KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
FACULTY OF ENGINEERING
B.E (CIVIL ENGINEERING)
COURSE OF STUDY AND SCHEME OF EXAMINATION
(2019 BATCH ONWARDS)

SEMESTER I

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
19BECE101	Mathematics-I (Calculus, Multivariable Calculus & Linear Algebra)	1	1	3	1	0	4	40	60	100
19BECE141	Chemistry-I	1	1	3	1	3	6	40	60	100
19BECE142	Basic Electrical Engineering	1	1	3	1	2	5	40	60	100
19BECE111	Engineering Graphics & Design	1	1	1	0	4	3	40	60	100
TOTAL				10	3	9	18	160	240	400

SEMESTER II

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
19BECE201	Mathematics-II (Differential Equations)	1	11	3	1	0	4	40	60	100
19BECE241	Mechanics and Mechanics of Solids	1,2	3	3	1	3	5	40	60	100
19BECE242	English	1	10	2	0	2	3	40	60	100
19BECE243	Programming For Problem Solving	1	2	3	0	4	5	40	60	100
19BECE211	Workshop / Manufacturing Practices Laboratory	1	1	1	0	4	3	40	60	100
TOTAL				12	2	13	20	200	300	500

SEMESTER III

Course	Course Title	Objectives &	Instruction	Credits	Maximum Marks

Code		Outcomes		hours/week						
		PEO	PO	L	T	P		CIA	ESE	Total
19BECE301	Mathematics-III (Transform & Discrete Mathematics)	1	1	3	1	0	4	40	60	100
19BECE302	Biology for Engineers	1	1	3	0	0	3	40	60	100
19BECE303	Energy Science & Engineering	1	1	1	1	0	2	40	60	100
19BECE304	Introduction to Civil Engineering	1	1	2	0	0	2	40	60	100
19BECE305	Engineering Mechanics	1	1	3	1	0	4	40	60	100
19BECE306	Effective Technical Communication	1	10	3	0	0	3	40	60	100
19BECE341	Basic Electronics	1	1	2	0	2	3	40	60	100
19BECE311	Computer-aided Civil Engineering Drawing	1	4,5,9,10	1	0	2	2	40	60	100
TOTAL				18	3	4	23	320	480	800

SEMESTER IV

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
19BECE401	Introduction to Mechanical Engineering	1	1	2	1	0	3	40	60	100
19BECE402	Engineering Geology	1,2	2	2	0	0	2	40	60	100
19BECE403	Disaster Preparedness & Planning Management	1,2	1,4	1	1	0	2	40	60	100
19BECE404	Introduction to Solid Mechanics	1	3	2	0	0	2	40	60	100
19BECE441	Instrumentation & Sensor Technologies for Civil	1,2	1,4	1	1	2	3	40	60	100

	Engineering Applications									
19BECE442	Introduction to Fluid Mechanics	1	3	2	0	2	3	40	60	100
19BECE443	Surveying & Geomatics	1	6	1	1	2	3	40	60	100
19BECE444	Materials, Testing &Evaluation	1,2	4,9	2	0	3	4	40	60	100
19BECE451	Civil Engineering - Societal & Global Impact	1,3	8	2	0	0	2	40	60	100
TOTAL				15	4	9	24	360	540	900

SEMESTER V

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
19BECE501	Mechanics of Materials	1	3	3	0	0	3	40	60	100
19BECE502	Structural Engineering	1,2	2	2	1	0	3	40	60	100
19BECE503	Hydrology & Water Resources Engineering	1,3	7	2	1	0	3	40	60	100
19BECE504	Environmental Engineering	1,3	7	3	0	0	3	40	60	100
19BECE505	Transportation Engineering	1,3	6	3	0	0	3	40	60	100
19BECE506	Professional Practice, Law & Ethics	3	8	2	0	0	2	40	60	100
19BECE541	Hydraulic Engineering	1	3	2	0	2	3	40	60	100
19BECE542	Geotechnical Engineering	1,2	2,3	2	0	2	3	40	60	100
TOTAL				19	2	4	23	320	480	800

SEMESTER VI

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total

19BECE601	Construction Engineering & Management	1	9,11	2	1	0	3	40	60	100
19BECE641	Engineering Economics, Estimation & Costing	1	11	2	1	4	5	40	60	100
19BECE6E--	Elective-I	1	6,12	3	0	0	3	40	60	100
19BECE6E--	Elective-II	1	6,12	3	0	0	3	40	60	100
19BECE6E--	Elective-III	1	6,12	3	0	0	3	40	60	100
19BECE6E--	Elective-IV	1	6,12	3	0	0	3	40	60	100
TOTAL				16	2	4	20	240	360	600

SEMESTER VII

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
19BECE7E--	Elective V	1	6,12	3	0	0	3	40	60	100
19BECE7E--	Elective-VI	1	6,12	3	0	0	3	40	60	100
	Open Elective-I (Metro System and Engineering)	1	6	3	0	0	3	40	60	100
	Open Elective-II	1	6	3	0	0	3	40	60	100
19BECE791	Project Work-1	1,2,3	4,5,9,11	0	0	12	6	80	120	200
TOTAL				12	0	12	18	240	360	600

SEMESTER VIII

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
19BECE8E--	Elective VII	1	6,12	3	0	0	3	40	60	100

19BECE8E--	Elective VIII	1	6,12	3	0	0	3	40	60	100
	Open Elective-III	1	6	3	0	0	3	40	60	100
	Open Elective-IV	1	6	3	0	0	3	40	60	100
19BECE891	Project Work-2 (Continued from VI I Semester)	1,2,3	4,5,9,11	0	0	12	6	80	120	200
TOTAL				12	0	12	18	240	360	600
TOTAL NO OF CREDITS=164										

L: Lecture Hour T: Tutorial Hour CIA: Continuous Internal Assessment

P: Practical Hour C: Credit ESE: End semester Examination

LIST OF ELECTIVES

PROFESSIONAL ELECTIVES (PE)

The Professional Elective Courses (PEC-CE) are shown indifferent tracks

Track	Professional Electives
I	Structural Engineering
II	Geotechnical Engineering
III	Environmental Engineering
IV	Construction Engineering & Management

STRUCTURAL ENGINEERING

Course Code	Course Title	Pre-requisite	PEO	PO	Instruction hours/week			Credits	Maximum Marks		
					L	T	P		CIA	ESE	Total
19BECEE01	Structural Analysis-I	Nil	1	2,3	3	0	0	3	40	60	100
19BECEE02	Structural Analysis-II	19BECEE01	1	2,3	3	0	0	3	40	60	100

19BECEE03	Advanced Structural Analysis	19BECEE02	1	2,3	3	0	0	3	40	60	100
19BECEE04	Structural Mechanics	19BECEE03	1,2	3,4	3	0	0	3	40	60	100
19BECEE05	Reinforced Concrete	19BECEE06	1	2,3	3	0	0	3	40	60	100
19BECEE06	Concrete Technology	Nil	1	2	3	0	0	3	40	60	100
19BECEE07	Design of Concrete Structures-I	19BECEE05	1	2,3	3	0	0	3	40	60	100
19BECEE08	Design of Concrete Structures-II	19BECEE07	1	2,3	3	0	0	3	40	60	100
19BECEE09	Prestressed Concrete	19BECEE08	1,2	1,9,12,15	3	0	0	3	40	60	100
19BECEE10	Design of Steel Structures	19BECEE08	1,2	1,2,3	3	0	0	3	40	60	100
19BECEE11	Concrete Materials	19BECEE06	1,2	2,3,4	3	0	0	3	40	60	100

GEOTECHNICAL ENGINEERING

Course Code	Course Title	Pre-requisite	PEO	PO	Instruction hours/week			Credits	Maximum Marks		
					L	T	P		CIA	ESE	Total
19BECEE12	Soil Mechanics-I	Nil	1	3	3	0	0	3	40	60	100
19BECEE13	Soil Mechanics-II	19BECEE12	1	3	3	0	0	3	40	60	100
19BECEE14	Foundation Engineering	19BECEE13	1,2	2,3,4	3	0	0	3	40	60	100
19BECEE15	Environmental Geo-technology	Nil	1,2	2,3,4	3	0	0	3	40	60	100

ENVIRONMENTAL ENGINEERING

Course Code	Course Title	Pre-requisite	PEO	PO	Instruction hours/week			Credits	Maximum Marks		
					L	T	P		CIA	ESE	Total
19BECEE16	Ecological Engineering	Nil	1,2	3.6.12	3	0	0	3	40	60	100
19BECEE17	Transport of Water	Nil	1,2	4.7.11.14	3	0	0	3	40	60	100

	and Wastewater										
19BECEE18	Physico-Chemical Processes for Water and Wastewater Treatment	19BECEE17	1,2	7.8.12	3	0	0	3	40	60	100
19BECEE19	Biological Processes for Contaminant Removal	19BECEE19	1,2	1.9.12	3	0	0	3	40	60	100
19BECEE20	Rural Water Supply and Onsite Sanitation Systems	19BECEE19	1,2	4.7.11.14	3	0	0	3	40	60	100
19BECEE21	Solid and Hazardous Waste Management	Nil	1,2	4.7.11.14	3	0	0	3	40	60	100
19BECEE22	Air and Noise Pollution and Control	Nil	1,2	3.4.5.7	3	0	0	3	40	60	100
19BECEE23	Environmental Impact Assessment and Life Cycle Analyses	19BECEE22	1,2	4.7.11.14	3	0	0	3	40	60	100

CONSTRUCTION ENGINEERING & MANAGEMENT

Course Code	Course Title	Pre-requisite	PEO	PO	Instruction hours/week			Credits	Maximum Marks		
					L	T	P		CIA	ESE	Total
19BECEE24	Building Construction Practice	19BECEE11	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE25	Construction Project Planning &Systems	19BECEE25	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE26	Sustainable Construction Methods	19BECEE25	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE27	Construction Engineering Materials.	Nil	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE28	Contracts Management	19BECEE25	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE29	Construction Equipment& Automation	19BECEE25	1,2	3,4,5,7	3	0	0	3	40	60	100
19BECEE30	Repairs & Rehabilitation of Structures	19BECEE25	1,2	4.5.7.12	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVES

COURSES OFFERED BY OTHER DEPARTMENTS

Course Code	Course Title	PEO	PO	Instruction hours/week			Credits	Maximum Marks		
				L	T	P		CIA	ESE	Total
SCIENCE AND HUIMANITIES										
19BESHOE01	Solid Waste Management	1, 2	7,11,14	3	0	0	3	40	60	100
19BESHOE02	Green Chemistry	1, 2	1,3,5	3	0	0	3	40	60	100
19BESHOE03	Applied Electrochemistry	1, 2	1,3,5	3	0	0	3	40	60	100
19BESHOE04	Industrial Chemistry	1, 2	1,3,5	3	0	0	3	40	60	100
19BESHOE05	Technical Writing	1	9,10,12	3	0	0	3	40	60	100
19BESHOE06	Geophysics	1, 2	1,3,4	3	0	0	3	40	60	100
19BESHOE07	Engineering Acoustics	1, 2	1,3,4	3	0	0	3	40	60	100
19BESHOE08	Industrial Mathematics – I	1	1	3	0	0	3	40	60	100
19BESHOE09	Industrial Mathematics – II	1	1	3	0	0	3	40	60	100
19BESHOE10	Fuzzy Mathematics	1	1	3	0	0	3	40	60	100
19BESHOE11	Mathematical Physics	1	1	3	0	0	3	40	60	100
19BESHOE12	Linear Algebra	1	1	3	0	0	3	40	60	100
COMPUTER SCIENCE ENGINEERING										
19BECSOE01	Internet Programming	1, 2	1,3	3	0	0	3	40	60	100
19BECSOE02	Multimedia and Animation	2	1,3	3	0	0	3	40	60	100
19BECSOE03	PC hardware and Troubleshooting	2	5,6	3	0	0	3	40	60	100
19BECSOE04	Java Programming	1, 2	1,3	3	0	0	3	40	60	100
ELECTRICAL & ELECTRONICS ENGINEERING										
19BEEEOE01	Electric Hybrid Vehicle	1, 2	1,5	3	0	0	3	40	60	100
19BEEEOE02	Energy Management & Energy Auditing	1, 2	1,6,7	3	0	0	3	40	60	100
19BEEEOE03	Programmable Logic Controller	1	1,4	3	0	0	3	40	60	100

19BEEEOE04	Renewable Energy Resources	1, 2	1,6,7	3	0	0	3	40	60	100
ELECTRONICS & COMMUNICATION ENGINEERING										
19BEECOE01	Real TimeEmbedded Systems	1, 2	1,2	3	0	0	3	40	60	100
19BEECOE02	Consumer Electronics	1	1	3	0	0	3	40	60	100
19BEECOE03	Neural Networks and its Applications	1, 2	1,5	3	0	0	3	40	60	100
19BEECOE04	Fuzzy Logic and its Applications	1, 2	1,5	3	0	0	3	40	60	100
19BEECOE05	Principles of Modern Communication System	1, 2	1,6	3	0	0	3	40	60	100
BIOTECHNOLOGY										
19BTBTOE01	Bioreactor design	1, 2	1,3, 6	3	0	0	3	40	60	100
19BTBTOE02	Food Processing and Preservation	1	1	3	0	0	3	40	60	100
19BTBTOE03	Basic Bioinformatics	1	1	3	0	0	3	40	60	100
19BTBTOE04	Fundamentals of Nanobiotechnology	1, 2	1	3	0	0	3	40	60	100
MECHANICAL ENGINEERING										
19BEMEOE01	COMPUTER AIDED DESIGN	1, 2	1,3,4,6	3	0	0	3	40	60	100
19BEMEOE02	INDUSTRIAL SAFETY AND ENVIRONMENT	1, 2	1,3,12	3	0	0	3	40	60	100
19BEMEOE03	TRANSPORT PHENOMENA	1, 2	1,3,5	3	0	0	3	40	60	100
19BEMEOE04	INTRODUCTION TO BIOMECHANICS	1	1,2	3	0	0	3	40	60	100
AUTOMOBILE ENGINEERING										
19BEAEOE01	Automobile Engineering	1	1,2	3	0	0	3	40	60	100
19BEAEOE02	Basics of Two and Three Wheelers	1	1,5	3	0	0	3	40	60	100
19BEAEOE03	Automobile Maintenance	1	1,12	3	0	0	3	40	60	100
19BEAEOE04	Introduction to Modern Vehicle Technology	1	1,12	3	0	0	3	40	60	100
19BEAEOE05	Commercial Fleet Operation	1	1,12	3	0	0	3	40	60	100
CHEMICAL ENGINEERING										

19BTCEOE01	Energy Management In Chemical Industries	1, 2	1,6,9	3	0	0	3	40	60	100
19BTCEOE02	Fertilizer Technology	1, 2	1,6,9	3	0	0	3	40	60	100
19BTCEOE03	Industrial Wastewater Treatment	1, 2	4,7,11 ,14	3	0	0	3	40	60	100
19BTCEOE04	Solid and Hazardous Waste Management	1, 2	4,7,11 ,14	3	0	0	3	40	60	100
FOOD TECHNOLOGY										
19BTFTOE01	Processing of Food Materials	1, 2	1,12,1 5	3	0	0	3	40	60	100
19BTFTOE02	Nutrition and Dietetics	1, 2	1,6,9	3	0	0	3	40	60	100
19BTFTOE03	Ready to Eat Foods	1, 2	1,6,9	3	0	0	3	40	60	100
19BTFTOE04	Agricultural Waste and Byproducts Utilization	1, 2	4,7,14	3	0	0	3	40	60	100
BIOMEDICAL ENGINEERING										
19BEBMEOE01	Robotics in medicine	1,2	1,2	3	0	0	3	40	60	100
19BEBMEOE02	Virtual Reality and Augmented Reality	1,2	1,2	3	0	0	3	40	60	100
19BEBMEOE03	Artificial organs and Implants	1,2	1,2	3	0	0	3	40	60	100

COURSES OFFERED TO OTHER DEPARTMENT

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	C	CIA	ESE	TOTAL
19BECEOE01	Housing, Plan and Management	1,2	5,9,6	3	0	0	3	40	60	100
19BECEOE02	Building Services	1,2	8	3	0	0	3	40	60	100
19BECEOE03	Repair and Rehabilitation of Structures	1,2	7,9,11	3	0	0	3	40	60	100
19BECEOE04	Computer Aided Civil Engineering Drawing	1,2	3,4,5,7	3	0	0	3	40	60	100

**-- Skill Development

**-- Employability

**--Entrepreneurship

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO-1Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

The B.E. Degree Programme in Civil Engineering is offered in the department with the following programme specific outcomes:

PSO-1 The Graduates of this Programme with proficiency in mathematics and physical sciences will excel in the core areas of civil engineering such as structural, environmental and water resources engineering.

PSO-2 Utilize principles, methods, software's and codes of practices to excel in the areas of planning, analysis and designs related to Civil Engineering systems.

PSO-3 Prepare detailed drawings, cost estimates, reports, walk through views, interact with clients, manage workers, work in a team and executes construction works.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Civil Engineering education at KAHE, Coimbatore, mainly based on practical oriented learning. The courses offered are focused on training the students to make them adaptable to any type of role in different fields of Civil Engineering.

The B.E. Degree Programme in Civil Engineering is offered in the department with the following educational objectives:

PEO-1 To equip the graduates with sufficient knowledge and experience to become leaders in industry and academia

PEO-2 To offer platform for research and development

PEO-3 To impart professional ethics with a commitment to the society and environment

PEO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	✓	✓	✓		✓			✓	✓		✓	✓
PEO2	✓	✓		✓	✓		✓		✓	✓	✓	✓
PEO3			✓		✓	✓	✓	✓		✓	✓	✓

PEO-PSO mapping

	PSO1	PSO2	PSO3
PEO1	✓	✓	✓
PEO2	✓	✓	✓
PEO3		✓	✓

SEMESTER I

B.E Civil Engineering **2019-2020**

Semester-I

19BECE101 **Mathematics –I** **4H-4C**

(Calculus, Multivariable Calculus & Linear Algebra)

Instruction Hours/week: L: 3 T: 1 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To understand geometrical aspects of curvature and elegant application of differential calculus. To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
3. To introduce sequence and series and Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
4. To understand the concept of functions of several variables and vector identities.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage
6. To make the student to solve various Engineering problems

Course Outcomes

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

1. In rank and Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices and the students will be able to use matrix algebra techniques for practical applications.
2. To apply differential and integral calculus to notions of evolute and introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed inengineering application
3. To solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
4. To understand the ideas of limits and continuity and an ability to calculate with them and apply them and also to calculate grad, div and curl in Cartesian and other simple coordinate systems.
5. To apply integration to compute multiple integrals, area, volume, integrals in polar and Cartesian coordinates, in addition to change of order and vector integration.
6. This course equips students to have basic knowledge and understanding in one field of materials, integral and differential calculus

UNIT I - Matrices

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation. Simple Problems using Scilab.

UNIT II - Calculus:

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT III - Sequences and series:

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV - Multivariable Calculus (Differentiation)

Limit continuity and partial derivatives, directional derivatives, total derivative, Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

UNIT V - Multivariable Calculus (Integration)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Applications: areas and volumes, Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, Simple applications involving cubes and rectangular parallelepipeds.

SUGGESTED READINGS

1. Hemamalini. P.T**,**(2014),Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.
2. G.B. Thomas and R.L. Finney**,** (2002),Calculus and Analytic geometry, 9th Edition,Pearson**,**.
3. Erwin kreyszig**,** (2006),Advanced Engineering Mathematics, 9th Edition,John Wiley & Sons**.**
4. Veerarajan T**,** (2008),Engineering Mathematics for first year,Tata McGraw-Hill, New Delhi.
5. Ramana B.V**,** (2010),Higher Engineering Mathematics, 11th Reprint, Tata McGraw Hill New Delhi.
6. D. Poole**,** (2005),Linear Algebra: A Modern Introduction, 2nd Edition,Brooks/Cole.
7. N.P. Bali and Manish Goyal, (2010), A text book of Engineering Mathematics, Laxmi Publications.
8. B.S. Grewal, (2010), Higher Engineering Mathematics, 36th Edition, Khanna Publishers.
9. V. Krishnamurthy, (2005),V.P.Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press.

B.E Civil Engineering **2019-2020**

Semester-I

19BECE141 **Chemistry –I** **7H-6C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

1. To understand the terminologies of atomic and molecular structure
2. To study the basics of Periodic properties, Intermolecular forces
3. To study about spectroscopic technique
4. To understand the thermodynamic functions
5. To comprehend the basic organic chemistry and to synthesis simple drug.
6. To understand the chemical principles in the projects undertaken in field of engineering and technology

Course Outcomes:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electr onegativity.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalise bulk properties and processes using thermodynamic considerations.
5. List major chemical reactions that are used in the synthesis of molecules.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I - Atomic and molecular structure

Schrodinger equation. Particle in a box solutions and their applications. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene and aromaticity.Introduction to Crystal field theory.

UNIT II - Periodic properties, Intermolecular forces and potential energy surfaces

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions.Equations of state of real gases and critical phenomena. Potential energy surfaces of H_2F and HCN and trajectories on these surfaces.

UNIT III - Spectroscopic techniques and applications

Spectroscopy (Principles and Instrumentation only).Electronic spectroscopy.Vibrational and rotational spectroscopy.Applications.Surface characterization techniques.Diffraction and scattering.Fluorescence and its applications in medicine.

UNIT IV - Use of free energy in chemical equilibria

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.Acid base, oxidation reduction and solubility equilibria.Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT V - Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings.Synthesis of a commonly used drug molecule.

SUGGESTED READINGS

1. B. H. Mahan, (2010), University chemistry, Pearson Education.
2. M. J. Sienko and R. A. Plane, Chemistry: Principles and Applications.
3. C. N. Banwell, (1994), Fundamentals of Molecular Spectroscopy, McGraw-Hill.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
5. P. W. Atkins, (2009), Physical Chemistry, Oxford University Press.
6. K. P. C. Volhardt and N. E. Schore, (2014), 5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman.
7. P C Jain & Monica Jain, (2015),Engineering Chemistry, Dhanpat Rai Publishing Company.

Chemistry Laboratory

Course Objectives

1. To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.
2. To estimate the amount of sodium carbonate and sodium hydrogen carbonate, hardness, chloride in water sample
3. To make the student acquire practical skills in the determination of conductance of solutions, EMF etc
4. To acquaint the students with the determination of rate constant of a reaction
5. To carried out different types of titrations for estimation of concerned in materials
6. To determine the partition coefficient of a substance between two immiscible liquids.

Course Outcomes

1. The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
2. Estimate rate constants of reactions from concentration of reactants/products as a function of time
3. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
4. Determine the partition coefficient of a substance between two immiscible liquids.
5. Acquaint the students with the determination of acid value of an oil
6. Carrying out different types of titrations for estimation of concerned in materials using comparatively more qualities and quantities of materials involved for accurate results

Choice of 10 experiments from the following:

1. Determination of surface tension and viscosity

2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure using volumetric titration
3. Determination of Ca / Mg using complexometric titration
4. Thin layer chromatography
5. Determination of chloride content of water
6. Determination of the rate constant of a reaction
7. Conductometry - Determination of cell constant and conductance of solutions
8. pH Metry – Determination of Acid / Base
9. Potentiometry - determination of redox potentials and emfs
10. Saponification/acid value of an oil
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

B.E Civil Engineering **2019-2020**

Semester-I

19BECE142 **Basic Electrical Engineering (Theory & Lab.)** **6H-5C**

Instruction Hours/week: L:3 T:1 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

- To impart the basic knowledge about the Electric circuits.
- To understand the working of Electrical Machines and Transformers.
- To understand the working of Power Converters and components of low-voltage electrical installations.
- To understand and analyze basic electric and magnetic circuits.
- To gain the basic knowledge about the Electric circuits.
- To study the working principles of electrical machines and power converters.

