution of management thought by Daniel A Wren, Arther G Bedeian : john wiley& sons



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INDIAN ECONOMY

Course code: 21MB4052

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

Economy: Meaning, types, problems and functions – Features of Indian Economy: Circular flow of economic activity: two sector, three sector and four sector models. Sectoral distribution of the economy. Nature and features of Indian Economy; Sectoral contribution of National Income-Share of Public and Private Sectors in GDP.

Agricultural Sector of India: importance and general problems; Land Reforms, Agricultural marketing problems and remedies. Industrial Sector of India: Types, Importance and general problems: Small Scale Sector: Importance and general problems.

Tertiary Sector in India- Importance – Infrastructure Development – Transport – Roadways, Railways – Banking and Insurance –Communication – Science and Technology – Software. Personal Income distribution and causes of inequality - Unemployment causes and remedial measures; Poverty in India- Poverty Line – antipoverty programs. Human development: concept and measurement - Human Development Index.

Economic Planning in India: Role of Planning Commission - Over all Objectives and achievements of various Five Year Plans. 12th Five Year Plan; Economic Liberalisation: LPG strategy-General Agreement on Tariffs and Trade (GATT) - Objectives of GATT and Evolution of WTO – WTO and the Indian Economy, NABARD and World Bank.

Text Book(s):

1. G.Dutt and K.P.M.Sundaram: Indian Economy (2011), S.Chand&Co., New Delhi.
2. S.K.Mishra and V.K.Puri: Indian Economy, 30th ed., Himalaya Publishing House, New Delhi.
3. M.L.Jingan: Macro Economics, 6th ed., Konark Publishing House.

Reference Books:

1. P.K.Dhar, Indian Economy-Its growing dimension, Kalyani Publishers.
2. Alok Ghosh, Indian Economy, Its Nature and Problem, World Press.
3. A.N.Agarawal, Indian Economy- Problems of Development and Planning, New Age



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MANAGING PERSONAL FINANCES

Course code: 21MB4053

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Financial planning process: Introduction-Importance of Financial Planning- Process of financial planning -The planning environment-Determinants of personal income- Financial statements and plans-Concept of Time value of money - Preparing a personal balance sheet - Preparing the income and expense statement-Using personal financial statements - Ratio Analysis.

Managing Taxes: Introduction-Importance of tax planning-Basic concepts of income tax - Personal taxation - Income tax benefits on certain long term investments -Tax planning-Ethical consideration in tax planning.

Making decisions regarding houses and automobiles:- Meeting housing needs-The rental option - The home buying process - Financing the housing transaction - Housing finance institutions in India - Housing schemes in India- Automobile purchase planning.

Planning for Investments:- Types of investment vehicles-Factors considered in the choice of investments-Developing the investment strategy-Investing in Equities- Investment Process- Investing in Fixed Income Securities- Bond Market-Bond Investing Strategies-Types of Bonds-Bond Returns- Risks from Investing in Bonds

Insurance & Mutual Funds:-Insurance planning - Buying a life insurance - Life insurance products in India-Health Insurance-Need-Types and Sources of health care plans-Providers of Health care-Long term care insurance-Disability income insurance-Health Insurance in India; Mutual funds – Types of mutual fund products – Objectives of investing in Mutual funds.

Text Book(s):

1. Jack R Kapoor, "Personal Finance" Mc Graw Hill Publications, New Delhi, 2008.
2. KC Mishra and Steward Doss, "Basics of Personal Financial Planning" Cengage Learning, First Edition 2009.

Reference books:

1. Joehnk, Billingsley and Gitman "Planning Your Personal Finances" Cengage Learning India Private Limited, Delhi, 2012.
2. Mark Hirschey and John Nofsinger "Investments Analysis" and Behavior" Mc Graw Hill Publications, New Delhi, 2008.