Course Outcomes

1. To understand and analyze basic electric and magnetic circuits.
2. Students will gain the basic knowledge about the Electric circuits.
3. To study the working principles of electrical machines and power converters.
4. To introduce the components of low-voltage electrical installations.
5. Gained the knowledge in working of Electrical Machines and Transformers.
6. Students will gain the applications of transformers.

UNIT I - DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation.Superposition, Thevenin and Norton Theorems.Time-domain analysis of first-order RL and RC circuits.

UNIT II - AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III - Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT IV - Transformers And Power Converters

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.Auto-transformer and three-phase transformer connections. Overviews of DC-DC buck and boost converters, duty ratio control. Introduction to Single-phase and three-phase voltage source inverters.

UNIT V - Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

SUGGESTED READINGS

1.V. D. Toro,(1989),Electrical Engineering Fundamentals, Prentice Hall India.
2. D. P. Kothari and I. J. Nagrath, (2010), Basic Electrical Engineering, Tata McGraw Hill.
3. D. C. Kulshreshtha, (2009),Basic Electrical Engineering, McGraw Hill.
4. L. S. Bobrow, (2011), Fundamentals of Electrical Engineering, Oxford University Press.
5. E. Hughes, (2010), Electrical and Electronics Technology, Pearson.

ii) Laboratory

Course Objective

- To impart the basic knowledge about the Electric circuits.
- To understand the working of Electrical Machines and Transformers.

Course Outcomes

At the end of this course, students will demonstrate the ability

1. To understand and analyze basic electric and magnetic circuits.
2. To study the working principles of electrical machines and power converters.

List of Experiments

1. Experimental verification of electrical circuit problems using Ohms law and Kirchoff's law.
2. Measurement of electrical quantities – voltage, current, power & power factor in R load.
3. Speed control of DC shunt motor
4. Draw the equivalent circuit of single phase Transformer by conducting OC &SC Test.
5. Measurement of energy using single phase energy meter.

SUGGESTED READING

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

B.E Civil Engineering **2019-2020**

Semester-I

19BECE111 **Engineering Graphics and Design** **5H-3C**

Instruction Hours/week: L:1 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. to prepare the students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. to prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice
3. To give exposure to solid modeling,computer-aided geometric design, creating working drawings and engineering communication.
4. To develop graphic skill for communication of concepts, ideas and design of engineering products
5. To give exposure to existing national standards related to technical drawings
6. To gather skills in technical drawing.

Course Outcomes

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design and engineering graphics standards
3. Exposure to solid modeling,computer-aided geometric design, creating working drawings and engineering communication.
4. To develop graphic skill for communication of concepts, ideas and design of engineering products
5. To give exposure to existing national standards related to technical drawings
6. To gather skills in technical drawing.

UNIT I - INTRODUCTION

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Conic sections including the Ellipse, Parabola and Hyperbola (eccentricity method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales

UNIT II - ORTHOGRAPHIC PROJECTIONS

Principles of Orthographic Projections- Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projections of Points and lines located in the first quadrant inclined to both planes - Determination of true lengths and true inclinations; Projection of polygonal surface and circular lamina inclined to both reference planes

UNIT IV PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V ISOMETRIC PROJECTIONS & COMPUTER GRAPHICS

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa

Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, Introduction to 3D modeling packages

SUGGESTED READINGS

1. Venugopal K and Prabhu Raja V, (2010),Engineering Graphics, New Age International Publishers.
2. C M Agrawal and Basant Agrawal, (2012), Engineering Graphics, Tata McGraw Hill, New Delhi.
3. James D. Bethune, (2015), Engineering Graphics with AutoCAD Pearson Education.
4. Narayana, K.L. & P Kannaiah, (2008), Text book on Engineering Drawing, Scitech Publishers.
5. Bureau of Indian Standards, (2003), Engineering Drawing Practices for Schools and Colleges SP 46, BIS, New Delhi.
6. Shah, M.B. & Rana B.C., (2008),Engineering Drawing and Computer Graphics, Pearson Education.
7. Bhatt N.D., (2014), Panchal V.M. & Ingle P.R, Engineering Drawing, Charotar Publishing House.

SEMESTER II

B.E Civil Engineering **2019-2020**

Semester-II

19BECE201 **Mathematics –II 4H-4C**

(Differential Equations)

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Evaluate first order differential equations including separable, homogeneous, exact and linear
    a. Solvable for p, x and y, Clairaut's form.
2. Solving differential equation of certain type and Power series solutions of Legendre polynomials, Bessel functions of the first kind and their properties.
3. To introduce the basic concepts of PDE for solving standard partial differential equations
4. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations
5. To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, to specify some difficult integration that appear in applications can be solved by complex integration in application areas such as fluid dynamics and flow of the electric current.
6. To make the student to solve various Engineering problems

Course Outcomes

The students will learn:

1. Solve first order differential equations utilizing the standard techniques for separable, exact, linear, Bernoulli cases.
2. Apply various techniques in solving differential equations and to understand the method of finding the series solution of Bessel's and Legendre's differential equations.
3. Understand how to solve the given standard partial differential equations.
4. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
5. To Evaluate complex integrals using the Cauchy integral formula and the residue Theorem and to appreciate how complex methods can be used to prove some important theoretical results.
6. To understand the fundamentals and basic concepts in vector calculus, ODE, complex functions and problems related to engineering applications by using these techniques.

UNIT I - First order ordinary differential equations

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT II - Ordinary differential equations of higher orders

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT III - Partial Differential Equations

First order partial differential equations, solutions of first order linear and non-linear PDEs-Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

UNIT IV - Partial Differential Equations

Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well posed problems), D'Alemberts solution of wave equation. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

UNIT V - Complex Integration

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

SUGGESTED READINGS

1. Hemamalini. P.T**,** (2014),Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.
2. G.B. Thomas and R.L. Finney**,** (2002),Calculus and Analytic geometry, 9th Edition,Pearson.
3. Erwin kreyszig**,** (2006),Advanced Engineering Mathematics, 9th Edition,John Wiley & Sons.
4. W. E. Boyce and R. C. DiPrima**,(2009),** Elementary Differential Equations and BoundaryValue Problems, 9th Edition**,** Wiley India.
5. S. L. Ross**, (1984),**Differential Equations, 3rd Ed.,**,** Wiley India.
6. Veerarajan T**,** (2008),Engineering Mathematics for first year,Tata McGraw-Hill, New Delhi.
7. E. A. Coddington,(1995), An Introduction to Ordinary Differential Equations, Prentice Hall India.
8. E. L. Ince**, (1958),**Ordinary Differential Equations**,** Dover Publications.
9. G.F. Simmons and S.G. Krantz,(2007),Differential Equations,Tata McGraw Hill.
10. S. J. Farlow, (1993),Partial Differential Equations for Scientists and Engineers, Dover Publications
11. R. Haberman, (1998),Elementary Applied Partial Differential equations with Fourier Series and Boundary Value, Problem4th Ed., Prentice Hall.
12. Ian Sneddon,(1964), Elements of Partial Differential Equations, McGraw Hill
13. J. W. Brown and R. V. Churchill,(2004),Complex Variables and Applications, 7th Ed., McGraw Hill.

B.E Civil Engineering **2019-2020**

Semester-II

19BECE241	**Mechanics and Mechanics of Solids (Theory &lab.)**	**7H-5C**

Instruction Hours/week: L:3 T:1 P:3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objective:

1. To develop capacity to predict the effect of force and motion.
2. To understand the theory of rigid body mechanics and newton laws.
3. To obtain knowledge on friction in limiting and nonlimiting cases.
4. To analyse various systems in terms of free body diagrams.
5. To remember stresses and deflections of beams on elastic foundations
6. To solve the relevant problems in engineering stream

Course Outcome:

1. Illustrate the vectorial and scalar representation of forces and moments.
2. Analyse the rigid body in equilibrium.
3. Evaluate the static forces exerted in rigid body.
4. Infer the concept of free body diagram.
5. Summarize the various properties of stress and strain.
6. Apply the knowledge gained from this course to solve the relevant propblems in engineering stream.

(i) Theory

Unit 1- Vector mechanics of a particle

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Solving Newton's equations of motion in polar coordinates.Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient.

Unit 2- Planar rigid body mechanics

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane;Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion. Introduction to three-dimensional rigid body motion.

Unit 3 - Statics

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Force displacement relationship; Geometric compatibility for small deformations.

Unit 4 - Mechanics of solids

Concept of stress at a point; Planet stress: transformation of stresses at a point, principal stresses and Mohr's circle; Displacement field; Concept of strain at a point; Plane strain:transformation of

strain at a point, principal strains and Mohr's circle; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding); Idealization of one dimensional stress-strain curve.

Unit 5 - Stress and strain

Bending stress; Shear stress; Cases of combined stresses; Concept of strain energy; Yield criteria; Deflection due to bending; Integration of the moment-curvature relationship for simple boundary conditions; Method of superposition (without using singularity functions); Strain energy and complementary strain energy for simple structural elements.

SUGGESTED READINGS:

1 MK Harbola,(2015),Engineering Mechanics (2nd ed.), Oxford University Press.
2 MK Verma, (2015),Introduction to Mechanics, GEMS Publisher, Coimbatore.
3 D Kleppner& R Kolenkow,(2012), An Introduction to Mechanics, Dhanpat Rai Publications
4 JL Synge & BA Griffiths,(2007), Principles of Mechanics, Milward Press
5 JL Meriam, (2012),Engineering Mechanics - Dynamics(7th ed), Wiley (7th Edition)
6 JP Den Hartog, (1985),Mechanical Vibrations, Courier Corporation.
7 SH Crandall, NC Dahl & TJ Lardner,(1978), An Introduction to the Mechanics of Solids(2nd ed.), McGraw-Hill Publishing Company.
8 EP Popov, (1998),Engineering Mechanics of Solids, Pearson.

(ii) Laboratory

Course Objective:

1. To develop basic laboratory skills and demonstrating the application of physical principles.
2. To prepare for the lab experiment and perform individually a wide spectrum of experiments.
3. To present experimental data in various appropriate forms like tabulation, and plots.
4. To analyze, Interpret and Summarize experimental results.
5. To communicate clearly understanding of various experimental principles, instruments/setup, and procedure
6. To develop the skills for understanding basic electric circuits.

Course Outcomes:

1. The students will have the knowledge on Physics practical experiments and that knowledge will be used by them in different engineering and technology applications.
2. Prepare for the lab experiment and perform individually a wide spectrum of experiments.
3. Present experimental data in various appropriate forms like tabulation, and plots.
4. Analyze, Interpret and Summarize experimental results.
5. Communicate clearly understanding of various experimental principles, instruments/setup, and procedure.
6. Prepare to develop the skills for understanding basic electric circuits.

LIST OF EXPERIMENTS – PHYSICS

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire

8. Optical fibre -Determination of Numerical Aperture and acceptance angle
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Determination of Band gap of a semiconductor.
11. Spectrometer- Determination of wavelength using grating.
12. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

B.E Civil Engineering **2019-2020**

Semester-II

19BECE242 **English** **4H-3C**

Instruction Hours/week: L:2 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional
    a. communication to meet the growing demand in the field of Global communication.
2. To help students acquire their ability to speak effectively in real life situations.
3. To inculcate the habit of reading and to develop their effective reading skills.
4. To ensure that students use dictionary to improve their active and passive vocabulary.
5. To enable students to improve their lexical, grammatical and communicative competence.
6. To improve the student's communication skill at interview level.

Course Outcomes

Students undergoing this course will be able to

1. Use English language for communication: verbal & non –verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Gain confidence in using English language in real life situations.
4. Improve word power: lexical, grammatical and communication competence.
5. To guide the students to write business letters and other forms of technical writing.
6. To enable students to prepare for oral communication in formal contexts.

Unit I - **Basic Writing Skills**

Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents - Techniques for writing precisely

Unit 1I - Vocabulary Building

The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance, with prefixes and suffixes from foreign languages in English to form derivatives. - Synonyms, antonyms, and standard abbreviations.

Unit III - Grammar and Usage

Subject-verb agreement - Noun-pronoun agreement - Misplaced modifiers – Articles – Prepositions – Redundancies - Clichés

Unit IV - Listening and Reading Skills

Note taking- viewing model interviews – listening to informal conversations – improving listening / reading comprehension – reading model prose / poems – reading exercise

Unit V - **Writing Practices** Comprehension - Précis Writing - Essay Writing Listening Comprehension - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

SUGGESTED READINGS

1. Sangeeta Sharma , Meenakshi Raman,(2015),Technical Communication: Principles And Practice, 2nd Edition, OUP, New Delhi.
2. Sanjay Kumar and PushpLata, (2011),Communication Skills ,Oxford University Press.
3. Liz Hamp - Lyons and Ben Heasly, (2006),Study Writing, Cambridge University Press.
4. F.T. Wood., (2007), Remedial English Grammar, Macmillan.
5. Michael Swan, (1995),Practical English Usage, OUP.

B.E Civil Engineering **2019-2020**

Semester-II

19BECE243 **Programming for Problem solving (Theory & Lab.)** **7H-5C**

Instruction Hours/week: L:3 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

1. Identify and understand the working of key components of a computer program.
2. Identify and understand the various kinds of keywords and different data types of C programming
3. Understand, analyze and implement software development tools like algorithm,
4. pseudo codes and programming structure
5. Study, analyze and understand logical structure of a computer program, and differentconstruct to develop a program in "C" language
6. To use algorithms and programs in practical applications.

Course Outcomes

The course will enable the students

1. To formulate simple algorithms for arithmetic and logical problems
2. To translate the algorithms to programs (in C language)
3. To test and execute the programs and correct syntax and logical errors
4. To implement conditional branching, iteration and recursion
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach
6. To use arrays, pointers and structures to formulate algorithms and programs

Unit I – Introduction to Programming, Arithmetic expressions and precedence

Introduction to Programming-Flowchart / pseudocode, compilation, Variables including data types, Arithmetic expressions and precedence.

Unit II – Conditional Branching and Loops

Conditional Branching – Loops Writingandevaluation of conditionals and consequent branching, Iteration and loops.

Unit III – Arrays and Basic Algorithms

Arrays1-D,2-D,CharacterarraysandStrings **Basic Algorithms**: Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity.

Unit IV – Function and Recursion

Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc.

Unit V - Structure, Pointers and File Handling

Pointers, Structures including self-referential structures e.g., linked list, notional introduction, File handling in C.

SUGGESTED READINGS

1. E. Balagurusamy,(2017) Computing Fundamentals and C Programming, 5th Edition, TMH Education
2. E. Balaguruswamy (2017), Programming in ANSI C, 7th Edition, Tata McGraw-Hill,
3. Byron Gottfried (2017), Schaum's Outline of Programming with C, 3rd Edition, McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie,(2015) The C Programming Language, 2nd Edition, Prentice Hall of India

(ii) Laboratory

Course Objectives

1. To provide an awareness to Computing and C Programming
2. To know the correct and efficient ways of solving problems
3. To learn to develop algorithm for simple problem solving
4. To be able to declare pointers of different types and use the mind defining self- referential structures.
5. To be able to create, read and write to and from simple text files.
6. To represent data in arrays

Course outcomes

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

List of Experiments

Tutorial 1: Problem solving using computers:
Lab 1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5:1DArrays: searching, sorting:
Lab 5:1DArray manipulation
Tutorial 6:2D arrays and Strings, memory structure:
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8and 9: Numericalmethods problems
Tutorial 10: Recursion, structure of recursive calls:
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

B.E Civil Engineering **2019-2020**

Semester-II

19BECE211 Workshop / Manufacturing Practices Laboratory5H-3C

Instruction Hours/week: L:1 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To prepare the students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. To prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice.
3. To gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
4. To fabricate components with their own hands.
5. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
6. By assembling different components, they will be able to produce small devices of their interest.

Course Outcomes

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
2. Students will be able to fabricate components with their own hands.
3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
4. By assembling different components, they will be able to produce small devices of their interest.
5. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
6. Communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice.

i) Lectures & videos: (10 PERIODS)

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical &Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**

6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

ii) Workshop Practice: (60 PERIODS)

9 Machine shop **(10 Periods)**
10 Fitting shop **(8 Periods)**
11 Carpentry **(6 Periods)**
12 Electrical &Electronics**(8 Periods)**
13 Welding shop **(8 hours (Arc welding 4 Periods + gas welding 4 Periods)**
14 Casting **(8 Periods)**
15 Smithy **(6 Periods)**
16 Plastic moulding& Glass Cutting **(3 Periods)**
17 Plumbing Exercises **(3 Periods)**

SUGGESTED READINGS

1. Jeyachandran, K. and Balasubramanian, S,(2007), A Premier on Engineering Practices Laboratory, Anuradha Publications, Kumbakonam.
2. Jeyapoovan, T., Saravanapandian, M, (2006), Engineering Practices Lab Manual, Vikas Puplishing House Pvt. Ltd, Chennai.
3. Bawa, H.S, Workshop Practice, (2007), Tata McGraw – Hill Publishing Company Limited, New Delhi.
4. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K, (2008&2010), Elements of Workshop Technology", Vol. I and Vol. II, Media promoters and publishers private limited.
5. Gowri P. Hariharan and A. Suresh Babu, (2008), Manufacturing Technology – I, Pearson Education.
6. Kalpakjian S. And Steven S. Schmid, (2002), Manufacturing Engineering and Technology, Pearson Education India Edition.
7. Roy A. Lindberg, (1998), Processes and Materials of Manufacture, Prentice Hall India.
8. Rao P.N., (2017),Manufacturing Technology, Vol. I and Vol. II, Tata McGrawHill House.

SEMESTER III

B.E Civil Engineering **2019-2020**

Semester-III

19BECE301 **Mathematics –III** **4H-4C**

(Transform & Discrete Mathematics)

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The objective of this course is to familiarize the students with statistical techniques.
2. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.
3. To understand the basic concepts of Set Theory.
4. To extend student's logical and mathematical maturity and ability to deal with abstraction.
5. To understand the basic concepts of graph theory.
6. To make the student to solve their core Engineering problems.

Course Outcomes

The students will learn:

1. To have a lucid idea about Laplace Transforms.
2. To equip themselves in the different Transform techniques like Z transforms.
3. To aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
4. To apply agivenlogic sentence express it in terms of predicates, quantifiers, and logical connectives.
5. To develop the given problem as graph networks and solve with techniques of graph theory.
6. To develop the fundamentals and basic concepts in Laplace transform ,Set Theory and to solve problems related to engineering applications by using these techniques.

UNIT I - Transform Calculus -1

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method.

UNIT II -Transform Calculus-2

Z-transform and properties, methods, inverses and their applications.

UNIT III – Sets, Relation and Function

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

UNIT IV–Logic and Proofs

Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Proof methods and strategy.

UNIT V –Graphs

Graphs and graph models – Graph terminology and special types of graphs–Matrix representation of graphs and graph isomorphism– Connectivity – Euler and Hamilton paths.

SUGGESTED READINGS

1. Erwin kreyszig**,** (2006),Advanced Engineering Mathematics, 9th Edition,John Wiley & Sons**.**
2. Veerarajan T**,** (2008),Engineering Mathematics for first year,Tata McGraw-Hill, New Delhi.
3. Ramana B.V**,** (2010),Higher Engineering Mathematics, 11th Reprint, Tata McGraw Hill New Delhi.
4. Hemamalini. P.T**,**(2014),Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.
5. K. H. Rosen, Discrete Mathematics and its Applications, 7th Edition, Tata McGraw-Hill, Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
6. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30^{th}Reprint, 2011.
7. S.Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3^{rd}Edition, 2010.
8. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,2000.
9. N. Deo, Graph Theory, Prentice Hall of India,1974.

B.E-Civil Engineering **2019-2020**

Semester-III

19BECE302	**Biology for Engineers**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To understand the basics of biology
2. To gain knowledge about different biomolecules
3. To get familiarize with human diseases
4. To learn about different clinical investigations
5. To know the recent advances in biology
6. To gain recent advancements in the field of biology.

Course Outcomes

At the end of the course

1. Summarize the cell structures and its functions
2. Explain the Biomolecules functions
3. Classify the communicable and non communicable human diseases
4. Illustrate the different organ function tests
5. Tell the applications of biology in environmental applications
6. Describe the applications of biology in concrete technology

UNIT I - BASICS OF BIOLOGY

Cell structure: Prokaryotic and eukaryotic cells, Animal and Plant Cell, Cell cycle – Mitosis - Meiosis,

UNIT II - BIOMOLECULES

Nucleic acid – DNA – Structure - types, RNA – Structure – types, Proteins – classification, biological functions, carbohydrates - classification, biological functions, lipids – classification, biological functions, Hormones-definition, importance; Vitamins.

UNIT III – HUMAN DISEASES

Communicable diseases –Tuberculosis, Chikungunya, Dengue, Influenza, HIV/AIDS; Non Communicable diseases – Diabetes, Cancer, Cardiovascular diseases.

UNIT IV – ORGAN FUNCTION TESTS

Liver function tests – Functions of liver- Tests to assess liver function- Bilirubin related liver test; Renal function tests – Tests to assess renal function - Clearance test – Creatine and urea- Urine concentration test; Gastric function tests – Tests to assess gastric function - Fractional test meal, Alcohol test meal, Insulin test meal; Pancreatic Function Test –Secretin test, Lundh test.

UNIT V – APPLICATIONS OF BIOLOGY IN CIVIL ENGINEERING

Microorganisms – Types of microorganisms, Application of microorganisms in civil engineering; Environmental engineering - Waste water management - Phytoremediation technique; solid waste management - Composting method; Biological oxygen demand (BOD), chemical oxygen demand (COD); Concrete technology- Self healing bacterial concrete.

SUGGESTED READINGS:

1. R.C.Dubey, S. Chand. (2013). A Text book of Biotechnology, Higher Academic Publications.
2. Arthur T. Johnson. (2016). Biology for Engineers, CRC Press, Taylor and Francis.
3. Satyanaraynaa. (2017). Biochemistry, 5th edition. Books and allied PVT ltd.
4. Carol D. Tamparo and Marcia A. Lewis, F.A. (2011) Diseases of the Human Body, Davis Company.
5. Satyanaraynaa. (2016). Biotechnology, Books and allied PVT Ltd.
6. Shetty M.S. (2018). Concrete Technology Theory and Practice, S. Chand & Company Ltd.

B.E Civil Engineering **2019-2020**

Semester-III

19BECE303 **Energy Science & Engineering** **2H-2C**

Instruction Hours/week: L: 1 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The objective of this Course is to provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field
2. To emphasis on alternative energy sources and their technology and application.
3. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy,
4. To focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear.
5. To know the energy conservation methods will be emphasized from Civil Engineering perspective.
6. The knowledge acquired lays a good foundation for design of various civil engineering systems/ projects dealing with these energy generation paradigms in an efficient manner.

Course Outcomes

1. List and generally explain the main sources of energy and their primary applications nationally and internationally
2. Have basic understanding of the energy sources and scientific concepts/principles behind them
3. Understand effect of using these sources on the environment and climate
4. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
5. List and describe the primary renewable energy resources and technologies.
6. To quantify energy demands and make comparisons among energy uses, resources, and technologies.

Proposed Syllabus

UNIT-I*: Introduction to Energy Science:* Introduction to Energy, sustainability and the environment. Primary energy sources – world energy resources–Indian energy scenario–energy cycle of the earth – environmental aspects of energy utilization, CO_2 emissions and Global warming–renewable energy resources and their importance.

UNIT-II: *Energy Sources:* Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; energy storage or regeneration.

UNIT-III: *Energy & Effect on Environment:* Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability, energy economics; Climate change, acid rain, ozone layer depletion, Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act.

UNIT-IV: *Civil Engineering Projects connected with the Energy Sources:* Coal mining technologies, Oil exploration off shore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear fuel storage and disposal systems.

UNIT-V: *Engineering for Energy conservation: Energy Auditing:* Need, Types, Methodology and Barriers. Role of energy Managers. Instruments for energy auditing. Concept of Green Building and Green Architecture; Green building concepts; Energy conservation opportunities Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems.

Text/Reference Books:

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
6. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
7. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
8. Rai G.D (2011). An Non conventional Energy sources; Khanna Publishers, New Delhi.
9. Related papers published in international journals

B.E Civil Engineering **2019-2020**

Semester-III

19BECE304 **Introduction to Civil Engineering** **2H-2C**

Instruction Hours/week: L: 2 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
2. To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
3. To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.
4. To Exploration of the various possibilities of a career in this field
5. To Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering
6. To Understanding the vast interfaces this field has with the society at large

Course Outcomes

1. Introduction to what constitutes Civil Engineering
2. Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering
3. Highlighting the depth of engagement possible within each of these areas
4. Exploration of the various possibilities of a career in this field
5. Understanding the vast interfaces this field has with the society at large
6. Providing inspiration for doing creative and innovative work

UNIT I Basic Understanding: What is Civil Engineering/ Infrastructure?Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career.

Overview of National Planning for Construction and Infrastructure Development; Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;

Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities

Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes

UNIT II Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management
Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;
Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling

UNIT III Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi- purpose reservoir projects
Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;
Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;

UNIT IV Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbor and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.
Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non- Destructive testing systems; Use of carbon fiber wrapping and carbon composites in repair.

UNIT Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP,STAAD, MATLAB, ETAB,MIKE 21,MODFLOW,REVIT,TEKLA, AUTOCAD, GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS)

Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R.(1979), Law of Contract, Oxford University Press
9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.

11. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
14. Bare text (2005), Right to Information Act
15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
17. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
18. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd
19. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
20. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
21. Engineering Ethics, National Institute for Engineering Ethics, USA
22. www.ieindia.org
23. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
24. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS
25. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
26. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractslaw1.html
27. Contract &Agreements , http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
28. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
29. Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
30. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html
32. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf

B.E Civil Engineering **2019-2020**

Semester-III

19BECE305 **Engineering Mechanics** **4H-4C**

Instruction Hours/week: L: 3 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To provide an introductory treatment of *Engineering Mechanics* to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters.
2. A working knowledge of statics with emphasis on force equilibrium and free body diagrams.
3. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems.
4. To understanding of the mechanical behavior of materials under various load conditions.
5. To apply Newton's laws of motion in practical experiences.
6. To apply basic knowledge of maths and physics to solve real-worldproblems

Course Outcomes

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
3. Apply basic knowledge of maths and physics to solve real-worldproblems
4. Understand measurement error, and propagation of error in processed data
5. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
6. Understand basic dynamics concepts – force, momentum, work and energy;

Proposed Syllabus

UNIT-I

Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT-II

Friction: Introduction to friction- Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Basic Structural Analysis: Equilibrium in three dimensions; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames.

UNIT-III

Centroid and Centre of Gravity: Centroid of simple figures from first principle, Centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder,

Cone, Sphere, Hook.

UNIT-IV

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium- Stability of equilibrium.

UNIT-V

Review of particle dynamics and Introduction to Kinetics of Rigid Bodies- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).
Introduction to Kinetics of Rigid Bodies-Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Text/Reference Books:

2. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
3. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
5. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
6. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
7. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
8. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
9. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
10. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
11. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

B.E Civil Engineering **2019-2020**

Semester-III

19BECE306 **Effective Technical Communication** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

OBJECTIVE:

1. Will understand the role of thinking in all forms of communication.
2. Students will gain the neutral accent.
3. To guide students to read and comprehend articles from newspapers and magazines.
4. To equip students with oral and appropriate written communication skills.
5. To assist students with employability and job search skills.
6. Self-development of the students will be increase.

OUTCOMES:

1. Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicative strategies.
2. Enhance them reading texts critically and analytically.
3. Develop writing effectively, persuasively and producing different types of writing such as narration, description, exposition and argument.
4. Improve their lexical, grammatical and communicative competence.
5. Will gain knowledge in creative, critical, analytical and evaluative writing.
6. Enrich the ability to face interviews with confidence.

UNIT-I: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

UNIT-II : Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-III: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity

UNIT-IV: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

UNIT-V: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, engineering ethics, managing time, Role and responsibility of engineer,

Work culture in jobs, Personal memory, Rapid reading, taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

B.E Civil Engineering **2019-2020**

Semester-III

19BECE341	**Basic Electronics**	**3H-3C**

Instruction Hours/week: L:2 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives

1. To provide an overview of various Diodes and other electronics components
2. To provide an overview of various transistors and their configurations
3. To provide an overview of application of various electronic devices
4. To gain confidence in handling and usage of electronic devices, tools and instruments in engineering applications
5. To obtain knowledge on the principles and procedure for the analysis of Circuit theory.
6. To understand the basic concepts in DC (circuit) and AC (circuit) Fundamentals.

COURSE OUTCOMES

At the end of the course the students will

1. Know broadly the concepts and functionalities of the electronic devices, tools and instruments
2. Understand use, general specifications and deploy abilities of the electronic devices, and assemblies.
3. Gain confidence in handling and usage of electronic devices, tools and instruments in engineering applications
4. Gain knowledge on the principles and procedure for the analysis of Circuit theory.
5. Understand the basic concepts in DC (circuit) and AC (circuit) Fundamentals.
6. Understand the basic principles of electromagnetic fields.

UNIT I DIODES AND APPLICATIONS

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;

UNIT II TRANSISTOR CHARACTERISTICS

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits

UNIT III TRANSISTOR AMPLIFIERS AND OSCILLATORS

Classification, Small Signal Amplifiers –Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages

of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

UNIT IV OPERATIONAL AMPLIFIERS AND APPLICATIONS

Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground

SUGGESTED READINGS

1. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India
2. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India
3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education,
4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH
5. R.T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson

(ii) Laboratory

Course Objective

- To learn the characteristics of basic electronic devices
- To understand the basic operation of electronic equipments
- To learn the working of rectifiers and power supply
- To understand the basics of logic gates and other digital circuits

COURSE OUTCOME

On completion of this laboratory course, the student should be able to:

- Design amplifiers for any given frequency
- Design oscillators for any frequency
- Construct simple digital design using logic gates.
- Construct any bit counter using Flip-flop

List of Experiments

1. Characteristics of PN diode and Zener Diode
2. Common Emitter input-output Characteristics
3. Frequency Response of CE and CS amplifier
4. JFET in Common Source (CS) Configuration
5. Integrator and Differentiator using Op-amp.
6. Phase shift and Wien bridge oscillators using Op-amp.
7. Functional verification of logic Gates
8. Realization of Flipflop using Logic gates
9. Design of Up/Down counter

B.E Civil Engineering

Semester-III

19BECE311 Computer-aided Civil Engineering Drawing 3H-2C

Instruction Hours/week: L: 1 T: 0 P: 2 Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course Objectives

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically/ visually
4. Examine a design critically and with understanding of CAD .
5. To interpret drawings, and to produce designs using a combination of 2D and 3D software.
6. To understand another person's designs, and to get exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice

Course Outcomes

1. Develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually as well as understand another person's designs, and to get exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice
2. Develop parametric design and the conventions of formal engineering drawing
3. Produce and interpret 2D & 3D drawings
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Do a detailed study of an engineering artifact
6. Develop drawings for conventional structures using practical norms.

UNIT-I:*INTRODUCTION***;** Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT-II: *SYMBOLS AND SIGN CONVENTIONS*: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT-III: *BUILDING DRAWING*: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

UNIT-IV: *PICTORIAL VIEW*: Principles of isometrics and perspective drawing. Perspective view of building.

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows.

Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words.

2. RCC framed structures
3. Reinforcement drawings for typical slabs, beams, columns and spread footings.
4. Industrial buildings - North light roof structures - Trusses
5. Perspective view of one and two storey buildings

Text/Reference Books:

1. Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing" , Standard Publishers
2. Ajeet Singh (2002), " Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham Tickoo Swapna D (2009), " AUTOCAD for Engineers and Designers" , Pearson Education,
4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.,
5. Balagopal and Prabhu (1987), " Building Drawing and Detailing", Spades publishing KDR building, Calicut,
6. (Corresponding set of) CAD Software Theory and User Manuals.
7. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
8. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,

SEMESTER IV

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE401 **Introduction to Mechanical Engineering** **3H-3C**

Instruction Hours/week: L: 2 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To explain the basic theorems used in mechanical engineering.
2. To explain the fundamentals of manufacturing process and machine tools.
3. To explain the principles of refrigeration and air- conditioning
4. To Study about the operations of power plants.
5. To know about the automobile engineering
6. To Gain the basic manufacturing and machining processes.

Course Outcomes

1. To impart the basic knowledge of various basic fields of mechanical engineering.
2. Gain the basic manufacturing and machining processes.
3. Able to know about basic machining process.
4. Study about the operations of power plants.
5. Know about the automobile engineering
6. The principles of refrigeration and air- conditioning

INTRODUCTION (Not included for examination)
Engineering and Technology - History of Mechanical Engineering- Mechanics - Statics and dynamics - Broad areas in Mechanical Engineering.

UNIT I **MANUFACTURING PROCESSES FOUNDRY** - Principles - Patterns - Types, Molding Processes, Cupola and Induction Furnaces. METAL FORMING - Principles - Hot and cold working of metals - Forging, rolling, extrusion and wire drawing, sheet metal operations. WELDING - Principles - Oxy-Acetylene Welding and Manual Metal Arc Welding, Brazing and Soldering.

UNIT II **MACHINE TOOLS**
Machining principles - Construction and working principles of basic machine tools - Lathe, Drilling, Shaper, Planer and Milling machine. Introduction to CNC machines.

UNIT III **AUTOMOBILE ENGINEERING**
Working principle of petrol and diesel engines - Four stroke and two stroke cycles - Comparison between four stroke and two stroke engines - Working principle of simple carburetor - Lubrication system and cooling system.

UNIT IV **ENERGY ENGINEERING & HYDRAULIC MACHINES**
Introduction to Boilers - Working principle of Thermal, Hydro - Electric and Nuclear Power Plants - Merits and demerits. Solar – Wind power plants.
Turbines - Impulse turbine - Pelton wheel, Reaction turbines - Kaplan and Francis turbines - Pumps - Working principle of Reciprocating pumps and Centrifugal pumps.

UNIT V **REFRIGERATION AND AIR- CONDITIONING**
Terminology of Refrigeration and Air Conditioning - Basic principles of Vapour Compression and Absorption Refrigeration System – Window and Split Room Air Conditioners.

TEXT BOOKS

S.No	Title of the book	Author(s) Name	Publisher	Year of Publication
1	Basic Mechanical Engineering	Shanmugam,	Tata McGraw Hill Publishing company Limited, New Delhi	2010
2	Basic Mechanical Engineering	Rajput, R.K	Laxmi Publications (P) Ltd, New Delhi	2008

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE402 **Engineering Geology** **2H-2C**

Instruction Hours/week: L: 2 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Identify the main and most common igneous, sedimentary and metamorphic rocks encountered by foundations and construction.
2. To identify and define the main morphological and geological characteristics as shown on maps
3. Analyze geological parameters important in geotechnical studies.
4. To establish and describe topographical and geological sections,
5. Identify potential geological hazards and various structures and ways of preventing and dealing with them
6. To collect, analyze, and report geologic data using standards in engineering practice

Course Outcomes:

1. Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice
2. The fundamentals of the engineering properties of Earth materials and fluids.
3. Rock mass characterization and the mechanics of planar rock slides and topples.
4. Soil characterization and the Unified Soil Classification System.
5. The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.
6. Students are able to identify the different types of formation of earth.

UNIT I General Geology: Geology in Civil Engineering – Branches of geology – Earth Structures and composition –Earth processes – Weathering – Work of rivers, wind and sea and their engineering importance – Seismic activity-Seismo-tectonics of Indian plates, seismic zones of India-Ground water.

UNIT II Mineralogy: Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming minerals – Quartz family. Feldpar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet – properties, behaviour and engineering significance of clay minerals – Fundamentals of process of formation of ore minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III Petrology: Classification of rocks – distinction between igneous, sedimentary and metamorphic rocks. Description, occurrence, engineering properties and distribution of following rocks. Igneous rocks – Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite and Basalt Sedimentary rocks sandstone, Limestone, shale conglo, Metamorphic rocks. Quartizite, Marble, Slate, Phyllite, Gniess and Schist.

UNIT IV Structural Geology And Geophysical Method: Attitude of beds – Outcrops – Introduction to Geological maps – study of structures – Folds, faults and joints – Seismic and Electrical methods for Civil Engineering investigations- Geophysical investigation

UNIT V Investigations In Civil Engineering : Remote sensing techniques – Study of air photos and satellite images – Interpretation for Civil Engineering projects – Geological conditions necessary for construction of Dams, Tunnels, Buildings, Road cuttings, Landslides – Causes and preventions. Sea erosion and coastal protection.

Text/Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE403 Disaster Preparedness & Planning Management 2H-2C

Instruction Hours/week: L: 1 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

1. To understand basic concepts in Disaster Management
2. To understand Definitions and Terminologies used in Disaster Management
3. To understand Types and Categories of Disasters
4. To understand the Challenges posed by Disasters
5. To understand Impacts of Disasters Key Skills
6. To understand Categories of Disasters

Course Outcome

The student will develop competencies in

1. The application of Disaster Concepts to Management
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters
4. Realization of the responsibilities to society
5. The Challenges posed by Disasters
6. Understand the impacts of Disasters Key Skills

UNIT-I: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation).

UNIT-II: Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT-III: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-IV: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post- disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Alternate Communication systems-Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT-V: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land- use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text/Reference Books:

2. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
3. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
6. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
7. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
8. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE404	**Introduction to Solid Mechanics**	**2H-2C**

Instruction Hours/week: L: 2 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

1. To introduce to continuum mechanics and material modeling of engineering materials based on first energy principles: deformation and strain.
2. To know about momentum balance, stress and stress states; elasticity and elasticity bounds; plasticity and yield design.
3. The overarching theme is a unified mechanistic language using thermodynamics
4. To understanding, modelling and design of a large range of engineering materials.
5. The subject of mechanics of materials involves analytical methods for determining the strength, stiffness (deformation characteristics)
6. To know stability of the various members in a structural system.

Course Outcome

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components.
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods.
3. Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wallbeams.
4. Calculate the deflection at any point on a beam subjected to a combination of loads.
5. Solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points.
6. Solve torsion problems in bars and thin walled members

UNIT-I: *Simple Stresses and Strains*- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT-II: Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

UNIT-III: Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of

concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT-IV: *Flexural Stresses-Theory of simple bending* – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.
Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.
Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

UNIT-V: Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.
Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

List of Experiments:

1. Tension test
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete
4. Impact test
5. Shear test
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation
7. Determination of torsion and deflection,
8. Measurement of forces on supports in statically determinate beam,
9. Determination of shear forces in beams,
10. Determination of bending moments in beams,
11. Measurement of deflections in statically determinate beam,
12. Measurement of strain in a bar
13. Bend test steel bar;
14. Yield/tensile strength of steel bar;

Text/Reference Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
5. Laboratory Manual of Testing Materials - William Kendrick Hall
6. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE441 Instrumentation & Sensor Technologies for Civil Engineering Applications 4H-3C

Instruction Hours/week: L: 1 T: 1 P: 2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making.
2. To understand theoretical and practical principles of design of sensor systems
3. To allow students to prepare, deploy and analyze observations from standard instruments.
4. Laboratory experiments shall be used on application of concepts introduced in the lectures.
5. To describe the requirements during the transmission of measured signals
6. To construct Instrumentation/Computer Networks
7. To suggest proper sensor technologies for specific applications

Course Outcomes:

1. To analyze the errors during measurements
2. To specify the requirements in the calibration of sensors and instruments
3. To describe the noise added during measurements and transmission
4. To describe the measurement of electrical variables
5. To describe the requirements during the transmission of measured signals
6. To construct Instrumentation/Computer Networks

UNIT-I*: Fundamentals of Measurement, Sensing and Instrumentation covering* definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations;

UNIT-II*: Sensor Installation and Operation covering to:* i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

UNIT-III*: Data Analysis and Interpretation covering* a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

UNIT-IV*: Frequency Domain Signal Processing and Analysis covering* Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

Tutorials *from the above modules* demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report

Practical's:

Instrumentation of typical civil engineering members/structures/structural elements Use of different sensors, strain gauges, inclinometers,
Performance characteristics Errors during the measurement process Calibration of measuring sensors and instruments Measurement, noise and signal processing Analog Signal processing
Digital Signal Processing Demonstration & use of sensor technologies

Text/Reference Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e,Butterworth Heinemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
4. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE442 **Introduction to Fluid Mechanics** **4H-3C**

Instruction Hours/week: L: 2 T: 0 P: 2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

1. The course provides a first level exposure to the students to fluid statics, kinematics and dynamics.
2. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems.
3. A training to analyze engineering problems involving fluids – such as those dealing with pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river
4. To know the groundwater flow - with a mechanistic perspective is essential for the civil engineering students.
5. To apply the continuity, momentum and energy principles
6. To apply dimensional analysis

Course Outcome

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Be able to apply the continuity, momentum and energy principles
5. Be able to apply dimensional analysis
6. Understand the open channel flow, jets, turbines and pumps, dams and spillways, culverts, river.

UNIT-I: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT-II: Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT-III: Fluid Kinematics- Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

UNIT-IV: Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber *Number and Euler Number;*

Buckingham's π-Theorem.

Lab Experiments

1. Calculation of viscosity
2. Study of Pressure Measuring Devices
3. Verification of Bernoulli's Theorem
4. Venturimeter
5. Orifice meter
6. Impacts of jets
7. Velocity distribution in pipes
8. Laminar Flow

Text/Reference Books:

2. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
3. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
4. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
5. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE443	**Surveying & Geomatics**	**4H-3C**

Instruction Hours/week: L: 1 T: 1 P: 2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

With the successful completion of the course, the student should have the capability to:

1. describe the function of surveying in civil engineering construction,
2. Work with survey observations, and perform calculations,
3. Customary units of measure. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
4. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,
5. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check leveling measurements,
6. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments,

Course Outcomes

1. Students will gain basic knowledge of surveying and unit conversions and its pronviple.
2. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
3. Translate the knowledge gained for the implementation of Civil infrastructure facilities
4. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetric and Remote Sensing.
5. Able to measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments,
6. Able to identify and calculate the errors in measurements

UNIT-I: *Introduction to Surveying (8 hours):* Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.

*Triangulation and Trilateration***:** Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric leveling - Axis single corrections.

UNIT-II: Curves-Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

UNIT-III: *Modern Field Survey Systems* : Principle of Electronic Distance Measurement,

Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications,Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT-IV: *Photogrammetry Surveying*: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

UNIT-V: *Remote Sensing*: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

Text/Reference Books:

2 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3 Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
4 Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
5 Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
6 Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
7 Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE444 **Materials, Testing & Evaluation** **5H-4C**

Instruction Hours/week: L: 2 T: 0 P: 3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

1. Make measurements of behavior of various materials used in Civil Engineering.
2. Provide physical observations to complement concepts learnt
3. Introduce experimental procedures and common measurement instruments, equipment, devices.
4. Exposure to a variety of established material testing procedures and techniques
5. Different methods of evaluation and inferences drawn from observations
6. To compute engineering values (e.g. stress or strain) from laboratory measures

Course outcomes

1. Calibrate electronic sensors
2. Operate a data acquisition system
3. Operate various types of testing machines
4. Configure a testing machine to measure tension or compression behavior
5. Compute engineering values (e.g. stress or strain) from laboratory measures
6. Analyze a stress versus strain curve for modulus, yield strength and other related attributes

UNIT-I : *Introduction to Engineering Materials covering,* Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

UNIT-II : *Introduction to Material Testing covering,* What is the " Material Engineering" ?; Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

UNIT-III: *Standard Testing & Evaluation Procedures covering,* Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep.

Practical's:

- Gradation of coarse and fine aggregates
- Different corresponding tests and need/application of these tests in design and quality control
- Tensile Strength of materials & concrete composites
- Compressive strength test on aggregates
- Tension I - Elastic Behaviour of metals & materials
- Tension II - Failure of Common Materials
- Direct Shear - Frictional Behaviour
- Concrete I - Early Age Properties
- Concrete II - Compression and Indirect Tension
- Compression – Directionality
- Soil Classification
- Consolidation and Strength Tests
- Tension III - Heat Treatment
- Torsion test
- Hardness tests (Brinnel's and Rockwell)
- Tests on closely coiled and open coiled springs
- Theories of Failure and Corroboration with Experiments
- Tests on unmodified bitumen and modified binders with polymers
- Bituminous Mix Design and Tests on bituminous mixes - Marshall method
- Concrete Mix Design as per BIS

Text/Reference Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
6. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards* (post 2000)
7. Related papers published in international journals

B.E Civil Engineering **2019-2020**

Semester-IV

19BECE451 Civil Engineering–Societal &Global Impact 2H-2C

Instruction Hours/week: L: 2 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

1. Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
2. Awareness of the impact of Civil Engineering for the various specific fields of human Endeavour
3. Need to think innovatively to ensure Sustainability.
4. To know the requirements for energy and how they are met: past, present and future
5. To know the impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
6. To applying professional and responsible judgement and take a leadership role.

Course objectives

1. The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
2. The extent of Infrastructure, its requirements for energy and how they are met: past, present and future
3. The Sustainability of the Environment, including its Aesthetics,
4. The potentials of Civil Engineering for Employment creation and its Contribution to the GDP
5. The Built Environment and factors impacting the Quality of Life
6. The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.

UNIT-I: Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;

UNIT-II: Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering

UNIT-III: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for

ensuring Sustainability;

UNIT-IV: Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationary and non- stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

UNIT-V: Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

UNIT-VI: Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

Text/Reference Books:

1. *Žiga* Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
3. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
4. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
5. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
6. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
7. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
8. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
9. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
10. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research**.** Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.

SEMESTER V

B.E Civil Engineering **2019-2020**

Semester-V

19BECE501 **Mechanics of Materials** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Understand the deformation and strains under different load action and response in terms of forces and moments
2. Understand the behavior under different loading actions
3. Application of engineering principles to calculate the reactions, forces and moments
4. Understand the energy methods used to derive the equations to solve engineering problems
5. Make use of the capabilities to determine the forces and moments for design.
6. To understand the impact of engineering solutions in a global and societal context

Course Outcomes:

At the end of the course, the student will have

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design a system, component, or process to meet desired needs
3. an ability to identify, formulate, and solve engineering problems
4. the broad education necessary to understand the impact of engineering solutions in a global and societal context
5. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. an ability to apply principles of engineering, basic science, and math to model, analyze, design and realize physical systems, components or processes

Proposed Syllabus

UNIT-I: *Deformation and Strain covering* description of finite deformation, Infinitesimal deformation; Stability of dams, retaining walls and chimneys;
Generalized state of stress and strain: Stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-Westerguard's stress space.