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BASICS OF MARKETING FOR ENGINEERS

Course code: 21MB4054

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits:3

SYLLABUS:

Introduction and Nature of Marketing: Evolution of Marketing Concept - Core concepts of marketing - Scope and Importance of Marketing. -Difference between Selling and Marketing - Marketing Myopia - Consumer Marketing Vs. Industrial Marketing.

Understanding Consumer Behaviour: nature, scope and importance of consumer behavior – Factors influencing Consumer Behavior - Buying decision making process - Market Segmentation, Targeting and Positioning (STP). Marketing mix - Product definition, levels of product, product classification, difference between goods and services, Product Life Cycle, New Product Development – Technology and Product Management - Concept of Pricing – Factors influencing the pricing policy – Pricing strategies - Pricing Considerations in High-Tech Markets.

Promotion mix - Marketing Communication Tools for High-Tech Markets - Channels of distribution - Supply Chain Management in High-Tech Markets - Technology Marketing, Green Marketing, Introduction to market study.

Text Books:

1. Philip Kotler and Gary Armstrong- Principles of Marketing- 17/e, Pearson Education.
2. Jakki J Mohr, Sanjit Sengupta and Stanley Slater, Marketing of High-Technology Products and Innovations, 3/e Pearson India

Reference Books:

1. V.S. Ramaswamy and S.Namakumari – Marketing Management, 4/e, Mc Millan Publications, New Delhi.
2. RajanSaxena, Marketing Management- 3/e, TMH, New Delhi.



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ORGANIZATION MANAGEMENT

Course code: 21MB4055

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS:

Development of Management thought – Introduction, Various theories; Functional approach, scientific management approach, human relations approach, latest management thoughts, organisation theory-classical organisation, neo-classical organisation theory, modern organisation theory.

Organization Structure--Principles of organisation, organizational theories, departmentalism, authority, power, organizing, organizational effectiveness, structuring the organisation, organizational change, organisation charts; types of organisations—line , functional and line and staff relations, Organisational manuals.

Motivation, Morale and behavioral science—Motivation: Characteristics, importance, Kinds of motivation. Thoughts of motivational philosophy: Gouglass Mc Gregore—X and Y theory; Herzberg's theory. Human needs, Incentive as motivators, Managing dissatisfaction and frustration. Morale, Absenteeism, Behavioral science, Group dynamics, Group behavior. Leadership—Meaning, importance, styles, theories, leaders Vs managers.

Management concept—Management, Administration, Organisation, Difference and Relationship between Management, Administration and Organisation, Importance of Management, Characteristics of management, Managerial Skills, Managerial Objectives, Harmonization of Objectives, Hirechy of Objectives.

Industrial Relations, Trade Union And Collective Bargaining—Industrial relations, Industrial Psychology, Industrial disputes, Conflict management, Views about conflict, Labor Policy. Workers grievances, Suggestion system. Trade Unions. Collective Bargainning, Negotiations, Industrial Safety—working conditions, Accidents, Preventive measures, Safety training.

TEXT BOOKS

1. Stephen P. Robins, Organizational behavior, PHI / Pearson education, 11th edition , 2008.
2. Koontz &Wehrich., Essentials of Management, 12th edition, Tata Mc Grawhill, 2007.

REFERENCES

1. Banga&Sarma , Industrial Engineering Management including Productionmanagement, 11th edition, 2010.
2. O.P. Khanna , Industrial engineering management, Khanna publications, 2006.

RESOURCE SAFETY AND QUALITY MANAGEMENT

Course code: 21MB4056

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

Mapping of Course Outcomes to Program Outcomes: The students will be able to

CO No:	CO	PO/PSO	B
1	Understand the basics systems of man power and materials management	PO5	2
2	Understand the basics systems of machinery management	PO5	2
3	Understand the basics systems of safety management	PO6	2
4	Understand the basics systems of quality management	PO5	2

SYLLABUS

Resource Management (Man Power, Materials & Machinery): Introduction; Resource smoothing; Resource Leveling, Establishing workers productivity; Objectives of material management; Functions of material management department; ABC classification of materials; Inventory of materials; Material procurement; Storage management; Classification of construction equipment; Earth moving equipment; Excavation equipment; Hauling equipment; Earth compaction equipment; Hoisting equipment; Concrete plant and equipment; Time and motion study; Selection of equipment – Task consideration, cost consideration; Factors affecting the selection; Factors affecting cost owning and operating the equipment; Equipment maintenance.