UNIT-II: *Momentum Balance and Stresses covering* Forces and Moments Transmitted by Slender Members, Shear Force and Bending Moment Diagrams, Momentum Balance, Stress States / Failure Criterion. *Mechanics of Deformable Bodies covering* Force-deformation Relationships and Static Indeterminacy, Uniaxial Loading and Material Properties, Trusses and Their Deformations, Statically Determinate and Indeterminate Trusses,

UNIT-III: *Force-Stress-Equilibrium covering* Multiaxial Stress and Strain------- *Displacement – Strain covering* Multiaxial Strain and Multiaxial Stress-strain Relationships

UNIT-IV: *Elasticity and Elasticity Bounds covering* Stress-strain-temperature Relationships and Thin-walled Pressure Vessels, Stress and strain Transformations and Principal Stress, Failure of Materials,

UNIT-V: *Bending: Stress and Strains; Deflections and Torsion covering* Pure Bending, Moment-curvature Relationship, Beam Deflection, Symmetry, Superposition, and Statically Indeterminate

Beams, Shear and Torsion, Torsion and Twisting, Thermoelasticity, Energy methods, Variational Methods; Strain energy, elastic, complementary and total strain energy, Strain energy of axially loaded bar, Beam in bending, shear and torsion; General energy theorems, Castigliano's theorem, Maxwell Bettie's reciprocal theorem; Virtual work and unit load method for deflection, Application to problems of beams and frames.

UNIT-VI: *Structural stability;* Stability of columns, Euler's formula, end conditions and effective length factor, Columns with eccentric and lateral load; Plasticity and Yield Design covering 1D-Plasticity – An Energy Approach, Plasticity Models, Limit Analysis and Yield Design

Text/Reference Books:

2. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" Mc Graw Hill, Tokyo, Japan.
3. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
4. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India.
5. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
6. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
7. Gere, J. M., and S. P. Timoshenko. *Mechanics of Materials.* 5th ed. Boston: PWS Kent Publishing, 1970.
8. Ashby, M. F., and D. R. H. Jones. *Engineering Materials, An Introduction to their Properties and Applications.* 2nd ed. Butterworth Heinemann.
9. Collins, J. A. *Failure of Materials in Mechanical Design.* 2nd ed. John Wiley & Sons, 1993.
10. Courtney, T. H. *Mechanical Behavior of Materials.* McGraw-Hill, 1990.
11. Hertzberg, R. W. *Deformation and Fracture Mechanics of Engineering Materials.* 4th ed. John Wiley & Sons, 1996.
12. Nash, W. A. *Strength of Materials.* 3d ed. Schaum's Outline Series, McGraw-Hill, 1994.

B.E Civil Engineering **2019-2020**

Semester-V

19BECE502 **Structural Engineering** **3H-3C**

Instruction Hours/week: L: 2 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

1. This course aims at providing students with a solid background on principles of structural engineering design.
2. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels.
3. Hands-on design experience and skills will be gained and learned through problem sets and a comprehensive design project.
4. An understanding of real-world open-ended design issues will be developed. Weekly recitations and project discussions will be held besides lectures.
5. To gain the knowledge of different analysis involved in structures.
6. To identify the failures involved in buildings

Course Outcomes:

1. The students will be able to apply their knowledge of structural mechanics in addressing design problems of structural engineering
2. They will possess the skills to solve problems dealing with different loads and concrete and steel
3. They will have knowledge in structural engineering
4. Students will gain the knowledge of different analysis involved in structures.
5. Students will be able to know about the different structural elements and their designing.
6. They are able to identify the failures involved in buildings.

UNIT-I: Introduction- concepts of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; what is a structural engineer, role of engineer, architect, user, builder; what are the functions' what do the engineers design, first principles of process of design

UNIT-II: Planning and Design Process; Materials, Loads, and Design Safety; Behaviour and Properties of Concrete and Steel; Wind and Earthquake Loads

UNIT-III: *Materials and Structural Design Criteria:* Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames, and design philosophies for structural engineering. Laboratory experiments dealing with the analysis of determinate and indeterminate structures;

UNIT-IV: *Design of Structural Elements;* Concrete Elements, Steel Elements, Structural Joints; Theories and concepts of both concrete and steel design and analysis both at the element and system levels. Approximate Analysis Methods as a Basis for Design; Design of
Reinforced Concrete Beams for Flexure; Design of Reinforced Concrete Beams for Shear; Bond, Anchorage, and Serviceability; Reinforced Concrete Columns; Reinforced Concrete Slabs;

Introduction to Steel Design; Tension Members and Connections; Bending Members; Structural Systems

UNIT-V: *System Design Concepts;* Special Topics that may be Covered as Part of the Design Project Discussions; Flat slabs; Prestressed Concrete Elements; Constructability and Structural Control; Fire Protection

Text/Reference Books:

1. Nilson, A. H. *Design of Concrete Structures.* 13th edition. McGraw Hill, 2004
2. McCormac, J.C., Nelson, J.K. Jr., *Structural Steel Design*. 3rd edition. PrenticeHall, N.J., 2003.
3. Galambos, T.V., Lin, F.J., Johnston, B.G., *Basic Steel Design with LRFD*, Prentice Hall, 1996
4. Segui, W. T., *LRFD Steel Design*, 2nd Ed., PWS Publishing, Boston.
5. Salmon, C.G. and Johnson, J.E., *Steel Structures: Design and Behavior*, 3rd Edition, Harper & Row, Publishers, New York, 1990.
6. MacGregor, J. G., *Reinforced Concrete: Mechanics and Design*, 3rd Edition, Prentice Hall, New Jersey, 1997.
7. Nawy, E. G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Prentice Hall, New Jersey.
8. Wang C-K. and Salmon, C. G., *Reinforced Concrete Design*, 6th Edition, Addison Wesley, New York.
9. Nawy, E. G. *Prestressed Concrete: A Fundamental Approach*, Prentice Hall, NJ, (2003).
10. Related Codes of Practice of BIS
11. Smith, J. C., *Structural Analysis*, Harpor and Row, Publishers, New York.
12. W. McGuire, R. H. Gallagher and R. D. Ziemian. “Matrix Structural Analysis", 2nd Edition, John Wiley and Sons, 2000.
13. NBC, *National Building Code*, BIS (2017).
14. ASCE, *Minimum Design Loads for Buildings and Other Structures, ASCE 7-02*, American Society of Civil Engineers, Virginia, 2002.

B.E Civil Engineering **2019-2020**

Semester-V

19BECE503 Hydrology and Water Resources Engineering 3H-3C

Instruction Hours/week: L: 2 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Understand the interaction among various processes in the hydrologic cycle
2. Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering
3. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
4. To cover the socio-technical aspects in the field of water resources
5. To calculate the hydrological extreme flood and drought events in water resources engineering
6. To understand the concept of precipitation and measurement of precipitation.

Course Outcomes

1. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions.
2. Able to understand the concept of precipitation and measurement of precipitation.
3. Will gain a brief knowledge of the distribution systems.
4. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
5. Apply the principles and applications of remote sensing,
6. Applying the knowledge of GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering

UNIT-I: *Introduction* - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data.
Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth- area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

UNIT-II: *Abstractions from precipitation* - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT-III: *Runoff* - runoff volume, SCS-CN method of estimating runoff volume, flow- duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows.
Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer

properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT-IV: *Water withdrawals and uses* – water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT-V: *Distribution systems* - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Text/Reference Books:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
4. G L Asawa, Irrigation Engineering, Wiley Eastern
5. L W Mays, Water Resources Engineering, Wiley.
6. J D Zimmerman, Irrigation, John Wiley & Sons
7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

B.E Civil Engineering **2019-2020**

Semester-V

19BECE504 **Environmental Engineering** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Understand the impact of humans on environment and environment on humans
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
3. To select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
4. To plan strategies to control, reduce and monitor pollution.
5. To analyze the impact of humans on environment and environment on humans
6. To know the different designing elements in sewer systems.

Course Outcomes

1. Analyze the impact of humans on environment and environment on humans
2. Be able to examine the effect of the pollutants on the environment: atmosphere, water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. Be conversant with basic environmental legislation.
6. Able now the different designing elements in sewer systems.

UNIT-I: *Water:* -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design.
Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes

UNIT-II: *Sewage*- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans,
Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT-III: *Air* - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations
Noise- Basic concept, measurement and various control methods.

UNIT-IV: *Solid waste management*-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

UNIT-V: *Building Plumbing*-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.
Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.

Practical Work: List of Experiments

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness
4. Analysis of ions: copper, chloride and sulfate
5. Optimum coagulant dose
6. Chemical Oxygen Demand (COD)
7. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
8. Break point Chlorination
9. Bacteriological quality measurement: MPN,
10. Ambient Air quality monitoring (TSP, RSPM, SOx, NOx)
11. Ambient noise measurement

Text/Reference Books:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw - Hill International Editions, New York 1985.
4. MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, Tata McGraw-Hill, New Delhi.
5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
8. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

B.E Civil Engineering **2019-2020**

Semester-V

19BECE505 **Transportation Engineering** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Recognize the function and scope of Transportation Engineering
2. Identify Driver, User, vehicle and Roadway characteristics and Analyze the interaction among the parameters.
3. Analyze Speed-Volume-Density, Perform Highway
4. Capacity Analysis and Describe Traffic Control System Components and Devices
5. Recognize problems and issues of Parking, Accident, Public Transport and ITS
6. Describe Transportation Planning Process and apply Traffic Forecasting Methods.

Course Outcomes

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

1. carry out surveys involved in planning and highway alignment
2. design the geometric elements of highways and expressways
3. carry out traffic studies and implement traffic regulation
4. Gained the knowledge in the control measures and intersection design of highway alignment.
5. characterize pavement materials and
6. design flexible and rigid pavements as per IRC

UNIT-I: Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

UNIT-II : Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT-III: Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT-IV: Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT-V: Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

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

B.E Civil Engineering **2019-2020**

Semester-V

19BECE506 Professional Practice, Law & Ethics 2H-2C

Instruction Hours/week: L: 2 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The course is designed to address the following:

1. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
2. To develop some ideas of the legal and practical aspects of their profession
3. To give an understanding of Intellectual Property Rights, Patents.
4. To give a good insight into contracts and contracts management
5. To know about Intellectual Property Rights, Patents.
6. To Gathered ideas of the legal and practical aspects of their profession

Course Outcomes

1. Familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
2. Gained a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour.
3. Good understanding of Intellectual Property Rights, Patents.
4. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
5. To develop good ideas of the legal and practical aspects of their profession
6. Gathered ideas of the legal and practical aspects of their profession

Proposed Syllabus

Professional practice covering the respective roles of the various stakeholders in the profession of civil engineering and the factors governing the same; Professional ethics relating to civil engineering; Various aspects of contracts relating to construction and management of contracts; types of contractual and other disputes in the profession and methods of dispute resolution; legal aspects relating to employment and service conditions of labour; intellectual property rights and their legal framework

UNIT-I A- Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

UNIT-I B- Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

UNIT-II: *General Principles of Contracts Management: Indian Contract Act, 1872 and amendments* covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /" Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms;

UNIT-III :*Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:* Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats

UNIT-IV :*Engagement of Labour and Labour & other construction-related Laws:* Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT-V : *Law relating to Intellectual property:* Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

Text/Reference Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
12. Bare text (2005), Right to Information Act
13. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
14. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
15. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
16. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
17. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
18. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractslaw1.html
24. Contract&Agreements http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
25. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
26. Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
27. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
28. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html
29. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02)

B.E Civil Engineering **2019-2020**

Semester-V

19BECE541	**Hydraulic Engineering**	**4H-3C**

Instruction Hours/week: L: 2 T: 0 P: 2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

1. To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
2. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering
3. To solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
4. To gain a complete knowledge of open channel flow.
5. To familiar with the dimensional analysis and hydraulic similitude.
6. To gain knowledge of pimp and turbines

Course Outcomes

1. The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
2. They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. They will have knowledge in hydraulic machineries (pumps and turbines).
4. Able to relate the theory and practice of problems in hydraulic engineering
5. Will gain a complete knowledge of open channel flow.
6. Will be familiar with the dimensional analysis and hydraulic similitude.

UNIT-I: Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.
Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.
Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

UNIT-II: Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

UNIT-III: Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

UNIT-IV: Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient " n .*Most economical section of ch*annel. Computation of Uniform flow, Normal depth.
Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method.
Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in water resources engineering

UNIT-V: Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,

UNIT-VI: Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

Practical Work:

1. Uniform Flow
2. Venturi Flume
3. Standing Wave Flume
4. Gradually Varied Flow
5. Hydraulic Jump
6. Flow under Sluice Gate
7. Flow through pipes
8. Turbulent flow through pipes
9. Laminar flow through pipes
10. Major losses / Minor losses in pipe

Text/Reference Books:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., "*Electromagnetic Distance Measurement*," Beekman Publishers, 1971.

B.E Civil Engineering **2019-2020**

Semester-V

19BECE542 **Geotechnical Engineering** **4H-3C**

Instruction Hours/week: L: 2 T: 0 P: 2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Understand the different types of soil based on their formation mechanism;
2. Understand the various phase diagrams and derive various phase relationships of the soil;
3. Understand the behaviour of soils based on their moisture contents;
4. Perform laboratory experiments to estimate various Atterberg limits and evaluate index properties of soils
5. Determine the permeability of soils through various laboratory and field tests;
6. Perform laboratory test to determine the maximum dry density and optimum moisture content of the soil

Course Outcomes

On completion of this module, the student must be able to:

1. Specify a strategy for site investigation to identify the soil deposits and determine the depth and spatial extent within the ground;
2. Understand various site investigation techniques and their in-situ applications;
3. Prepare a soil investigation report based on borehole log data and various in-situ tests like SPT, CPT, etc.
4. To estimate various Atterberg limits and evaluate index properties of soils
5. Will get familiar with the various test available for determining the permeability of soil.
6. Will get a good exposure to the bearing capacity of soil.

UNIT-I: *Introduction*–Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation-moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method,nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method.

UNIT-II: *Plasticity Characteristics of Soil* - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

UNIT-III: *Permeability of Soil* - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

UNIT-IV: *Effective Stress Principle* - *Stresses in soils* – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.
Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

UNIT-V: *Compaction of Soil*-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.
Consolidation of Soil - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

UNIT-VI: *Shear Strength* - Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. Unconfined compression test, vane shear test
UNIT-VII: *Stability of Slopes* - Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

UNIT-VIII: *Soil Exploration*- Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.

Practical Work: List of tests on-

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Field identification of Fine Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.

14. Compaction test: Modified Proctor test.
15. Relative density.
16. Consolidation Test.
17. Triaxial Test (UU)
18. Vane shear test
19. Direct Shear Test
20. Unconfined Compression Strength Test.

Text/Reference Books:

2. Soil Mechanics by Craig R.F., Chapman & Hall
3. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
4. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
5. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
6. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
7. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
8. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
9. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

SEMESTER VI

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE601 **Construction Engineering & Management** **3H-3C**

Instruction Hours/week: L: 2 T: 1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To understand modern construction practices
2. To understand how the construction projects are administered with respect to contract structures and issues.
3. To control and monitor construction projects with respect to time and cost
4. To optimize the construction projects based on costs.
5. To gain knowledge of different network analysis in construction management.
6. To get an idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics

Course Outcomes

1. An idea of how structures are built and projects are developed on the field
2. A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics
3. A basic ability to plan, control and monitor construction projects with respect to time and cost
4. An idea of how to optimize construction projects based on costs
5. An ability to put forward ideas and understandings to others with effective communication processes
6. Will gain the knowledge of the different network analysis in construction management.

UNIT-I: *Basics of* Construction- Unique features of construction, construction projects- 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 break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks.PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

UNIT-II: Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work 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.

UNIT-III: Construction Equipment basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities

UNIT-IV: Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction

UNIT-V: *Project Monitoring & Control*- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

UNIT-VI: *Contracts Management basics:* Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods-Contract Recovery
Construction Costs: Make-up of construction costs; Classification of costs, time- cost trade-off in construction projects, compression and decompression.

Text/Reference Books:

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM,Laxmi Publications, 2016.

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE641 **Engineering Economics, Estimation & Costing** **7H-5C**

Instruction Hours/week: L: 2 T: 1 P: 4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To understand how competitive bidding works and how to submit a competitive bid proposal.
2. To understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
3. to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
4. to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
5. to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
6. To know the technical specifications for various works can be done easily

Course Outcomes

On completion of the course, the students will:

1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
5. The technical specifications for various works can be done easily.
6. Gained the knowledge in successful participation of a bid.

UNIT-I: Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes (3 lectures)

UNIT-II: Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve. (2 lectures)

UNIT-III: Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method. (3 lectures)

UNIT-IV: *Estimation /* Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying (7 lectures)

UNIT-V: Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. (3 lectures)
Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. (3 lectures)

UNIT-VI: Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes,
R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management (6 lectures)

Term Work Assignments may include:

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
    a. Ground plus three storied RCC Framed structure building with blockwork walls
    b. bridge with minimum 2 spans
    c. factory building
    d. road work
    e. cross drainage work
    f. Ground plus three storied building with load-bearing walls g Cost of finishes, MEP works for (f) above
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

Text/Reference Books:

1. Mankiw Gregory N. (2002), *Principles of Economics,* Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), *Managerial Economics,* Tata McGraw Hill
3. Misra, S.K. and Puri (2009), *Indian Economy,* Himalaya
4. Pareek Saroj (2003), *Textbook of Business Economics,* Sunrise Publishers
5. M Chakravarty, Estimating, Costing Specifications & Valuation
6. Joy P K, Handbook of Construction Management, Macmillan
7. B.S. Patil, Building & Engineering Contracts
8. Relevant Indian Standard Specifications.
9. World Bank Approved Contract Documents.
10. FIDIC Contract Conditions.
11. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
12. Typical PWD Rate Analysis documents.
13. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016

14. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE6E-- **Professional Elective-I** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE6E-- **Professional Elective-II** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE6E-- **Professional Elective-III** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE6E-- **Professional Elective-IV** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

SEMESTER VII

B.E Civil Engineering **2019-2020**

Semester-VII

19BECE7E-- **Professional Elective-V** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VII

19BECE7E-- **Professional Elective-VI** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VII

Open Elective-I **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VII

Open Elective-II **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VII

19BECE791- **Project Work -I** **12H-6C**

Instruction Hours/week: L: 0 T: 0 P: 12 **Marks:** Internal**:120** External**:180**

Total**:300**

End Semester Exam:3 Hours

OBJECTIVE

1. To work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to Civil Engineering.
2. Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions.
3. This experience of project work shall help the student in expanding his / her knowledge base
4. Will provide opportunity to utilise the creative ability and inference capability.
5. Students will gain the presentation skills.
6. To explain his/her project to the external examiner and can publish the projects in a reputed journal.

7.

SEMESTER VIII

B.E Civil Engineering **2019-2020**

Semester-VIII

19BECE8E-- **Professional Elective-VII** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VIII

19BECE8E-- **Professional Elective-VIII** **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VIII

Open Elective-III **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VI

Open Elective-IV **3H-3C**

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Civil Engineering **2019-2020**

Semester-VI

19BECE892	**Project Work -II**	**12H-6C**
Instruction Hours/week: L: 0 T: 0 P: 12	**Marks:** Internal**:120** External**:180** Total**:300**	
	End Semester Exam:3 Hours	

OBJECTIVE

1. To work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to Civil Engineering.
2. Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions.
3. This experience of project work shall help the student in expanding his / her knowledge base
4. Will provide opportunity to utilise the creative ability and inference capability.
5. Students will gain the presentation skills.
6. To explain his/her project to the external examiner and can publish the projects in a reputed journal.

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B.E Civil Engineering **2019-2020**

Semester-

19BECEE01 **Structural Analysis-I** **3H-3C**

(Truss Analysis, Principle of virtual work – Unit load method, Strain Energy methods, Moving loads and influence lines, Cables)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To equip the students with the comprehensive methods of structural analysis with Emphasis on analysis of elementary structures.
2. To analyze trusses and study displacement response of statically determinate structural systems using energy methods:
3. To analyze statically indeterminate structures using strain energy method and method of consistent deformation
4. To know about moving loads and influence lines
5. To know about Statically determinate and indeterminate suspension bridges and arches.
6. To analyze the forces in cables under concentrated and uniformly distributed loads

Course Outcomes

The students will be able to

1. Analyze trusses and study displacement response of statically determinate structural systems using energy methods:
2. Apply unit load method and strain energy method for determination of deflection of statically determinate beams, frames & pin jointed trusses
3. Analyze statically indeterminate structures using strain energy method and method of consistent deformation
4. know about moving loads and influence lines
5. Know about Statically determinate and indeterminate suspension bridges and arches.
6. Analyze the forces in cables under concentrated and uniformly distributed loads

UNIT I –Truss Analysis: Analysis of determinate truss-Methods of 8 15% joints and sections (Numerical problems) Elastic theorems and energy principles - strain energy due to axial load, bending moment, shear and torsion - strain energy method, Castigliano's method for deflection (Derivations only)

UNIT II -Principle of virtual work – Unit load method-Betti's theorem – Maxwell's law of reciprocal deflections - principle of least work - application of unit load method and strain energy method for determination of deflection of statically determinate beams, frames - pin jointed trusses (simple numerical problems) Concepts of temperature effects and lack of fit.(No numerical problems) Statically indeterminate structures: Degree of static and kinematic indeterminacies – Introduction to force and displacement method(step by step procedure).

UNIT III –Strain Energy methods: Analysis of beams, frames and trusses with internal and external redundancy – (Simple problems with maximum two redundants) Concepts of effect of prestrain, lack of fit, temperature changes and support settlement.(No numerical problems) Method of Consistent deformations: Analysis of beams frames and trusses with internal and external

redundancy(Simple problems with maximum two redundants) Concepts of effect of prestrain, lack of fit, temp

UNIT IV - Moving loads and influence lines. Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams - analysis for different types of moving loads - single concentrated load - several concentrated loads, uniformly distributed load on shorter and longer than the span.
UNIT V Cables: Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cables Suspension Bridges: Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.
SUGGESTED READINGS

15. Nilson, A. H. *Design of Concrete Structures.* 13th edition. McGraw Hill,2004
16. McCormac, J.C., Nelson, J.K. Jr., *Structural Steel Design*. 3rd edition. PrenticeHall, N.J.,2003.
17. Galambos, T.V., Lin, F.J., Johnston, B.G., *Basic Steel Design with LRFD*, Prentice Hall,1996
18. Segui, W. T., *LRFD Steel Design*, 2nd Ed., PWS Publishing,Boston.
19. Salmon, C.G. and Johnson, J.E., *Steel Structures: Design and Behavior*, 3rd Edition, Harper & Row, Publishers, New York,1990.
20. MacGregor, J. G., *Reinforced Concrete: Mechanics and Design*, 3rd Edition, Prentice Hall, New Jersey,1997.
21. Nawy, E. G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Prentice Hall, NewJersey.
22. Wang C-K. and Salmon, C. G., *Reinforced Concrete Design*, 6th Edition, Addison Wesley, NewYork.
23. Nawy, E. G. *Prestressed Concrete: A Fundamental Approach*, Prentice Hall, NJ, (2003).
24. Related Codes of Practice ofBIS
25. Smith, J. C., *Structural Analysis*, Harpor and Row, Publishers, NewYork.
26. W. McGuire, R. H. Gallagher and R. D. Ziemian. “Matrix Structural Analysis", 2nd Edition, John Wiley and Sons,2000.
27. NBC, *National Building Code*, BIS(2017).
28. ASCE, *Minimum Design Loads for Buildings and Other Structures, ASCE 7-02*, American Society of Civil Engineers, Virginia,2002.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE02 **Structural Analysis-II** **3H-3C**

(Flexibility Method, Stiffness Matrix Method, Finite Element Method, Plastic Analysis Of Structures, Space And Cable Structures)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To introduce the students to advanced methods of analysis like matrix methods, Plastic analysis and FE method and also analysis of space structures.
2. Understand indeterminate structure and methods of analysis by flexible method.
3. Analysis of element by global stiffness matrix method
4. To analysis of plane stress and plane strain and displacement function by finite element method.
5. To calculation the deflection of trusses, beams and frames by using unit load method.
6. To analyze the space truss using method of tension coefficients.

Course Outcomes

The student will have the knowledge on advanced methods of analysis of structures including space and cable structures.