Safety and Quality Management:

Accident prevention program; Immediate attention in case of accident; Approaches to improve safety in construction; Safety benefits to employees, employees and customers; Prevention of fire in construction industries; Fault tree analysis; Safety information system; Safety budgeting;

Importance of quality; Elements of quality; Organization for quality control; Quality assurance techniques; Documentation; Quality control circles; Total quality management; ISO 9000 – 2008.

TEXT BOOKS:

1. Construction Engineering and Management by S.Seetharaman; Umesh Publications, NaiSarakl, Delhi.
2. Fundamentals of PERT/CPM and Project Management by S.K.Bhattacharjee; Khanna

Publishers, NaiSarak; Delhi.

REFERENCE BOOKS:

1. Construction Management and Planning by B.Sengupta and H.Guha; Tata Mc.Graw-Hill Publishing Co. Ltd., New Delhi.
2. Construction Planning, Equipment and Methods by Peurifoy R.L; MC Graw-Hill International Book Company.



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ECONOMICS FOR ENGINEERS

Course code: 21MB4057

L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Credits: 3

SYLLABUS

Introduction to Engineering Economics: Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Elementary economic Analysis

Unit II: Value Engineering: Make or buy decision, Value engineering – Function, aims, value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

Unit III: Cash Flow: Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the method

Unit IV: Replacement and Maintenance Analysis: Introduction-Types of maintenance –types of replacement Problem-Determination of economic life of an asset-Replacement of existing asset with a new asset.Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction.

Text Books:

1. Dr. K K Patra, DhirajBhattacharjee, Engineering Economics and Costing, S. Chand & Company Ltd, New Delhi, 2013.
2. PanneerSelvam, R., *Engineering Economics*, Prentice Hall of India Ltd, New Delhi, 2001.

Reference Books:

1. Chan S.Park, *Contemporary Engineering Economics*, Prentice Hall of India, 2002.
- Donald.G. Newman, Jerome.P.Lavelle, *Engineering Economics and analysis*Engg. Press, Texas, 2002.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, *Engineering Economy*, Macmillan, New York, 1984.
3. William G. Sullivan, Elin M Wicks, and James Luxhoj, Engineering Economy, 13th edition (Prentice-Hall)



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DEPARTMENT OF CIVIL ENGINEERING-Y21 COURSE STRUCTURE

S E M E S T E R - 1

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	20UC1101	Integrated Professional English	HSS	0	0	4	0	2	4
2	20MT1101	Mathematics for Computing	BS	2	2	0	2	4.5	6
3	21SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	5.5	11
4	20ME1103	Design Tools Workshop - I	ES	0	0	4	0	2	4
5	21PH1010	Mechanics	ES	3	1	0	0	4	4
Total				8	3	10	8	18	29

S E M E S T E R - 2

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	20UC1202	English Proficiency	HSS	0	0	4	0	2	4
2	21SC1202	Design of Data Structures	ES	3	0	2	4	5	9
3	21MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3
4	21SC1209	Design Tools Workshop – II	ES	0	0	4	0	2	4
5	21UC1203	Design Thinking and Innovation	BS	0	0	4	0	2	4
6	21CE1002	Engineering Graphics	ES	2	0	4	0	4	6
7	21CE2205	Geology	PC	3	0	2	0	4	5
Total				10	1	20	4	22	35

Summer Break

1	21IE2040	Social Internship	PR	0	0	0	4	1	4
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S E M E S T E R - 3

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21CE2101	Solid Mechanics	PC	3	0	2	0	4	5
2	21CE2102	Fluid Mechanics & Hydraulics	PC	3	0	2	0	4	5
3	21CE2103	Surveying	PC	3	0	2	0	4	5
4	21UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4
5	21MT2007	Probability, statistics and Numerical Methods	BS	3	1	0	0	4	4
6	21CY1001	Engineering Chemistry	BS	2	0	2	0	3	4
7	21PH1002	Engineering Physics	BS	2	0	2	0	3	4
8	OE	Foreign Language Elective OE-1	OE	2	0	0	0	2	2
9	21IE2046	Project Based Learning -1	PR	0	0	0	6	1.5	6
Total				18	1	14	6	27.5	39



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SEMESTER - 4

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21CE2201	Structural Analysis	PC	3	1	0	0	4	4
2	21CE2203	Construction Materials & Concrete Technology	PC	3	0	2	0	4	5
3	21CE2204	Environmental Engineering	PC	3	0	2	0	4	5
4	21CE2202	Building Planning, Drawing & Construction Management	PC	3	0	2	0	4	5
5	21CE2206	Geotechnical Engineering	PC	3	0	2	0	4	5
6	21UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4
7	21IE2047	Project based learning -2	PR	0	0	0	6	1.5	6
Total				15	1	12	6	23.5	34

Summer Break

1	21IE3041	Technical Internship	PR	0	0	0	4	1	4
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SEMESTER - 5

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21UC3105	Problem Solving Skills-I	BS	0	0	2	2	1.5	4
2	21CE3101	Design Of Reinforced Concrete Structures	PC	3	0	2	0	4	5
3	21CE3103	Transportation Engineering	PC	3	0	2	0	4	5
4	21CE3102	Water Resources Engineering	PC	3	1	0	0	4	4
5	PE	PE-1	PE	3	0	0	0	3	3
6	PE	PE-2	PE	3	0	0	0	3	3
7	21UC0011	Gender Sensitization	HSS	2	0	0	0	2	2
8	21IE3044	Mid Grade Capstone Project – I	PR	0	0	0	8	2	8
Total				17	1	6	10	24	34

SEMESTER - 6

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21UC3206	Problem Solving Skills-II	BS	0	0	2	2	1.5	4
2	21CE3201	Design Of Steel Structures	PC	3	1	0	0	4	4
3	21CE3202	Quantity Surveying and Estimation	PC	3	0	2	0	4	5
4	PE	PE-3	PE	3	0	0	0	3	3
5	PE	PE-4	PE	3	0	0	0	3	3
6	PE	PE-5	PE	3	0	0	0	3	3
7	21UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	2



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8	20UC0008	Indian Constitution	MC	2	0	0	0	0	2
9	21IE3043	Term paper	PR	0	0	0	4	1	4
10	21IE3045	Mid Grade Capstone Project – II	PR	0	0	0	8	2	8
Total				19	1	4	14	23.5	38
Summer Break									
1	21IE4042	Industry Internship	PR	0	0	0	4	1	4
S E M E S T E R - 7									
Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21CE4101	Comprehensive Exam	PC	0	0	6	0	3	6
2	21CE4102	Construction Planning & Project Management	HSS	3	0	0	0	3	3
3	20UC0007	Indian Heritage and Culture	MC	2	0	0	0	0	2
4	ME	Management Elective	OE	3	0	0	0	3	3
5	OE	Open Elective 1	OE	3	0	0	0	3	3
6	21IE4048/ 21IE4051/ 21IE4050	Project / Internship -1/Practice School	PR	0	0	0	16	4	16
Total				6	0	0	16	16	22
S E M E S T E R - 8									
Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	OE	Open Elective 2	OE	3	0	0	0	3	3
2	OE	Open Elective 3	OE	3	0	0	0	3	3
3	20UC0009	Ecology & Environment	MC	2	0	0	0	0	2
4	21IE4049/ 21IE4052/ 21IE4050	Project / Internship 2/Practice School	PR	0	0	0	16	4	16
Total				8	0	0	16	10	24
GRAND TOTAL				101	7	66	100	167	255