1. Understand indeterminate structure and methods of analysis by flexible method.
2. Analysis of element by global stiffness matrix method
3. Analysis of plane stress and plane strain and displacement function by finite element method.
4. Analyze the space truss using method of tension coefficients.
5. Apply influence line for indeterminate beams.
6. Understand matrix method and its application for computer-based analysis of structure.

UNIT I : Flexibility Method Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT II : Stiffness Matrix Method Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy limited to two)

UNIT III Finite Element Method Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain – Triangular elements

UNIT IV : Plastic Analysis Of Structures Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

UNIT V: Space And Cable Structures Analysis of Space trusses using method of tension coefficients – Beams curved in plan Suspension cables – suspension bridges with two and three hinged stiffening girders

SUGGESTED READINGS

1. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures", Laxmi Publications, 2004.
2. Vaidyanathan, R. and Perumal, P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003
3. Negi L.S. &Jangid R.S., "Structural Analysis", Tata McGraw Hill Publications, New Delhi, 2003.
4. BhavaiKatti, S.S, "Structural Analysis – Vol. 1 Vol. 2", Vikas Publishing House Pvt. Ltd., New Delhi, 2008
5. Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" 6th edition. Spon Press, London and New York, 2013.
6. Coates R.C, Coutie M.G. and Kong F.K., "Structural Analysis", ELBS and Nelson, 1990
7. Pandit G.S. & Gupta S.P. "Structural Analysis – A Matrix Approach", Tata McGraw Hill 2004.
8. William Weaver Jr. & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, Delhi, 2004
9. Gambhir. M.L., "Fundamentals of Structural Mechanics and Analysis"., PHI Learning Pvt. Ltd., New Delhi, 2011.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE03 **Advanced Structural Analysis** **3H-3C**

(Review of basic concepts in structural analysis, Review of analysis of indeterminate structures, Matrix concepts and Matrix analysis of structures, Matrix analysis of structures with axial elements, Analysis of elastic instability and second-order effects)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.
2. The basic concepts of structural analysis and matrix algebra
3. To demonstrations through many examples of how matrix methods can be applied to linear static analysis of skeletal structures.
4. To analyses of Plane and space trusses; beams and grids; plane and space frames by the stiffness method
5. To analysis of trusses by flexibility method.
6. Simple structures can be conveniently solved using a reduced stiffness formulation, involving far less computational effort.

Course Outcomes

The student will have the knowledge on

1. The basic concepts of structural analysis and matrix algebra
2. Descriptions and demonstrations through many examples of how matrix methods can be applied to linear static analysis of skeletal structures.
3. Analyses of Plane and space trusses; beams and grids; plane and space frames by the stiffness method
4. Analysis of trusses by flexibility method.
5. Simple structures can be conveniently solved using a reduced stiffness formulation, involving far less computational effort.
6. Analysis of elastic instability and second-order response.

UNIT I Review of basic concepts in structural analysis: Review topics on Structural Analysis and Linear Algebra. structure (structural elements, joints and supports, stability, rigidity and static indeterminacy, kinematic indeterminacy); loads (direct actions, indirect loading); (equilibrium, compatibility, force-displacement relations); levels of analysis; analysis of statically determinate structures (trusses, beams, frames); applications of principle of virtual work and displacement-based and force-based energy principles; deriving stiffness and flexibility coefficients.

UNIT II Review of analysis of indeterminate structures: Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work). Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

UNIT III Matrix concepts and Matrix analysis of structures: Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; Eigen values and eigenvectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient

principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

UNIT IV Matrix analysis of structures with axial elements: Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof);Analysis by flexibility method; Plane trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof);Analysis by flexibility method; Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

UNIT V Analysis of elastic instability and second-order effects: Effects of axial force on flexural stiffness: Review of buckling of ideal columns; flexural behaviour and stiffness measures for beam-columns - braced and unbraced, under axial compression; Solution by slope deflection method: Slope deflection equations for prismatic beam columns using stability functions; modifications for pinned and guided-fixed-end conditions; fixed end moments in beam-columns; Solution by matrix method: Stiffness matrix for prismatic beam column element; estimation of critical elastic buckling loads; second-order analysis;

SUGGESTED READINGS

1. Devdas Menon,"Advanced Structural Analysis", Naros Publishing House, 2009.
2. AsslamKassimali,"Matrix Analysis of Structures" Brooks/Cole Publishing Co., USA 1999.
3. Amin Ghali,Adam M Neville and Tom G Brown,"Structural Analysis:A Unified Classical and Matrix Approach",SixthEdition, 2007, Chapman & Hall
4. Devdas Menon,"Structural Analysis", Narosa Publishing House, 2008. A joint venture by IISc and IITs

B.E Civil Engineering **2019-2020**

Semester-

19BECEE04 **Structural Mechanics** **3H-3C**

(Direct Stress & Strain, Moment Of Inertia, S.F & B.M IN BEAM, Bending & Shear Stresses in Beam, Analysis Of Truss)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The main objective is to enable the student to have a good grasp of Calculating various structural material properties under direct loading condition, Analyze Statically Determinate structures like Beam, Column & Truss.
2. To study the external effects on the body due to action of force system.
3. To understand so that design can done by the engineer.
4. To analysis determinate structures under action of transverse loading, along with, analysis of members under direct loading is to be studied.
5. To analysis the industrial Trusses is also incorporated to give an idea of typical structure to the students.
6. To enables the student to analyse Steel & Concrete Structures used in Civil Engineering construction.

Course Outcomes

The student will have the knowledge on

1. The Applied Mechanics in Second Semester was taught to study the external effects on the body due to action of force system.
2. The behaviour of structure under different loading conditions is needed to understand so that design can do by the engineer.
3. Analysis of determinate structures under action of transverse loading, along with, analysis of members under direct loading is to be studied.
4. Analysis of Industrial Trusses is also incorporated to give an idea of typical structure to the students.
5. The Structural Mechanics-I which enables the student to analyse Steel & Concrete Structures used in Civil Engineering construction.
6. Analyze Statically Determinate structures like Beam, Column & Truss.

UNIT I Direct Stress & Strain- Different types of Structures and Loads - Direct Stress , linear Strain , Hook's Law Numerical Problems on Direct Stress & Linear Strain . Stress Strain curve of Mild Steel. Modulus of Elasticity. Yield , Breaking & Ultimate Stress and factor of Safety along with numerical problems - Lateral Strain and Poission's ratio with numerical problems - Basics Concepts of Shear Stress , Shear Strain & Shear Modulus - Bulk Modulus , volumetric Strain along with numerical Problems - Differentiate between Sudden , Gradual & Impact Loads Define Strain Energy , Proof Resilience for Sudden , Gradual & Impact Load along with numerical problems

UNIT II Moment Of Inertia Moment of Inertia & its Importance - Parallel & Perpendicular Axis Theorem - Formula of Moment of Inertia of solid & Hollow sections like Rectangle , Triangle , Circle - Moment of Inertia about C.G for I section , H section , Channel Section , Angle Section , T Section and Built up Section having flange plates to I & H Section and of Double Channels back to back & toe to toe

UNIT III S.F & B.M in Beam Statically Determinate Beam Like Cantilever , Simply Supported & Over Hang Beam - Shear Force and Bending Moment and its relationship - Sagging & Hogging Bending Moment and its importance - Point of Contra-flexure & its importance - S.F & B.M Diagram for Cantilever , Simply Supported & Over Hang Beam subjected to Point Load and/ or U.D.L

UNIT IV Bending & Shear Stresses in Beam- Bending Theory Equation Bending stress, Sectional Modulus, Neutral Axis Apply Bending theory to statically determinate beams having rectangular or circular section - Shear Stress equation Shear Stress Distribution Diagram for Solid &Hollow Rectangular and Circular Section Apply shear Stress Equation & Draw Shear
Stress Distribution Diagram for I, H, T, Channel & Angle Section.

UNIT V Analysis Of Truss- Perfect& Imperfect Truss various trusses for different spans and application - Analysis of Triangle, Howe, North Light & Fan trusses under Panel Point Loads using Graphical & Method of Joint.

SUGGESTED READINGS

1. Strength of Material & Mechanics of Structures
2. Dr. B C Punmia Structural Mechanics Course code: 3330604 GTU/NITTTR/Bhopal/12-13

   Gujarat State 5 2. Strength of Material S RAMAMURTHAN
3. Strength of Material Timo Shanku
4. Theory of Structures R S KHURMI

B.E Civil Engineering **2019-2020**

Semester-

19BECEE05 **Reinforced Concrete** **3H-3C**

(Methods Of Design Of Concrete Structures, Limit State Design For Flexure , Limit State Design for Bond, Anchorage Shear & Torsion , Limit State Design of Columns , Limit State Design of Footing)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The main objective is to introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.
2. To understand the general mechanical behavior of reinforced concrete.
3. To analyze and design reinforced concrete flexural members.
4. To analyze and design reinforced concrete compression members.
5. To analyze and design for vertical and horizontal shear in reinforced concrete.
6. To analyze transfer and development length of concrete reinforcement.

Course Outcomes

The student will have the knowledge on

1. Understand the general mechanical behavior of reinforced concrete.
2. Analyze and design reinforced concrete flexural members.
3. Analyze and design reinforced concrete compression members.
4. Analyze and design for vertical and horizontal shear in reinforced concrete.
5. Analyze transfer and development length of concrete reinforcement.
6. Analyze and design for deflection and crack control of reinforced concrete members.

UNIT I : Methods Of Design Of Concrete Structures Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method.

UNIT II: Limit State Design For Flexure Analysis and design of singly and doubly reinforced rectangular and flanged beams – Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.

UNIT III: Limit State Design for Bond, Anchorage Shear & Torsion Behaviour of RC members in bond and Anchorage – Design requirements as per current code – Behaviour of RC beams in shear and torsion – Design of RC members for combined bending shear and torsion.

UNIT IV: Limit State Design of Columns Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

UNIT V: Limit State Design of Footing Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

SUGGESTED READINGS

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.

2. Gambhir.M.L., “Fundamentals of Reinforced Concrete Design”, Prentice Hall of India Private Limited, New Delhi, 2006.
3. Subramanian,N.,”Design of Reinforced Concrete Structures”,Oxford University Press, New Delhi, 2013.
4. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications, Roorkee, 1998
5. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002
6. UnnikrishnaPillai, S., DevdasMenon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009
7. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”,Laxmi Publication Pvt. Ltd., New Delhi, 2007.
8. Bandyopadhyay. J.N., “Design of Concrete Structures”., Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
9. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
10. SP16, IS456:1978 “Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999
11. Shah V L Karve S R., “Limit State Theory and Design of Reinforced Concrete”, Structures Publilcations, Pune, 2013

B.E Civil Engineering **2019-2020**

Semester-

19BECEE06 **Concrete Technology** **3H-3C**

(Constituent Materials , Chemical and Mineral Admixtures, Proportioning Of Concrete Mix , Fresh And Hardened Properties of Concrete, Special Concretes)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.
2. To properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.
3. To identifying the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
4. To acquiring and applying fundamental knowledge in the fresh and hardened properties of concrete
5. To evaluating the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure
6. To developing an awareness of the utilization of waste materials as novel innovative materials for use in concrete

Course Outcomes

The student will possess the knowledge on

1. Properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.
2. Identifying the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
3. Acquiring and applying fundamental knowledge in the fresh and hardened properties of concrete
4. Evaluating the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure
5. Developing an awareness of the utilization of waste materials as novel innovative materials for use in concrete
6. Designing a concrete mix which fulfills the required properties for fresh and hardened concrete

UNIT I : Constituent Materials-Cement-Different types-Chemical composition and Properties - Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements- Water- Quality of water for use in concrete.

UNIT II:Chemical and Mineral Admixtures- Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III:Proportioning Of Concrete Mix- Principles of Mix Proportioning-Properties of Concrete Related to Mix Design Physical Properties of materials required for Mix Design – Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples

UNIT IV:Fresh And Hardened Properties of Concrete- Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS – Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete Determination of Young's Modulus.

UNIT V : Special Concretes Light weight concretes – High strength concrete – Fibre reinforced concrete – Ferro cement – Ready mix concrete – SIFCON-Shotcrete – Polymer concrete – High performance concrete- Geopolymer Concrete

SUGGESTED READINGS

1. Gupta.B.L.,Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
4. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
5. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
6. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998

B.E Civil Engineering **2019-2020**

Semester-

19BECEE07 **Design of Concrete Structures-I** **3H-3C**

(Introduction- Plain and Reinforced concrete, Limit state of collapse in shear and bond, Design of Singly Reinforced Beams, Design of slabs, Two- way slabs)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To provide the students with the knowledge of the behavior of reinforced concrete structural elements in flexure, shear, compression and torsion
2. To enable them to design essential elements such as beams, columns, slabs staircases and footings under various loads
3. Apply the fundamental concepts of limit state method
4. Use IS code of practice for the design of concrete elements
5. Understand the structural behavior of reinforced concrete elements in bending, shear, compression and torsion.
6. Design beams, slab, stairs, and columns and draw the reinforcement details.

Course Outcomes

The students will be able to

1. Apply the fundamental concepts of limit state method
2. Use IS code of practice for the design of concrete elements
3. Understand the structural behavior of reinforced concrete elements in bending, shear, compression and torsion.
4. Design beams, slab, stairs, and columns and draw the reinforcement details.
5. Analyze and design for deflection and crack control of reinforced concrete members.
6. Know the short term and long term deflections.

UNIT I : Introduction- Plain and Reinforced concrete- Properties of concrete and reinforcing steel-Objectives of design-Different design philosophies- Working Stress and Limit State method of design-Introduction to BIS code- Types of limit states characteristic and design values-partial safety factors-types of loads and their factors. Limit State of Collapse in Bending-assumptions-stress-strain relationship of steel and concrete- analysis of singly reinforced rectangular beams-balanced-under reinforced-over reinforced sections-moment of resistance codal provisions

UNIT II: Limit state of collapse in shear and bond- shear stresses in beams types of reinforcement-shear strength of RC beam-IS code recommendations for shear design-design of shear reinforcement examples Bond and development length - anchorage for reinforcement bars - code recommendations regarding curtailment of reinforcement

UNIT III: Design of Singly Reinforced Beams- basic rules for design- design example of simply supported beam- design of cantilever beam detailing Analysis and design of doubly reinforced beams – detailing, T-beams- terminology- analysis of T beams- examples - Design for torsion-IS code approach- examples.

UNIT IV: Design of slabs- introduction- one-way and two-way action of slabs - load distribution in a slab- IS recommendations for design of slabs- design of one-way slab- cantilever slab- numerical problems – concepts of detailing of continuous slab –code coefficients.

UNIT V : Two- way slabs- simply supported and restrained slabs – design using IS Code coefficients Reinforcement detailing Limit State of Serviceability- limit state of deflection- short

term and long term deflection-IS code recommendations- limit state of cracking- estimation of crack width- simple numerical examples

SUGGESTED READINGS

1. Pillai S.U & Menon D–Reinforced Concrete Design, Tata McGraw Hill Publishing Co., 2005.
2. Punmia, B. C, Jain A.K and, Jain A.K ,RCC Designs, Laxmi Publications Ltd., 10e, 2015
3. Varghese P.C, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt Ltd,,2008
4. Relevant IS codes (I.S 456, I.S 875, SP 34)

B.E Civil Engineering **2019-2020**

Semester-

19BECEE08 **Design of Concrete Structures-II** **3H-3C**

(Analysis and design of short columns , Foundations, Retaining walls Introduction to design of water tanks, Circular slabs)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To provide knowledge in the structural design of selected advanced structures of concrete and enable them to design reinforced concrete structures for real-world applications.
2. To design eccentrically loaded and slender columns using SP 16 design charts and different types of foundations
3. To design and detail cantilever retaining wall and understand the design principles of Counterfort retaining wall
4. To design and detail circular slabs and domes
5. To design rectangular and circular water tanks using IS code coefficients (IS 3370).
6. To gain knowledge of design of rectangular footing and combined footing.

Course Outcomes

The students will be able to

1. Design eccentrically loaded and slender columns using SP 16 design charts and different types of foundations
2. Design and detail cantilever retaining wall and understand the design principles of Counterfort retaining wall
3. Design and detail circular slabs and domes
4. Design rectangular and circular water tanks using IS code coefficients (IS 3370).
5. Gain knowledge of design of rectangular footing and combined footing.
6. Analyze combined footing with rectangular and trapezoidal sections.

UNIT I:Analysis and design of short columns under eccentric loading Columns subjected to compression and uniaxial bending- design using SP16 charts for limit state Columns subjected to combined axial load and biaxial bending moments-code procedure for design- design using SP16 charts for limit state Slender columns- behavior of slender columns-braced and un-braced columns-design procedure- design using SP16 charts for limit state

UNIT II: Foundations- classification-IS code provisions for design of isolated footings- design principles of rectangular footings- Design of rectangular footings-uniform thickness and sloped-eccentrically loaded rectangular footing of uniform thickness-detailing. Combined footings (design principles only)- analysis of combined footings-rectangular and trapezoidal.

UNIT III: Retaining walls-Types- Cantilever retaining wall- earth pressure and forces acting-stability-proportioning-structural behavior of components -design example of cantilever retaining wall without surcharge-detailing Counterfort retaining wall- design principles of components and detailing (design not required)

UNIT IV: Introduction to design of water tanks-design philosophy and requirements-joints- IS code recommendations Design of rectangular water tanks using IS code coefficients (IS 3370). Design of circular water tanks using- IS code coefficients (IS 3370)

UNIT V:Circular slabs- stresses- reinforcements- simply supported, fixed and partially fixed subjected to uniformly distributed loads Design and detailing of spherical and conical domes

SUGGESTED READINGS

1. N. Krishnaraju, Prestressed Concrete , Tata McGraw- Hill, 5e, 2012
2. 2. Pillai S.U &Menon D – Reinforced Concrete Design, Tata McGraw Hill Book Co., 2009
3. 3. Punmia, B. C, Jain A.K and, Jain A.K , R C C Designs, Laxmi Publications Ltd., 10e, 2015
4. Relevant IS codes (IS 456, IS 875IS 1343, IS 3370, SP 16, SP 34)

B.E Civil Engineering **2019-2020**

Semester-

19BECEE09 **Prestressed Concrete** **3H-3C**

(Introduction to Prestressed concrete, Limit state design criteria, Shear and torsional resistance, Anchorage Zone stresses in post tensioned members, Composite beams)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To make students familiar with the concepts and design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.
2. To design prestressed concrete members using codal provisions
3. To design for shear and torsion of prestressed concrete members
4. To design end blocks and provide detailing of reinforcements
5. To design composite members and other applications
6. To design continuous members.

Course Outcomes

The students will be able to

1. Analyze prestressed concrete members
2. Design prestressed concrete members using codal provisions
3. Design for shear and torsion of prestressed concrete members
4. Design end blocks and provide detailing of reinforcements
5. Design composite members and other applications
6. Design continuous members.

UNIT I: Introduction: Basic concept and principles of pre-stressed concrete, materials, prestressing systems – Analysis of prestress and bending stresses loss of pre-stress Stresses at transfer and service loads.

UNIT II: Limit state design criteria: Inadequacy of elastic and ultimate load method, criteria for limit states, strength and serviceability. Design of sections for flexure codal provisions- ultimate strength in flexure

UNIT III: Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion, shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long term deflection. Codal provisions

UNIT IV: Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement. Prestressed concrete poles and sleepers: Design of sections for compression and bending Partial pre-stressing- Definitions, principles and design approaches and applications

UNIT V: Composite beams –Analysis and design – Ultimate strength – applications, Elementary idea of composite construction for tee beams in bridges. Statically Indeterminate structures: advantages of continuous member (Concepts and steps for analysis).

SUGGESTED READINGS

1. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995

2. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd., 1997
3. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990 4. IS 1343 – 1998 ISCode Bureau of Indian Standards

B.E Civil Engineering **2019-2020**

Semester-

19BECEE10 **Design of Steel Structures** **3H-3C**

(Introduction to steel and steel structures, Tension members, Compression members, Design of roof trusses, Design of timber structures)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To introduce the limit state design of steel structural components subjected to bending, compression and tensile loads including the connections.
2. To enable design of structural components using timber.
3. To design tension members and beams using the is specifications
4. To design columns under axial loads using is specifications
5. To design beams and plate girders
6. To assess loads on truss and design purlins

Course Outcomes

The students will be able to

1. Design bolted and welded connections
2. Design tension members and beams using the is specifications
3. Design columns under axial loads using is specifications
4. Design beams and plate girders
5. Assess loads on truss and design purlins
6. Design structural components using timber

UNIT I: Introduction to steel and steel structures- properties of steel, structural steel sections. Introduction to design: Design loads and load combinations, limit state design concepts. Connections bolted and welded (direct loads)

UNIT II: Tension members-Types of sections – net area- design of tension members- concept of shear lag-use of lug angle-connections in tension members

UNIT III: Compression members- design of struts- solid and built up columns for axial loads--design of lacings and battens-column bases- slab base – gusseted base

UNIT IV: Design of roof trusses- types-design loads and load combinations assessment of wind loads- design of purlins. Moment resistant/Eccentric connections (in plane and out of plane)

UNIT V: Design of timber structures: types of timber - classification - allowable stresses-design of beams-flexure, shear, bearing and deflection considerations-Design of columns. Design of composite beam sections with timber and steel.

SUGGESTED READINGS

1. P. Dayaratnam., Design of Steel Structures ,Wheeler Publishing, 2003

2. Punmia B. C., Jain A. K. and Jain A. K., Design of Steel Structures, Laxmi Publications (P) Ltd, 2017

3. Raghupathi, Steel Structures, Tata McGraw Hill, 2006

4. Ramchandra S and Virendra Gehlot, Design of Steel Structures Vol. II, Standard Book House, 2007

B.E Civil Engineering **2019-2020**

Semester-

19BECEE11 **Concrete Materials** **3H-3C**

(Stones – Bricks – Concrete Blocks , Lime – Cement – Aggregates – Mortar , Concrete, Timber And Other Materials ,Modern Materials)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

At the end of this course the students should have learnt about

1. The various materials, both conventional and modern, that are commonly used in civil engineering construction.
2. Further he should be able to appreciate the criteria for choice of the appropriate materials and the various tests for quality control in the use of these materials.
3. To know the properties of different ingredients of concrete.
4. To know the properties and characteristics of different admixtures.
5. To know about the testing methods of fresh and harden concrete.
6. To know about the modern materials which are used in concrete.

Course Outcomes

The students will be able to

1. Know about the tests involved in the concrete, bricks and stones.
2. Acquire the knowledge about the properties of different ingredients of concrete.
3. Know about the testing methods of fresh and harden concrete.
4. Gain the knowledge of properties and characteristics of different admixtures.
5. Know about the modern materials which are used in concrete.
6. Know the Applications of laminar composites, Fibre textiles and Geosynthetics.

UNIT I. Stones – Bricks – Concrete Blocks Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacture of clay bricks – Tests on bricks – Compressive Strength - Water Absorption – Efflorescence –Bricks for special use – Refractory bricks – Cement and Concrete hollow blocks – Lightweight concrete blocks – Code Practices

UNIT II. Lime – Cement – Aggregates – Mortar Lime – Preparation of lime mortar – Cement. Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration - Compressive strength – Tensile strength – Soundness and consistency – Setting time – Aggregates – Natural stone aggregates – Industrial byproducts – Crushing strength – Impact strength – Flakiness – Abrasion Resistance – Grading – Sand – Bulking – Code Practices

UNIT III. Concrete- Concrete Ingredients – Manufacture – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction – Principles of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – IS method – High Strength Concrete and HPC – Other types of Concrete – Code Practices

UNIT IV. Timber And Other Materials Timber – Market forms – Industrial timber- Plywood - Veneer – Thermocole – Panels of laminates – Steel – Aluminum and Other Metallic Materials - Composition – uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Code Practices

UNIT V. Modern Materials Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geosynthetics for Civil Engineering applications.

SUGGESTED READINGS

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE12 **Soil Mechanics-I** **4H-3C**

(Soil Classification And Compaction, Soil Water And Water Flow, Stress Distribution And Settlement, Shear Strength and Slope stability)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Should be able to assess soil behavior with the mineralogy present and advanced soil testing of soils such as in thermal, chemical, magnetic fields.
2. Should be able to do seepage analysis for finding discharge calculation and stability of structure.
3. To perceive The Compaction And The Settlements Of Cohesive and cohesiveless Soils.
4. To make Use of the Condition of Soil Hydraulic.
5. To calculate The Total Normal Stress, Pore Water Pressure, and Effective Normal Stress.
6. To determine The Distribution Of Stresses In Subsoil Under The Energy Of External Loads (Method Boussinesq).

Course Outcomes

Upon Completion Of Lecture, Students Will Be Able To:

1. Perceive The Compaction And The Settlements Of Cohesive and cohesiveless Soils.
2. Comfortly Make Use of the Condition of Soil Hydraulic.
3. Calculate The Total Normal Stress, Pore Water Pressure, and Effective Normal Stress.
4. Determine The Distribution Of Stresses In Subsoil Under The Energy Of External Loads (Method Boussinesq).
5. Describe The Mechanical Behavior And The Mohr –Coulomb Failure Criterion.
6. Identify Lateral Earth Pressure By Rankine And Coulomb And The Bearing Capacity Of Shallow Foundations By Terzaghi and Slope Stability Measures.

UNIT I Soil Classification And Compaction: Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – Index properties of soils - BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

UNIT II Soil Water And Water Flow: Soil water – static pressure in water - Effective stress concepts in soils – capillary stress – Permeability measurement in the laboratory and field pumping in pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III Stress Distribution And Settlement: Stress distribution - soil media – Boussinesq theory - Use of Newmarks influence chart – Components of settlement — immediate and consolidation settlement – Terzaghi‟sonedimensional consolidation theory – computation of rate of settlement. - √t and log t methods– e-log p relationship - Factors influencing compression behaviour of soils.

UNIT IV Shear Strength: Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – cyclic mobility – Liquefaction.

UNIT V Slope Stability: Slope failure mechanisms – Types - infinite slopes – finite slopes – Total stress analysis for saturated clay – Fellenius method - Friction circle method – Use of stability number - slope protection measures.

SUGGESTED READINGS

10. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers
11. Distribution Ltd., New Delhi. 2007
12. GopalRanjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern
13. Ltd, New Delhi (India), 2000.
14. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers
15. and
16. Distributors, New Delhi, 2002.
17. McCarthy D.F. "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2002.
18. Coduto, D.P. "Geotechnical Engineering – Principles and Practices", Prentice Hall
19. of India Pvt.Ltd, New Delhi, 2002.
20. Das, B.M. "Principles of Geotechnical Engineering". Thompson Brooks / Coles
21. Learning Singapore, 5th Edition, 2002.
22. Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd.,
23. New Delhi, 2005.
24. Palanikumar. M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private
25. Limited, Delhi, 2013.
26. Craig. R.F., "Soil Mechanics". E & FN Spon, London and New York, 2007
27. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd
28. Edition, Pearson Education, 2013

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Semester-

19BECEE13 **Soil Mechanics-II** **4H-3C**

(Earth Pressure theories, Sheet pile, Excavation Methods, Analyses of Slope Stability and measures)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Should be able to assess soil behavior with the mineralogy present and advanced soil testing of soils such as in thermal, chemical, magnetic fields.
2. Should be able to do seepage analysis for finding discharge calculation and stability of structure.
3. To design sheet pile wall with different methods.
4. To familiarized with different construction practices for excavation with advantages and disadvantages of each method.
5. To determine the safety analysis for slopes with different methods proposed in the syllabus.
6. To introduce with the commercial software's for analyzing the stability of slopes and retaining walls.

Course Outcomes

Upon Completion Of Lecture, Students Will Be Able To:

1. Should be able design retaining wall subjected to various loads with the knowledge of earth pressure theories.
2. Should be able to design sheet pile wall with different methods.
3. Should get familiarized with different construction practices for excavation with advantages and disadvantages of each method.
4. Should be able to determine the safety analysis for slopes with different methods proposed in the syllabus.
5. Should get introduced with the commercial software's for analyzing the stability of slopes and retaining walls.
6. Should be able to design slope ratios by using software's (Computer-Aided Stability Analyses).

UNIT I Earth Pressure theories: Introduction Lateral Earth Pressure At Rest - Active Pressure Rankine - Active Earth Pressure For Inclined Backfill Coulomb's -Active Earth Pressure For Earthquake conditions- Lateral Earth Pressure Due To Surcharge Active Pressure For Wall Rotation About Top-Braced Cut Active Earth Pressure For Translation Of Retaining Wall-Granular Backfill Passive Pressure - Rankine Passive Earth Pressure inclined Backfill.

UNIT II Sheet pile: Design of Retaining Structures Lecture: Anchored sheet pile walls- Objectives-Different types of anchored sheet pile walls-Free earth support piles -Fixed earth support piles-Comparison between fixed earth method and free earth method- Design of sheet pile wall by free

earth support. Conditions for free earth support of an anchored sheet pile wall- Forces acting on sheet pile in free earth support case (cohesionless soil)- Forces acting on sheet pile in free earth support case (cohesive soil).Moment reduction factor for cohesive foundation soils.

UNIT III Excavation Methods: The nature of the excavation work- Trenching-Preparation and excavation. Tunneling- The nature of tunneling work - the planning, investigation, design and construction stages- Tunneling hazards and risks- Common hazards and risks involved in shaft construction- Control measures. Preventing Ground Collapse- Ground conditions. Benching and battering. Shoring- Hydraulic systems- Steel sheet piling- Steel trench sheeting- Timber soldier sets- Other ground support methods- Regular inspection.

UNIT IV Slope Stability measures: Slope failure mechanisms – Types - infinite slopes – finite slopes – Total stress analysis for saturated clay – Fellenius method - Friction circle method – Use of stability number - slope protection measures.

UNIT V Analyzing The Stability Of Slopes: Stability Of Slopes and Retaining Structures-Stability of Slopes and Retaining Structures- Reclamation And Ground Improvement-Stability of Natural Slopes, Rock Bund and Rip-Rap Stability of Retaining Structure- Flexible Retaining Structure - Computer-Aided Stability Analyses

SUGGESTED READINGS

1. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, CBS Publishers
2. Distribution Ltd., New Delhi. 2007
3. GopalRanjan and Rao A.S.R. “Basic and Applied soil mechanics”, Wiley Eastern
4. Ltd, New Delhi (India), 2000.
5. Arora K.R. “Soil Mechanics and Foundation Engineering”, Standard Publishers andDistributors, New Delhi, 2002.
6. McCarthy D.F. “Essentials of Soil Mechanics and Foundations”. Prentice-Hall, 2002.
7. Coduto, D.P. "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd, New Delhi, 2002.
8. Das, B.M. "Principles of Geotechnical Engineering”. Thompson Brooks / Coles
9. Learning Singapore, 5th Edition, 2002.
10. Punmia, B.C. "Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd.,
11. New Delhi, 2005.
12. Palanikumar. M, “Soil Mechanics”, Prentice Hall of India Pvt. Ltd, Leaning Private
13. Limited, Delhi, 2013.
14. Craig. R.F., "Soil Mechanics". E & FN Spon, London and New York, 2007
15. Purushothama Raj. P., “Soil Mechanics and Foundation Engineering”, 2nd Edition, Pearson Education, 2013

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Semester-

19BECEE14 **Foundation Engineering** **4H-3C**

(Selection of foundation and Sub-soil exploration/investigation, Shallow Foundation, Pile Foundation, Retaining walls)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Able to Analyze and design the foundations, types of foundations, bearing capacity and settlement of foundations; ground movements due to construction
2. To analysis and design of excavations, retaining walls, cuts & excavations and sheet piles, slopes and underground structures.
3. To select and design appropriate/suitable foundation system (shallow/Deep) for different structures, that
4. To satisfy the allowable bearing capacity and settlement requirements based on soil properties,
5. To design deep foundation satisfying bearing capacity and settlement requirements,
6. To understand the engineering behaviour of expansive soils and selection of suitable foundation type for such soils.

Course Outcomes

After learning the course the students should be able to:

1. Select appropriate soil investigation/testing technique/method and get true sub soil parameters used for
2. Select and design appropriate/suitable foundation system (shallow/Deep) for different structures, that
3. satisfy the allowable bearing capacity and settlement requirements based on soil properties,
4. Design deep foundation satisfying bearing capacity and settlement requirements,
5. Understand the engineering behaviour of expansive soils and selection of suitable foundation type for such soils.
6. Selection of alternate materials like geosynthetics and its application in foundation problems.

UNIT I:Selection of foundation and Sub-soil exploration/investigation: Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, Objectives and planning of exploration program, methods of exploration-wash boring and rotary drilling-depth of boring, soil samples and soil samplers-representative and undisturbed sampling, field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log and report writing, data interpretation.

UNIT II Shallow Foundation: Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton), bearing capacity determination using IS Code, Presumptive bearing capacity. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity from in-situ tests(SPT, SCPT, PLATE LOAD), Factors affecting bearing capacity including Water Table., Bearing capacity of raft/mat foundation as per

coda provisions, Contact pressure under rigid and flexible footings. Floating foundation. Types of pavements & its design.

UNIT III Pile foundations : Introduction, load transfer mechanism, types of piles and their function, factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911). Pile group: carrying capacity, efficiency and settlement. Negative skin friction.

UNIT IV Foundations on problematic soil &Introduction to Geosynthetics :Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures. Under-reamed pile foundation-its concept, design& field installation. Significant characteristics of silt and loess, problems & remedial measures footing on such soils, introduction to geosynthetics-types and uses.

UNIT V Retaining walls: Types (types of flexible and rigid earth retention systems: counterfort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging).

SUGGESTED READINGS

1) P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.

2) B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.

3) Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi

4) Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai

5) V. N. S. Murthy; Soil Mechanics & Foundation Engineering; SaiKripa Technical Consultants, Banglore

6) GopalRanjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.

7) Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi

8) Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.

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Semester-

19BECEE15 **Environmental Geo-technology** **4H-3C**

(Fundamentals of Geo environmental Engineering, Soil-Water-Contaminant Interaction, Waste Containment System, Contaminant Site Remediation)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Have an exposure to interdisciplinary issues pertaining to environment and geotechnical engineering
2. Be trained to develop sustainable and environmentally sound solutions for geotechnical problems
3. To understand the relevance of various legal aspects involved in addressing environmental consequences associated with geotechnical issues.
4. To understand the Fundamentals of geo environmental engineering and multiphase behavior of soil.
5. To understand the Soil-water contaminant interaction studies and concepts of unsaturated soil in geo environmental engineering,
6. To understand the Waste containment system and also the property evaluation of soil, design practices, Vertical barriers

Course Outcomes

After learning the course the students should be able to:

1. Understand the Fundamentals of geo environmental engineering and multiphase behavior of soil.
2. Understand the Soil-water contaminant interaction studies and concepts of unsaturated soil in geo environmental engineering,
3. Understand the Waste containment system and also the property evaluation of soil, design practices, Vertical barriers,
4. Understand the Contaminant site remediation, some examples of in-situ remediation
5. Understand the Advanced soil characterization for geo environmental applications
6. Develop sustainable and environmentally sound solutions for geotechnical problems

UNIT I:Fundamentals of Geo environmental Engineering: Scope of geo environmental engineering - multiphase behavior of soil – role of soil in geo environmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination– impact of ground contamination on geo environment - case histories on geo environmental problems.

UNIT II Soil-Water-Contaminant Interaction: Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles. Concepts of unsaturated soil – importance of unsaturated soil in geo environmental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone. Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.

UNIT III Waste Containment System: Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities
UNIT IV Contaminant Site Remediation: Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.

UNIT V Advanced Soil Characterization: Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.

SUGGESTED READINGS

1. Rowe R.K.,"Geo technical and Geo environmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
2. Reddi L.N. and Inyang, H. I.,"Geo environmental Engineering, Principles and Applications" Marcel DekkerInc. New York, 2000.
3. Yong, R. N.,"Geoenvironmental Engineering, Contaminated Soils,Pollutant Fate, and Mitigation" CRCPress, New York, 2001.
4. Sharma H.D. and Reddy K.R.,"Geo environmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004.
5. Fredlund D.G. and Rahardjo, H.,"Soil Mechanics for Unsaturated Soils" Wiley-Interscience, USA, 1993.
6. Mitchell, J.K.,"Fundamentals of Soil Behavior" Wiley,2005.
7. Hillel D.,"Introduction to Environmental Soil Physics" Academic Press, New York, 2003.
8. Hillel D.,"Introduction to Soil Physics" Academic Press,New York, 1982.
9. Sparks, D.L.,"Environmental Soil Chemistry" Academic Press, New York, 2002.
10. Bagchi,A.,"Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA, 2004.
11. Alvarez-Benedi J. and Munoz-Carpena, R.,"Soil-WaterSolute Process Characterization:An IntegratedApproach" CRC Press, New York, 2005.
12. Berkowitz,B. Dror, I. and Yaron,B.,"ContaminantGeochemistry" Springer, Germany, 2008..
Mohamed,A. M. O.,"Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering"Taylor and Francis, New York, 2006.

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Semester-

19BECEE16 **Ecological Engineering** **3H-3C**

(Ecosystems &Eco technology, Systems Approach In Ecological Engineering, Ecological Engineering Processes Self-organizing design and processes, Waste Treatment Ecological engineers and ecotechnology)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To impart knowledge on the principles of ecological engineering that strengthen the functions of ecosystems, restore devastated ecosystems
2. To utilize the functions of ecosystems to develop ecological engineering designs for environmental management.
3. To gain the knowledge of system approach in ecological engineering
4. To estimate the sources separation systems, aqua cultural system and agro systems
5. To analyze the ecological processes self-organizing the design process..
6. To realize Eco technology for Waste Treatment Ecological engineers and ecotechnology

Course Outcomes

1. Identify the application, development and evolution of ecology
2. knowledge of system approach in ecological engineering
3. Estimate the sources separation systems, aqua cultural system and agro systems
4. Analyze the ecological processes self-organizing the design process..
5. Realize Eco technology for Waste Treatment Ecological engineers and ecotechnology
6. Balance the Case studies of Integrated Ecological Engineering

UNIT I Ecosystems &Ecotechnology Aim, scope and applications of ecology – Development and evolution of ecosystems – Principles and concepts pertaining to communities in ecosystem – Energy flow and material cycling in ecosystems – productivity in ecosystems.

UNIT II Systems Approach In Ecological Engineering Principles, components and characteristics of systems – Classification of systems – Structural and functional interactions of environmental systems – Environmental systems as energy systems – Mechanisms of steady-state maintenance in open and closed systems – Modeling and Eco technology – Elements modeling – Modelling procedure – Classification of ecological model s- Applications of models in Eco technology – Ecological economics.

UNIT III Ecological Engineering Processes Self-organizing design and processes – Multi seeded microcosms – Interface coupling in ecological systems – Concept of energy – Determination of sustainable loading of ecosystems.

UNIT IV Ecotechnology for Waste Treatment Ecological engineers and ecotechnology – Classification of ecotechnology – Principles of ecological engineering. Ecosanitation-Principles and operation of soil infiltration systems – Wetlands and ponds – source separation systems – Aquacultural systems – Agro ecosystems – Detritus based treatment for solid wastes – Applications of ecological engineering for marine systems.

UNIT V Case Studies: Case studies of Integrated Ecological Engineering Systems and their commercial prospects.

SUGGESTED READINGS

9. Jorgensen, S.E. Ecological Engineering: Principles and Practice. CRC Press, 2003
10. Mitsch, J.W. and Jorgensen, S.E. Ecological Engineering – An Introduction to
11. Ecotechnology, John Wiley & Sons, New York, 1989.
12. Mitsch, W.J. Ecological Engineering and Ecosystem Restoration, Wiley 2nd Ed., 2003
13. White I.D., Mottershed, D.N. and Harisson, S.J. Environmental systems – An Introductory
14. text, Chapman Hall, London, 1994

B.E Civil Engineering **2019-2020**

Semester-

19BECEE17 **Transport of Water and Wastewater** **3H-3C**

(General Hydraulics And Flow Measurement, Water Transmission And Distribution, Wastewater Collection And Conveyance, Storm Water Drainage)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To educate the students in detailed design concepts related to water transmission mains, water distribution system, sewer networks and storm water drain and computer application on design.
2. To understand and apply the principle of hydraulics in water transportation and distribution and wastewater collection and conveyance.
3. To design water supply mains taking into account all the design parameters.
4. To analyze a water supply distribution network.
5. To select an appropriate pipe material, necessary pipe appurtenances and able to locate the leaking mains for the water distribution system. Analyze
6. To estimate the quantity of storm drainage and design a proper storm drainage for speedy draining of storm water from the city area.

Course Outcomes

1. Understand and apply the principle of hydraulics in water transportation and distribution and wastewater collection and conveyance.
2. Design water supply mains taking into account all the design parameters.
3. Analyze a water supply distribution network.
4. Select an appropriate pipe material, necessary pipe appurtenances and able to locate the leaking mains for the water distribution system. Analyze
5. Estimate the quantity of storm drainage and design a proper storm drainage for speedy draining of storm water from the city area.
6. Design a sewer network for the proper disposal of the sewage generated from the city limits to treatment plant.

UNIT I General Hydraulics And Flow Measurement Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, minor heads losses, Carrying Capacity–Flow measurement.

UNIT II Water Transmission And Distribution Need for Transport of water and wastewater-Planning of Water System –Selection of pipe materials, Water transmission main design- gravity and pumping main; Selection of Pumps- characteristics- economics; Specials, Jointing, laying and maintenance, water hammer analysis; water distribution pipe networks Design, analysis and optimization – appurtenances – corrosion prevention – minimization of water losses – leak detection Storage reservoirs.

UNIT III Wastewater Collection And Conveyance Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; Wastewater pumps and pumping stations- sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters.

UNIT IV Storm Water Drainage Necessity- - combined and separate system; Estimation of storm water run-off Formulation of rainfall intensity duration and frequency relationships- Rational methods

UNIT V Case Studies And Software Applications Use of computer software in water transmission, water distribution and sewer design – EPANET 2.0, LOOP version 4.0, SEWER, BRANCH, Canal ++ and GIS based software's.

SUGGESTED READINGS

1. "Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. 2. Bajwa, G.S. "Practical Handbook on Public Health Engineering", Deep Publishers, Shimla, 2003
3. CPHEEO Manual on Sewerage and Sewage Treatment Systems Part A, B & C, Ministry of Urban Development,

B.E Civil Engineering **2019-2020**

Semester-

19BECEE18 Physico-Chemical Processes for Water and Wastewater Treatment

3H-3C

(Quality , Quantity of Water and Waste Water ,Screening and Skimming, Sedimentation, Softening Desalination &Disinfection)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. The course content should be taught and with the aim to develop required skills in students so that they are able to acquire following competencies.
2. Estimate the quantity of water required for domestic and industrial uses and waste water generated by domestic and industrial use.
3. Supervise operation and maintenance of the fresh water and waste water Treatment plants.
4. To estimate water for domestic and industrial requirement
5. To explain the characteristics of water and waste water.
6. To determine the quality of generated sludge by treatment of water and waste water and various methods for disposal of sludge

Course Outcomes

1. The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.
2. Estimate water for domestic and industrial requirement
3. Explain the characteristics of water and waste water.
4. Determine the quality of generated sludge by treatment of water and waste water and various methods for disposal of sludge
5. Explain methods of disinfection, chlorination – chlorine dose, chlorine demand,
6. Describe process for removal of oil, grease etc & disposal of skimming

UNIT –I Quality , Quantity of Water and Waste Water Quality of water and wastewater Wholesome water -Impurity of water- Characteristics of water- Examination of water - Standards of potable water quality - Characteristics of sewage - Examination of sewage - Standards of quality of treated water and wastewater - Quantity of water and waste water - Waste water and gas flow - Water requirement for domestic and industrial purposes - Waste water formation and estimation - Spectrum of particulate size distribution - Variation of flows.

UNIT II Screening and Skimming Purpose of screenings and terms : blinding, stratification , contamination (oversize , fines, foreign body), gradation, grading, Flow equalization -Types of bar racks and screens -Disposal of screenings - Removal of oil, grease etc. - Floatation - Skimming tank - Disposal of skimming.

UNIT III Sedimentation Introduction - Principles of Sedimentation and Stokes' law applied to fluids - Characteristics of the settleable solids - Classification of sedimentation tanks for water and

waste water - Factors influencing sedimentation -Deciding size of sedimentation tank for water and wastewater -Standard design loading - Detention period -Coagulation – purpose, principle - Types of coagulants and its suitability -Determination of optimum coagulation dose. - Feeding of coagulant and feeding devices = Flocculation and flocculation tanks and design criteria of flocculator - Clarifiers, its types and design criteria. - Settling efficiency of particles - Grit removal

UNIT IV Filtration -Theory of filtration- Mechanism for particle size -Hydraulics of filters -Types of filters and their flow direction -Filter clogging -Filter washing -Break through -Deciding size of filter unit - Advances in filtration

UNIT V Softening Desalination &Disinfection Chemical precipitation - Water and wastewater softening -Estimation of dose of chemical - Methods of softening - ammonia, borax, lye, lime-soda, chelating, Ion exchange method etc. - osmosis, electrolysis -. Methods of disinfection -chlorination – chlorine dose, chlorine demand, application of chlorine - Use of various forms of chlorine, break through chlorination - Removal of colour

SUGGESTED READINGS

1. Text book of Water supply and Sanitary Engg. S K Hussain Oxford And IBH
2. Water Supply and Sanitary Engg . G S BirdiDhanpatraj and Sons
3. A text book of Water Supply. V N Gharpure Allied Book House
4. A text book of Sanitary Engg. V N Gharpure Allied Book House
5. Water supply and Sanitary Engg. Vazirani and ChandolaKhanna Publishers
6. Wastewater Engineering, Treatment, Disposal, Reuse Metcalf and Eddy McGraw Hill International Edition.
7. Water supply and Sewerage. . E W Steel and Terence J McGhee McGraw Hill Book Company

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Semester-

19BECEE19 Biological Processes for Contaminant Removal 3H-3C

(Introduction: microbiology fundamentals, Aerobic biological treatment, Anaerobic biological treatment, Energetic and stoichiometric)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

Have knowledge of the main contaminant removal procedures and associated problems.

1. The biological treatment of effluents consists in the use of bacterial cultures to degrade household and industrial effluents.
2. This requires the knowledge of some microbiology fundamentals and of the meaning and determination of the kinetic and stoichiometric coefficients that govern the process.
3. To serve as the basis for studying the aerobic and anaerobic biological processes and for developing the construction details of the reactors where these take place.
4. To analyse the different options applicable to different substrates.
5. To examine the different equipment options required for each treatment.
6. To study different work scenarios to determine the most effective options.

Course Outcomes

1. Have a sound knowledge of microbiology fundamentals applied to biological treatments.
2. Correctly implement the procedures for determining kinetic and stoichiometric parameters.
3. Apply knowledge of enzyme reaction kinetics to reactor design.
4. Analyse the different options applicable to different substrates.
5. Examine the different equipment options required for each treatment.
6. Study different work scenarios to determine the most effective options.

UNIT –I Introduction: microbiology fundamentals and kinetic and stoichiometric coefficients: a. Bacterial growth and biological oxidation b. Kinetics and stoichiometric of biological growth

UNIT II Aerobic biological treatment: fixed and suspension cultures a. Suspension cultures b. Characteristics of the activated sludge process. c. Control parameters d. Overproduction of sludge and oxygen consumption: Scums h. Fixed cultures: percolators and biodiscs. i. Nutrient (N and P) removal.

UNIT III Anaerobic biological treatment: biogas production, collection and use a. Mechanism and phases of the anaerobic process. b. Gas production, collection and use. c. Energetics and stoichiometric of the process d. Anaerobic contact process and slurry filter e. anaerobic digestion of slurry.

UNIT IV Energetics and stoichiometric- activated sludge process. f. Balanced diet: C:N:P ratio. Presence of toxic substances g. Operational difficulties: swelling, rising sludge.

UNIT V Control parameters: load, pH, VFAs, acidity-alkalinity, gas quantity and quality.

SUGGESTED READINGS

1. Water research International Association of Water Quality,(IAWQ)
2. Water environment and technology ¬Water Pollution Control Federation (WPCF) Journal of the Water Pollution Control Federation
3. American Water Works Association (AWWA) ¬Environmental Science & Technology. American Chemical Society (ACS).

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Semester-

19BECEE20 Rural Water Supply and Onsite Sanitation Systems 3H-3C
(Rural Water Supply, Low Cost Water Treatment, Rural Sanitation, Solid Waste Management)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

Have knowledge of the main contaminant removal procedures and associated problems.

1. Issues of rural water supply, low cost water treatment , sanitation and solid waste management.
2. To design water supply and sanitation system for rural community.
3. To design low cost waste management systems for rural areas.
4. To plan and design an effluent disposal mechanism
5. To identify the occupational hazards.
6. To plan and identify the removal of hazards by composting

Course Outcomes

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

1. Identify the problems pertaining to rural water supply and sanitation.
2. Design water supply and sanitation system for rural community.
3. Design low cost waste management systems for rural areas.
4. Plan and design an effluent disposal mechanism
5. Identify the occupational hazards.
6. Plan and identify the removal of hazards by composting

UNIT –I Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies

UNIT II Low Cost Water Treatment: Introduction – Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems.

UNIT III Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

UNIT IV Industrial Hygiene And Sanitation: Occupational Hazards- Schools- Public Buildings Hospitals- Eating establishments- Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation.

UNIT V Solid Waste Management: Disposal of Solid Wastes- Composting- land filling incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation.

SUGGESTED READINGS

1. . Eulers, V.M., and Steel, E.W., Municipal and Rural Sanitation, 6th Ed., McGraw Hill Book Company, 1965
2. Park, J.E., and Park, K., Text Book of Preventive and Social Medicine, Banarsidas Bhanot, 1972
3. Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishin, Company, Huntington, New York, 1977
4. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: GlobalViews on Community Water Supply and Sanitation, IWA Publishing (Intl Water, Assoc), 2007

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Semester-

19BECEE21 Solid and Hazardous Waste Management 3H-3C

(Sources, Classification And Regulatory Framework, Waste Characterization And Source Reduction Storage, Collection And Transport Of Wastes, Waste Processing Technologies Waste Disposal)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To impart knowledge and skills in the collection, storage, transport, treatment, disposal and recycling options for solid wastes including the related engineering principles, design criteria, methods and equipment's.
2. To define and explain important concepts in the field of solid waste management and suggest suitable technical solutions for treatment of municipal and industrial waste
3. To understand the role legislation and policy drivers play in stakeholders' response to the waste
4. To apply the basic scientific principles for solving practical waste management challenges
5. To design the different elements of waste management systems.
6. To understand the techniques involves in the waste disposal, landfill etc..,

Course Outcomes

On completion of the course, the student is expected to be able to

1. Understand the characteristics of different types of solid and hazardous wastes and the factors affecting variation
2. Define and explain important concepts in the field of solid waste management and suggest suitable technical solutions for treatment of municipal and industrial waste
3. Understand the role legislation and policy drivers play in stakeholders' response to the waste
4. Apply the basic scientific principles for solving practical waste management challenges
5. Design the different elements of waste management systems.
6. Understand the techniques involves in the waste disposal, landfill etc..,

UNIT I Sources, Classification And Regulatory Framework

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management –- Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics and fly ash – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management- Integrated solid waste management.

UNIT II Waste Characterization And Source Reduction Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse

UNIT III Storage, Collection And Transport Of Wastes Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for

transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

UNIT IV Waste Processing Technologies Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes- treatment of biomedical wastes - Health considerations in the context of operation of facilities.

UNIT V Waste Disposal Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps-remediation of contaminated sites.

SUGGESTED READINGS

1. CPHEEO, "Manual on Municipal Solid waste management, Central PublicHealth and Environmental Engineering Organisation , Government of India, New Delhi,2014.
2. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated SolidWaste Management, Mc-Graw Hill International edition, New York, 1993.
3. John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014
4. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.
5. William A. Worrell, P. AarneVesilind, Solid Waste Engineering, Cengage Learning, 2012.
6. 2. Frank Kreith, George Tchobanoglous ,Handbook of Solid Waste management,McGrawHill, 2002.

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Semester-

19BECEE22 Air and Noise Pollution and Control 3H-3C

(Introduction Air Pollution Monitoring And Modelling, Control Of Particulate Contaminants ,Control Of Gaseous Contaminants, Automobile And Noise Pollution)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends.
2. To apply sampling techniques and Suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
3. To apply air pollution monitoring and modeling
4. To induce operational considerations under the processing and control monitoring.
5. To apply sampling techniques of gaseous contaminants.
6. To control noise pollution by specific measurements, standard and preventive measures.

Course Outcomes

After completion of this course, the student is expected to be able to:

1. Apply sampling techniques and Suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
2. Apply air pollution monitoring and modeling
3. Induce operational considerations under the processing and control monitoring.
4. Apply sampling techniques of gaseous contaminants.
5. Control noise pollution by specific measurements, standard and preventive measures.
6. Gain the knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends.

UNIT I Introduction Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices – Emission Inventories.

UNIT II Air Pollution Monitoring And Modelling Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air Pollution Climatology. 19

UNIT III Control Of Particulate Contaminants Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring – Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT IV Control Of Gaseous Contaminants Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V Automobile And Noise Pollution Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

SUGGESTED READINGS

1. Anjaneyulu. Y, "Air Pollution & Control Technologies" Allied Publishers (P) Ltd.,India, 2002.
2. Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Daniel Vallero" Fundamentals of Air Pollution", Fourth Edition,2008.
4. David H.F. Liu, Bela G. Liptak „Air Pollution", Lweis Publishers, 2000.
5. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, 2004.
6. Noel de Nevers, "Air Pollution Control Engg".,McGraw Hill, New York, 1995.
7. Wayne T.Davis, „Air Pollution Engineering Manual", John Wiley & Sons, Inc., 2000.

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Semester-

19BECEE23 Environmental Impact Assessment and Life Cycle Analyses 3H-3C
(Environmental impact assessment (EIA)Methodologies, Environmental management EMS and Standardization, LCA)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To impart Knowledge on the growing need of civil engineering professionals to be acquainted with the potential environmental risks of infrastructure projects.
2. To give an appropriate knowledge the complementary role of ecological engineering through application of different environmental technologies.
3. To know the emerging aspects of environmental management including techniques of ecological foot printing and carbon trading will be illustrated.
4. To know the examples and case studies of some mega-projects will be included.
5. To assess the techniques of corporate environmental management to regional environmental management.
6. To know the remediation techniques and development of predictive models.

Course Outcomes

After completion of this course, the student is expected to be able to:

1. Approach the Environmental Management including methods of standardization and certification will be discussed.
2. Give an appropriate knowledge the complementary role of ecological engineering through application of different environmental technologies.
3. Know the emerging aspects of environmental management including techniques of ecological foot printing and carbon trading will be illustrated.
4. Know the examples and case studies of some mega-projects will be included.
5. Assess the techniques of corporate environmental management to regional environmental management.
6. Know the remediation techniques and development of predictive models.

UNIT I Environmental impact assessment (EIA): Introduction, definitions and concepts, rationale and historical development of EIA, EIA for civil engineers. **road components of EIA:** Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration. Pertinent institutional information, unique pollution problems, existing visual quality, public participation techniques. Composite consideration, potential cultural resources, potential visual impacts, geographical study area.

UNIT II Methodologies: Measurement of environmental impact, organization, scope and methodologies of EIA pertinent environmental factors. Six generic steps, descriptive checklists, simple interaction matrix, stepped matrix, uniqueness ratio, habitat evaluation system. Public involvement techniques, comprehensive environmental impact study, various project types,

archaeological properties, leachate testing, evaluation species, proposing agency, EIA Models. **Status of EIA in India:** EIA Regulations in India, TOR for Hydropower Projects and other projects. Case studies from hydropower projects, hazardous industries and mining.

UNIT III Environmental management: Principles, problems and strategies; Review of political, ecological and remedial actions. Future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions. Environmental audit: Definitions and concepts, partial audit, compliance audit, methodologies and regulations.

UNIT IV EMS and Standardization: Introduction to ISO and ISO 14000.EMAS regulations, wider application of system based approach. Local infrastructure development and environmental management: A system approach, Regional environmental management system, Conversion plan development and implementation strategies, Environmental management systems in local government**.**

UNIT V LCA: Life cycle assessment; Triple bottom line approach; Industrial Ecology. Ecological foot printing, Design for Environment, Future role of LCA, Product stewardship, design, durability and justifiability, measurement techniques and reporting. **Carbon trading** Energy foot printing, Food foot printing and Carbon foot printing.GHG emissions, global warming, climate change and Carbon credits, CDM, Initiatives in India; Sustainable development; Future scenarios.

SUGGESTED READINGS

1. L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997.
2. P. Judith and G. Eduljee, Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons, 1994.
3. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley & Sons, 2000.
4. C. H. Eccleston, Environment Impact Statements: A Comprehensive Guide to Project and Strategic Planning, John Wiley & Sons, 2000.
5. R. Welford, Corporate Environmental Management - Systems and Strategies, Universities Press, 1996.
6. K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997.
7. The Economist Intelligence Unit, Best Practices - Environment, Universities Press, 1993.
8. R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE24 **Building Construction Practice** **3H-3C**

(Building Materials, Foundation and Masonry, Construction Practices and Sub –Super structure construction)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

After successful completion of the course, the student will be able to

1. To select suitable materials for buildings and adopt suitable construction techniques.
2. To select suitable techniques used in super and sub structure construction.
3. To recognizing the good materials to be used for the construction work
4. To investigation of soil condition, Deciding and design of suitable foundation for different structures
5. To supervise of different types of masonry
6. To apply grouting techniques.

Course Outcomes

This course will develop a student;

1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In applying grouting techniques.
5. In applying different construction techniques in underwater construction
6. In explaining erection techniques for high rise structures.

UNIT I- Building Materials: Stone as building material; Requirement of good building stones, dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and war page. Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks. Mortar: types and requirements. Timber as construction material Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

UNIT II –Foundation and Masonry: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation, types of foundation, introduction to spread, combined, strap, mat and pile foundation Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls.

UNIT III- Construction Practices : Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork – masonry – stone masonry

– Bond in masonry – concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection..

UNIT IV- Sub Structure Construction: Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation;

UNIT V- Super Structure Construction-: Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks;

SUGGESTED READINGS

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

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Semester-

19BECEE25 **Construction Project Planning &Systems** **3H-3C**

(Project Planning systems, Planning Techniques, Contracts Management, Project Monitoring, Quality control)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

After successful completion of the course, the student will be able to

1. To analyze and apply the project planning systems and techniques
2. To plan, organize and manage the production and business processes of lesser or medium complexity within the business systems (civil engineering and public utility companies, local government offices)
3. To develop detailed appreciation for construction planning and scheduling
4. To apply their learned knowledge as it pertains to upper level construction management skills and procedures.
5. To update their knowledge on time and cost overruns and their corrective measures.
6. To apply their learned knowledge as it pertains to Project monitoring skills.

Course Outcomes

At the end of this course the student is expected to have learnt how to

1. Plan construction projects, schedule the activities using network diagrams,
2. develop detailed appreciation for construction planning and scheduling
3. Apply their learned knowledge as it pertains to upper level construction management skills and procedures.
4. Update their knowledge on time and cost overruns and their corrective measures.
5. Apply their learned knowledge as it pertains to Project monitoring skills.
6. Identify and understand the safety concepts of quality control.

UNIT I –Project Planning systems: Definition of Projects; 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 break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data.

UNIT II –Planning Techniques:- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. Allocation of Resources- materials, equipment, staff, labour and finance; resource levelling and optimal schedules; Project organisation, documentation and reporting systems

UNIT III-: Contracts Management: Importance of Contracts Management; Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction;

UNIT IV- Project Monitoring: Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management;

UNIT V- Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

SUGGESTED READINGS

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

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Semester-

19BECEE26 **Sustainable Construction Methods** **3H-3C**

(Types of foundations and construction methods, Modular construction methods, Cutting Edge of Sustainable Construction, Sustainability in Built environment and LEED Construction Management)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

This class is an introduction to sustainable construction.

1. Demonstrate an ability to evaluate and/or design whole or parts of projects, taking into account not only the financial and economic issues but also the social and environmental impacts affecting the sustainability of infrastructure.
2. Promote an approach to project evaluation that is based on an appreciation of the needs of society, the potential for sustainable development
3. To recognition the problems that may result from poorly conceived or poorly implemented projects and programs.
4. To know the construction method which is used in the sustainable environment.
5. To know the cutting edge rating systems in detail, including its evolution, objectives, criteria, levels of certification benefits, and shortcomings
6. To know a series of case studies representing diverse project types, sizes, certification levels, and climate regions

Course Outcomes

After taking this class students should be able to:

1. Understand rating systems and compares key features such as cost, ease of use, and building performance
2. Know the construction method which is used in the sustainable environment.
3. Know the cutting edge rating systems in detail, including its evolution, objectives, criteria, levels of certification benefits, and shortcomings
4. Know a series of case studies representing diverse project types, sizes, certification levels, and climate regions
5. Know what are “lessons learned” of sustainable construction through LEED case studies
6. Understand the concept of sustainable development or sustainability in the built environment

UNIT I –Types of foundations and construction methods: Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls).

UNIT II –Modular construction methods: 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.

UNIT III-:Cutting Edge of Sustainable Construction: 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.

UNIT IV- Sustainability in Built environment: The fundamental concepts of sustainable development in the built environment; the environmental - resources issues and industrial - construction metabolism with examples. Environmental ethics and environmental justice; ecological - environmental economics including Life Cycle Costing; building assessment (frameworks) and ecolabels. Energy systems, energy, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, energy, and materials. Concepts such as New Urbanism, bioclimatic design principles, ecological concepts, passive design strategies will be discussed.

UNIT V- LEED Construction Management: 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.

SUGGESTED READINGS

1. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.
2. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
3. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
4. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
5. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
6. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
7. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
8. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
9. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE27 **Construction Engineering Materials** **3H-3C**

(Stones – Bricks – Concrete Blocks, Lime – Cement – Aggregates – Mortar, Concrete, Timber And Other Modern Materials)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

At the end of this course the students should have learnt about the

1. Various materials, both conventional and modern, that are commonly used in civil engineering construction.
2. Further he should be able to appreciate the criteria for choice of the appropriate materials and the various tests for quality control in the use of these materials.
3. To expose students to the various building and general construction products and their associated quality, durability, warrantees, and availability.
4. To impart knowledge of various types of properties, uses, and variety of materials important in construction.
5. To expose students to various quality control aspects of the civil engineering materials by performing different lab test on materials.
6. To provide hands-on, research, and collaborative activities to vary and deepen the study of construction materials.

Course Outcomes

After taking this class students should be able to:

1. Expose students to the various building and general construction products and their associated quality, durability, warrantees, and availability.
2. Impart knowledge of various types of properties, uses, and variety of materials important in construction.
3. Expose students to various quality control aspects of the civil engineering materials by performing different lab test on materials.
4. Provide hands-on, research, and collaborative activities to vary and deepen the study of construction materials.
5. Know what are market forms of Timbers, Plywood's, Steels etc..
6. Understand the concept of Modern materials used in the construction.

Unit I Stones – Bricks – Concrete Blocks: Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacture of clay bricks – Tests on bricks – Compressive Strength - Water Absorption – Efflorescence –Bricks for special use – Refractory bricks – Cement and Concrete hollow blocks – Lightweight concrete blocks – Code Practices

Unit II-Lime – Cement – Aggregates – Mortar: Lime – Preparation of lime mortar – Cement. Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar

– Hydration - Compressive strength – Tensile strength – Soundness and consistency – Setting time – Aggregates – Natural stone aggregates – Industrial byproducts – Crushing strength – Impact strength – Flakiness – Abrasion Resistance – Grading – Sand – Bulking – Code Practices

Unit III - Concrete: Concrete – Ingredients – Manufacture – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction – Principles of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – IS method – High Strength Concrete and HPC – Other types of Concrete – Code Practices

Unit IV - Timber And Other Materials: Timber – Market forms – Industrial timber- Plywood - Veneer – Thermocole – Panels of laminates – Steel – Aluminum and Other Metallic Materials - Composition – uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Code Practices

Unit V. Modern Materials: Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fiber textiles – Geosynthetics for Civil Engineering applications.

SUGGESTED READINGS

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.
4. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
5. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
6. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
7. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
8. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
9. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
10. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
11. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE28 **Contracts Management** **3H-3C**

(Contract Management, Contract Parameters, Various Acts governing Contracts Bid Process and Bid Evaluation)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

Upon completion of this course, the student should:

1. To have developed a more detailed appreciation for construction planning and scheduling
2. To apply their learned knowledge as it pertains to upper level construction management skills and procedures.
3. To evaluate the best practices associated with the development of contract parameters.
4. To understand the legal aspects of acts governing the contracts
5. To discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
6. To understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

Course Outcomes

After taking this class students should be able to:

1. Apply project Procurement management concepts in a project environment.
2. Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
3. Evaluate the best practices associated with the development of contract parameters.
4. Understand the legal aspects of acts governing the contracts
5. Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
6. Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

Unit I Contract Management: Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

Unit II-Contract Parameters: Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

Unit III - Various Acts governing Contracts; Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,;

Unit IV - Bid Process and Bid Evaluation: bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types

of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

Unit V. Managing Risks and Change- Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement.

SUGGESTED READINGS

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.
4. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
5. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
6. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
7. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
8. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
9. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
10. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
11. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE29 **Construction Equipment& Automation** **3H-3C**

(Construction Equipment's And Management, Equipment For Earthwork, Other Construction Equipment, Asphalt And Concrete Plants and Material handling Equipment)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To study and understand the various types of equipment's used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.
2. To know various types of equipment have to be used in the constructions projects.
3. To know the equipment's used for earthwork.
4. To know the equipment's used for lifting, demolishing, grouting and dewatering purposes.
5. To know the equipment's used in batching asphalt and concrete plants.
6. To know the material handling conveyors, use of drones and use of robots for repetitive activities.

Course Outcomes

At the end of this course students will be able to

1. Know various types of equipment have to be used in the constructions projects.
2. Know the equipment's used for earthwork.
3. Know the equipment's used for lifting, demolishing, grouting and dewatering purposes.
4. Know the equipment's used in batching asphalt and concrete plants.
5. Know the material handling conveyors, use of drones and use of robots for repetitive activities.
6. Understand the various types of equipment's used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.

Unit I Construction Equipment's And Management: Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management

UNIT II Equipment For Earthwork: Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment.

UNIT III Other Construction Equipment: Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition. Under water concreting equipment's

UNIT IV Asphalt And Concrete Plants: Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping

Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment

UNIT V Materials Handling Equipment: Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks. Equipment for transportation of materials. Equipment Productivities; Use of Drones for spread out sites; Use of robots for repetitive activities.

SUGGESTED READINGS

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.
4. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
5. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
6. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
7. Chudley, R., *Construction Technology*, ELBS Publishers,2007.
8. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
9. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
10. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
11. Punmia, B.C., Khandelwal, K.K., Project Planning with PERTandCPM,LaxmiPublications,2016.

B.E Civil Engineering **2019-2020**

Semester-

19BECEE30 Repairs & Rehabilitation of Structures 3H-3C

(Maintenance And Repair Strategies, Strength And Durability of Concrete, Special Concretes, Repair, Rehabilitation and Retrofitting of Structures)

Instruction Hours/week: L: 3 T: 0 P: 0 **Marks:** Internal**:40**External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Students must gained knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.
2. To assessing damage to structures and various repair techniques
3. To know various types and properties of repair materials
4. To Analyse the damage to structures using various tests
5. To gain the importance and methods of substrate preparation
6. To know about various repair techniques of damaged structures, corroded structures

Course Outcomes

By the end of this course students will have the capability/knowledge of

1. various distress and damages to concrete and masonry structures
2. the importance of maintenance of structures, types and properties of repair materials etc
3. assessing damage to structures and various repair techniques
4. various types and properties of repair materials
5. damage to structures using various tests
6. the importance and methods of substrate preparation

UNIT I : Maintenance And Repair Strategies: Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II: Strength And Durability of Concrete: Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.

UNIT III : Special Concretes: Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV: Techniques For Repair and Protection Methods: Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V: Repair, Rehabilitation and Retrofitting of Structures: Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Demolition Techniques – Engineered demolition methods – Case studies.

SUGGESTED READINGS

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
3. Shetty M.S., "Concrete Technology – Theory and Practice", S.Chand and Company, 2008.
4. DovKominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
5. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and
6. Rehabilitation of Concrete Structures", Allied Publishers, 2004.
7. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
8. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
9. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
10. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
11. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.
12. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
13. Varghese, P.C., "*Building Construction"*, Prentice Hall India,2007.
14. *National Building Code,* Bureau of Indian Standards, New Delhi,2017.
15. Chudley, R., *Construction Technology*, ELBS Publishers,2007.

B.E/B.Tech **2019-2020**

19BESHOE01/19BTSHOE01 **3H-3C**

SOLID WASTE MANAGEMENT

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

1. To make the students conversant with basics of Solid wastes and its classification.
2. To make the student acquire sound knowledge of different treatments of solid wastes.
3. To acquaint the student with concepts of waste disposals.
4. To develop an understanding of the basic concepts of Hazardous waste management's.
5. To acquaint the students with the basics of energy generation from waste materials.
6. To understand the chemical principles in the projects undertaken in field of engineering and technology

Course Outcome:

1. Outline the basic principles of Solid waste and separation of wastes (K)
2. Identify the concepts of treatment of solid wastes(S)
3. Identify the methods of wastes disposals.(S)
4. Examine the level of Hazardousness and its management. (S)
5. Examine the possible of the energy production using waste materials. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I SOLID WASTE

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III WASTE DISPOSAL

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV HAZARDOUS WASTE MANAGEMENT

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V ENERGY GENERATION FROM WASTE

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, Energy recovery systems. Biological & Chemical conversion technologies –

Aerobic composting, low solids. Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

Suggested Readings:

1. Dara.S.S,Mishra.D.D, A Text book of Environmental Chemistry and Pollution Control, S.Chand and Company Ltd., New Delhi.2011.
2. Naomi B. Klinghoffer and Marco J. Castaldi,Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy),Woodhead Publishing Ltd., Cambridge, UK,2013.
3. Frank Kreith, George Tchobanoglous,Hand Book of Solid Waste Management- 2nd edition, McGraw Hill Publishing Ltd., Newyork,2002.
4. Shah, L Kanti, Basics of Solid & Hazardous Waste Management Technology, Prentice Hall (P) Ltd.,
5. New Delhi.1999.
6. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
7. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
8. www.alternative-energy-news.info/technology/garbage-energy/
9. nzic.org.nz/ChemProcesses/environment/

B.E/B.Tech **2019-2020**

19BESHOE02/19BTSHOE02 **3H-3C**

GREEN CHEMISTRY

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
3. To acquaint the student with concepts of green technology.
4. To develop an understanding of the basic concepts of renewable energy resources.
5. To acquaint the students with the basics information on catalysis
6. To apply the concepts of green catalysts in the synthesis

COURSE OUTCOMES:

1. Outline the basic principles of green chemistry (K)
2. Examine the different atom efficient process and synthesis elaborately (S)
3. Apply the concepts combustion of green technology (S)
4. Identify and apply the concepts of renewable energy(S)
5. Apply the concepts of green catalysts in the synthesis (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air.Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

Suggested Readings:

1. Sanjay K. Sharma, AckmezMudhoo,Green Chemistry for Environmental Sustainability,CRC Press , London,2010
2. Ahluwalia V. K. and M.Kidwai,New Trends in Green Chemistry 2nd edition,Anamaya publishers., New Delhi,2007.
3. Dr. SunitaRatan,A Textbook of Engineering Chemistry,S.K. Kataria and Sons., New Delhi.,2012.
4. MukeshDoble. Ken Rollins, Anil Kumar,Green Chemistry and Engineering, 1st edition, Academic Press, Elesevier., New Delhi.2007.
5. Desai K. R.,GreenChemistry, Himalaya Publishing House, Mumbai.,2005.
6. Matlack A. S.,Introduction to Green Chemistry.,Marcel Dekker: New York,2001.
7. http://www.organic-chemistry.org/topics/green-chemistry.shtm
8. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
9. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
10. http://www.epa.gov/research/greenchemistry/
11. http://www.amazon.in/Green-Chemistry-Catalysis

B.E/B.Tech **2019-2020**

19BESHOE03/19BTSHOE03 **3H-3C**

APPLIED ELECTROCHEMISTRY

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Objectives:

1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
3. To acquaint the student with concepts of green technology.
4. To develop an understanding of the basic concepts of renewable energy resources.
5. To acquaint the students with the basics information on catalysis
6. To understand the chemical principles in the projects undertaken in field of engineering.

Course Outcomes:

1. Outline the basic principles of chemistry in electrochemical material (K)
2. Examine the properties of conducting polymers(S)
3. Apply the concepts of electrochemistry in storage devices.(S)
4. Identify the concepts of storage devices and its applications. (S)
5. Apply the suitable materials for the manufacturing of storage devices. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I METAL FINISHING

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning.

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS

lectropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers- poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III BATTERIES AND POWER SOURCES-I

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV BATTERIES AND POWER SOURCES-II

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIAL SCIENCE

Solar cells- Preparation of CdS/Cu_2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics **TOTAL :45**

Suggested Readings:

1. Cynthia G. Zoski,Hand Book of Electrochemistry,Academic Press, Elesevier., UK,2007.
2. D.Pletcher and F.C.Walsh,Industrial Electrochemistry,Chapman and Hall, London,1990.
3. M. Barak,Electrochemical Power Sources,I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.1997.
4. Bruno Scrosati,Applications of Electroactive Polymers,Chapman & Hall, London,1993.
5. K.L. Chopra and I. Kaur,Thin Film Devices and their Application,Plenum Press, New York.1983.
6. M.M.Baizer,Organic Electrochemistry,Dekker Inc. New York,1983.
7. http://www.anoplate.com/finishes/
8. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
9. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

B.E/B.Tech **2019-2020**

19BESHOE04/19BTSHOE04 **3H-3C**

INDUSTRIAL CHEMISTRY

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

Course Objectives:

1. To make the students conversant with cement and lime and its uses.
2. To make the student acquire sound knowledge of abrasives and refractories.
3. To acquaint the student with concepts of inorganic chemicals.
4. To develop an understanding of the basic concepts explosives.
5. To acquaint the students with the basics of agriculture chemicals.
6. To understand the chemical principles in the projects undertaken in field of engineering.

Course Outcomes:

1. Outline the basic chemistry of cement and lime (K)
2. Examine the uses of abrasives and refractories (S)
3. Identify the usage of the inorganic chemicals. (S)
4. Identify the concepts of explosives and smoke screens(S)
5. Identify the usage of the agriculture chemicals(S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I CEMENT AND LIME

Manufacture of Portland cement – settling of hardening of portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

UNIT II ABRASIVES AND REFRACTORIES

Abrasives – hard abrasives – siliceous abrasives – soft abrasives – artificial abrasives – uses. Refractories – definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

UNIT IIIINORGANIC CHEMICALS

Common salt and soda ash – manufacture – different grades – products – alkalis – Na_2CO_3, caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture – absorption – uses, sulphur and sulphuric acid – extraction of sulphur – manufacture of H_2SO_4 – chamber – contact processes – industrial uses.

UNIT IV EXPLOSIVES

Explosives – uses – properties and tests – explosives for war – nitrocellulose – picric acid and T.N.T. – industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gas mask.

UNIT V AGRICULTURE CHEMICALS

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

Suggested Readings:

1. Harikrishan, ndustrial Chemistry, Goel Publishing House, Meerut.,2014.

2. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.,2000.
3. B.N.Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing CO. New Delhi.1998.
4. James A. Kent, Hand Book of Industrial Chemistry, 9th edition, Van Nostrand Reinhold, New York.1992.
5. R.N. Sherve, Chemical Process Industries, McGraw-Hill, Kugakuisha Ltd., Tokyo.1984.
6. S.D. Shukla and G.N. Pandy, A Text book of Chemical Technology, Vikas Publishing
7. House (P) Ltd, New Delhi.1979.
8. http://en.wikipedia.org/wiki/Cement
9. http://www.hon.ch/HONselect/Selection/D01.html
10. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
11. http://toxics.usgs.gov/topics/agchemicals.html

B.E/B.Tech **2019-2020**

19BESHOE05/19BTSHOE05 **3H-3C**

TECHNICAL WRITING

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. Develop abilities to write technically and expressively,
2. Recognize writing as a constructive, meaningful process,
3. Practice using reading strategies for effective writing.
4. Design effective technical documents for both print and digital media
5. Identify the qualities of good technical writing
6. To improve the ability of writing.

COURSE OUTCOMES:

Students undergoing this course are able to

1. Construct simple sentences, correct common grammatical errors in written English.
2. Build confidence in English language by imbibing lexical and syntax rules.
3. Enrich their reading ability for effective writing.
4. Minimize word, sentence, and paragraph length without sacrificing clarity or substance
5. Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
6. Understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

UNIT – I BASICS OF WRITING

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language –– Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer's block – Prioritizing for effective writing– Avoiding plagiarism.

UNIT – 2 PARAGRAPHS AND ESSAYS

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

UNIT – 3 LETTERS, MEMOS AND EMAIL

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

UNIT – 4 THE ART OF CONDENSATION AND TECHNICAL PROPOSALS

Steps to Effective précis writing – Guidelines – Technical Proposals – Types of Proposals – Characteristics – Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /Film Review – Travelogue – Dialogue Writing.

UNIT – 5 REPORTS AND RESEARCH ARTICLES

Discussion of newspaper articles -Objectives of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

SUGGESTED READINGS:

1. **V.N. Arora & Lakshmi Chandra, Improve Your Writing: Revised First Edition,** OUP, New Delhi. 2014.
2. David Morley, The Cambridge Intro. to Creative Writing, CUP, New Delhi.2010.
3. Graham King, Collins Improve Your Writing Collins; First edition, UK 2009
4. Crème, P. and M. Lea.Writing at University: A guide for students.OUP, New Delhi.2003
5. http://www.stevepavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/http://www.nyu.edu/classes/keefer/brain/net2.html
6. https://www.udemy.com/technical-writing-and-editing/
7. http://techwhirl.com/what-is-technical-writing/

B.E/B.Tech **2019-2020**

19BESHOE06/19BTSHOE06 **3H-3C**

GEOPHYSICS

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

Course Objective:

1. To inculcate the basics of brief history of Earth sciences (K)
2. To divulge knowledge on the basics of structure of earth and earth's gravitational field.(S)
3. To disseminate the fundamentals of magnetic field and thermal distribution of earth(K)
4. To introduce the concepts of seismology and seismic waves (S) .
5. To understand the basics and properties of sea water.

Course Outcome:

1. gain knowledge on the basics of history of Earth sciences.
2. acquire knowledge on concepts of structure of earth and earth's gravitational field.
3. have adequate knowledge on the concepts of magnetic field and thermal distribution of earth
4. obtain knowledge on the basics of seismic waves.
5. understand the basics of oceans and properties of sea water.
6. apply the knowledge gained from this course to solve the relevant propblems in engineering stream.

UNIT I ORIGIN OF EARTH

A brief history of the development of Earth Sciences . An overview of Geophysical methods and their essential features, Problems of inversion and non-uniqueness in Geophysics, Origin & evolution of Solar system, Earth and Moon structure,.Kepler's law of planetary motion, A review of the Earth's structure and composition

UNIT II STRUCTURE OF EARTH

Chemical composition of Earth, Rheological behavior of crust and upper mantle, visco-elasticity and rock failure criteria, Geochronology: Radiometric dating and their advantages, meaning of radiometric ages, Major features of the Earth's gravitational field and relationship with tectonic processes in the crust and upper mantle, concept of isostasy, mathematical concept of Airy and Pratt hypotheses of isostasy

UNIT III MAGNETIC FIELD AND THERMAL DISTRUBUTION OF EARTH

Origin of geomagnetic field, polar wandering, secular variations and westward drift, reversals of geomagnetic field, sun spot, solar flares, geomagnetic storms, sea-floor spreading, Paleomagnetism and its uses, Thermal history of the Earth, sources of heat generation and temperature distribution inside the earth, convection in the mantle

UNIT IV SEISMOLOGY

Earthquake seismology, Earthquakes and its classifications, Global seismicity and tectonics, Earth's internal structure derived from seismology, Earthquake mechanism and Anderson's theory of faulting, Continental drift and plate tectonics: its essential features, present day plate motions, Triple junctions, oceanic ridges, Benioff zones, arcs, hot spots, Mantle Plume, Mountain building, origin of Himalaya,

Geodynamics of Indian subcontinent.

UNIT V OCEANS

Physical properties of seawater and methods of determination, distribution of salinity in the oceans, factors affecting salinity, water masses and water type, TS Diagram, Circulation of currents in major ocean waves. Tides: Dynamical and equilibrium theory of tides. Marine pollution, steps to control marine pollution, Laws of seas, Coastal zone management

Suggested Readings:

1. B.F. Howell,Introduction to Geophysics, McGraw-Hill,2007.
2. W. Lowrie,Fundamentals of Geophysics, Cambridge University Press,2007.
3. J.A. Jacobs, R.D. Russel,Physics and Geology, McGraw-Hill.2002.
4. www. ocw.mit.edu
5. www.physicsclassroom.com
6. www.nptel.ac.in
7. www.physics.org

B.E/B.Tech **2019-2020**

19BESHOE07/19BTSHOE07 **3H-3C**

ENGINEERING ACOUSTICS

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. To disseminate the fundamentals of acoustic waves. (K)
2. To inculcate the characteristics of radiation and reception of acoustic waves. (K)
3. To divulge knowledge on the basics of pipe resonators and filters.(S)
4. To introduce the features of architectural acoustics.**(S)**
5. To impart the basic knowledge of transducers and receivers.(K)
6. To apply the knowledge inputs of the course for engineering applications

COURSE OUTCOME:

1. Develop the idea of the fundamentals of acoustic waves.
2. Apply the concepts of radiation and reception of acoustic waves.
3. Explain the basic ideas of pipe resonators and filters.
4. Illusrate the basics of architectural acoustics..
5. Illustrate the transducers and receivers and its applications in various electronic devices.
6. Apply the knowledge inputs of the course for engineering applications.

UNIT I INTRODUCTION

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves - Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales.Reflection and Transmission:Transmission from one fluid to another normal and oblique incidence –method ofimages.

UNIT IIRADIATION AND RECEPTION OF ACOUSTIC WAVES

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line sourceradiation impedance - Fundamental properties of transducers.Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III PIPES RESONATORS AND FILTERS

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters – low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

UNIT IV ARCHITECTURAL ACOUSTICS

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design. Environmental Acoustics: Highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

UNIT V TRANSDUCTION

Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker– horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

Suggested Readings:

1. LawerenceE.Kinsler, Austin R.Frey, Fundamentals of Acoustics, John Wiley & Sons, 4th edition 2000.
2. F. AltonEverest & Ken Pohlmann, Master Handbook of Acoustics, McGraw Hill Professional, 6th edition 2014.
3. www.acousticalsociety.org
4. www.acoustics-engineering.com
5. www.nptel.ac.in
6. www. ocw.mit.edu

B.E/B.Tech **2019-2020**

19BESHOE08/19BTSHOE08 **3H-3C**

INDUSTRIAL MATHEMATICS – I

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

OBJECTIVES:

1. To develop analytical skills for solving engineering problems
2. To teach the students the basic concepts of LPP,
3. To learn the techniques to solve transportation and Assignment problems
4. To make the students to study about the Integer Programming and Network Analysis
5. Analyse the results and propose recommendations to the decision-making processes in Management Engineering
6. To formulate and solve problems as networks.

INTENDED OUTCOMES:

1. To define and formulate linear programming problems and appreciate their limitations.
2. To solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. To be able to build and solve Transportation Models, Assignment Models,
4. To construct linear integer programming models and discuss the solution techniques.
5. To formulate and solve problems as networks and graphs.
6. To be able to solve problems in different environments and develop critical thinking

UNIT I LINEAR PROGRAMMING PROBLEM

Formulation of LPP - Graphical Method - Simplex Method - Artificial variable technique and two phase simplex method. Duality - Dual and simplex method - Dual Simplex Method .

UNIT II TRANSPORTATION PROBLEM

Transportation Model, finding initial basic feasible solutions, moving towards optimality, Degeneracy.

UNIT III ASSIGNMENT PROBLEM

Solution of an Assignment problem, Multiple Solution, Hungarian Algorithm, Maximization in Assignment Model, Impossible Assignment.

UNIT IV INTEGER PROGRAMMING

Integer Programming Problem – Gromory's fractional cut Method – Branch Bound Method

UNIT V NETWORK ANALYSIS

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis.

Suggested Readings:

1. HamdyTaha. A., Operations Research, Prentice – Hall of India Private Limited, New Delhi.2013.
2. KantiSwarup, Manmohan, Gupta, Operations Research, Sultan Chand & Sons, New Delhi.2010.
3. Natarajan A.M., Balasubramani P., Thamilarasi A, Operations Research, Pearson Education, New Delhi.2005.
4. Srinivasan G, Operations Research: Principles and Applications, PHI Private Limited, New Delhi.2007.
5. Winston, Operations Research, Applications and Algorithms, Cengage Learning India Pvt. Ltd, New Delhi,2004.
6. www.mathworld.
7. Wolfram.com
8. www.mit.edu
9. **www.nptel.com**

B.E/B.Tech **2019-2020**

19BESHOE09/19BTSHOE09 **3H-3C**

INDUSTRIAL MATHEMATICS – II

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

OBJECTIVES:

1. To kindle analytical skills for solving engineering problems
2. To impact the knowledge about inventory models
3. To learn replacement models and simulation models
4. To provide techniques for effective methods to solve nonlinear programming and decision making.
5. To analyse the results and propose recommendations to the decision-making processes in Management Engineering.
6. To solve problems using non integer programming.

INTENDED OUTCOMES:

The students will

1. To be able to solve simple models in Inventory problems and Replacement problems.
2. To understand different queuing situations and find the optimal solutions using models for different situations.
3. Simulate different real life probabilistic situations using Monte Carlo simulation technique.
4. To be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
5. Convert and solve the practical situations into replacement models.
6. To understand how to model and solve problems using non integer programming.

UNIT – I INVENTORY MODELS

Economic order quantity models-techniques in inventory management-ABC analysis.

UNIT – II NON LINEAR PROGRAMMING

Khun-tucker conditions with non-negative constraints- Quadratic programming- Wolf's modified simplex method.

UNIT – III SIMULATION MODELS

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1): (∞\FIFO) , (M\M\c): (∞\FIFO) Models.

UNIT -IV DECISION MODELS

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

UNIT -V REPLACEMENT MODELS

Models based on models that gradually detoriate with time-whose maintenance cost increase with time-Replacement of items that fail suddenly and completely.

Suggested Readings:

1. HamdyTaha. A., Operations Research, Prentice – Hall of India Private Limited, New Delhi.2013.
2. KantiSwarup, Manmohan, Gupta, Operations Research, Sultan Chand & Sons, New Delhi.2010.
3. Natarajan A.M., Balasubramani P., Thamilarasi A, Operations Research, Pearson Education, New Delhi.2005.
4. Srinivasan G, Operations Research: Principles and Applications, PHI Private Limited, New Delhi.2007.
5. Winston, Operations Research, Applications and Algorithms, Cengage Learning India Pvt. Ltd, New Delhi,2004.
6. www.mathworld.
7. Wolfram.com
8. www.mit.edu
9. **www.nptel.com**

B.E/B.Tech **2019-2020**

19BESHOE10/19BTSHOE10 **3H-3C**

FUZZY MATHEMATICS

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. Be able to understand basic knowledge of fuzzy sets and fuzzy logic
2. Be able to apply basic knowledge of fuzzy operations.
3. To know the basic definitions of fuzzy relations
4. Be able to apply basic fuzzy inference and approximate reasoning
5. To know the applications of fuzzy Technology.
6. To understand the concept of fuzziness involved in various systems.

COURSE OUTCOME:

1. To gain the main subject of fuzzy sets.
2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
3. To gain the methods of fuzzy logic.
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I FUZZY SETS

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II OPERATIONS ON FUZZY SETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V FUZZY INFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Suggested Readings:

1. George J Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic : Theory and Applications, Prentice Hall of India, New Delhi,2003.
2. Zimmermann H.J. Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.2001.
3. Michal Baczynski and BalasubramaniamJayaram, Fuzzy Implications, Springer-Verlag publishers, Heidelberg,2008
4. Kevin M Passino and Stephen Yurkovich, Fuzzy Control, Addison Wesley Longman publishers, USA,1998.

B.E/B.Tech **2019-2020**

19BESHOE11/19BTSHOE11 **3H-3C**

MATHEMATICAL PHYSICS

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. To know the fundamentals of Tensors.
2. To know the series solutions to differential equations.
3. To introduce the concepts of special functions.
4. To study about Calculus of variations and integral equations
5. Be familiar with the main mathematical methods used in physics.
6. To learn different ways of solving second order differential equations.

COURSE OUTCOME:

1. Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
2. Learn about special type of matrices that are relevant in physics and then learn about tensors.
3. Get introduced to Special functions like Bessel, Legendre , Hermite and Laguerre functions and their recurrence relations
4. Learn different ways of solving second order differential equations and familiarized with singular points and Frobenius method.
5. Students will master in calculus of variations and linear integral equations.
6. The students will have the knowledge on Mathematical Physics and that knowledge will be used by them in different engineering and technology applications.

UNIT I TENSORS

Definition of tensor - rank, symmetric tensors, contraction, quotient rule - tensors with zero components, tensor equations, metric tensors and their determinants - pseudo tensors

UNIT II DIFFERENTIAL EQUATIONS-SERIES SOLUTIONS Series Solution : Classification of singularities of an ordinary differential equation - Series solution-Method of Frobenius - indicial equation - examples

UNIT III SPECIAL FUNCTIONS

Basic properties (Recurrence and Orthogonality relations, series expansion) of Bessel, Legendre ,Hermite and Laguerre functions – Generating Function

UNIT IV CALCULUS OF VARIATIONS

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric Problems – Direct methods – Ritz and Kantorovich methods.

UNIT V LINEAR INTEGRAL EQUATIONS

Introduction – conversion of a linear differential equation to an integral equations and vice versa – conversion of boundary value problem to integral equations using Green's function – solution of aintegral

equation – integral equations of the convolution type – Abel's integral equations –integro–differential equations – integral equations with separable kernels – solution of Fredholm equations with separable kernels.

Suggested Readings:

1. Dr. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.2013.
2. Murray R Spiegel, Seymour Lipschutz, Dennis Spellman, Vector Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010
3. Stephenson, G, Radmore, P.M, Advanced Mathematical Methods for Engineering and Science students, Cambridge University Press India Pvt. Ltd., New Delhi,1990.
4. Andrews, Larry C. Special Functions of Mathematics for Engineers, Oxford Science publishers, New Delhi,1997.
5. www.mathcentre.ac.uk
6. www.mathworld.
7. wolfram.com
8. www.nptel.ac.in

B.E/B.Tech **2019-2020**

19BESHOE12/19BTSHOE12 **3H-3C**

LINEAR ALGEBRA

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

1. To introduce the basic concepts of vector space
2. To know the fundamentals of linear Algebra
3. To solve system of linear equations
4. To study about the linear transformations
5. To introduce the concepts of inner product spaces
6. To apply the basic concepts in their respective fields

COURSE OUTCOMES:

The student will be able to

1. To explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
2. To apply the fundamental concepts in their respective engineering fields
3. To visualize linear transformations as matrix form
4. To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
5. To articulate the importance of Linear Algebra and its applications in branches of Mathematics

UNIT I VECTOR SPACES

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space,

UNIT II EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS

Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss-Jacobi method, Gauss–Seidel method, convergence criteria.

UNIT IV LINEAR TRANSFORMATIONS

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES

The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

Suggested Readings:

1. Kreyszig,E, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.,2014.
2. Anton and Rorres, Elementary Linear Algebra, Applications version, Wiley India Edition, New Delhi,2012.
3. Jim Defranza, Daniel Gagliardi, Introduction to Linear Algebra with Application, Tata McGraw-Hill, New Delhi.2008.
4. wolfram.com
5. www.sosmath.com
6. www.nptel.ac.in
7. www.mathworld.

		L	T	P	C
19BECSOE01	**INTERNET PROGRAMMING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To study concepts of Internet, IP addresses and protocols
2. To explain the concept of web page development through HTML
3. To introduce the PERL and explore its current strengths and Weaknesses
4. To write working Java code to demonstrate the use of applets for client side programming
5. To study Internet telephony and various multimedia applications
6. To Elaborate on the principles of web page development

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

1. Learn the advanced concepts& techniques of Internet and Java.
2. Analyze the requirements for and create and implement the principles of web page development
3. Understand the concepts of PERL
4. Implement client side programming using java applets
5. Generate internet telephony based upon advanced concepts
6. Develop applications on internet programming based on java applets and scripts

UNIT I Introduction

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing, Subnetting

UNIT II HTML

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

UNIT III PERL

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets- Container Class, Components, Applet Life Cycle, Update method, Applications.

UNIT IV Client-Server programming

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic

transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V Internet Telephony

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

TEXT BOOKS:

1. Paul Deitel, Harvey Deitel and Abby Deitel, “Internet and World Wide Web-How to Program”, 5th Edition, 2011.
2. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.

REFERENCES:

1. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2011.
2. Robert W. Sebesta, “Programming the World Wide Web”, Pearson Education, 2016

	L	T	P	C
19BECSOE02 MULTIMEDIA AND ANIMATION	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To impart the fundamental concepts of Computer Animation and Multimedia
2. To study the graphic techniques and algorithms using flash
3. Explain various concepts available in 3D animation
4. Explain various devices available for animation
5. To study the multimedia concepts and various I/O technologies for concept development
6. To understand the three-dimensional graphics and their transformations

COURSE OUTCOMES

Upon completion of this course, the student will be able to:

1. Develop their creativity using animation and multimedia
2. Understand the concepts of Flash and able to develop animation using it
3. Understand about various latest interactive 3D animation concepts
4. Know the various devices and software available in motion capture
5. Understand the concept development process
6. Develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

UNIT I Introduction

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation – Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation.

UNIT II Creating Animation in Flash

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

UNIT III 3D Animation & its Concepts

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

UNIT IV Motion Caption

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software.

UNIT V Concept Development

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

TEXT BOOK:

1. Computer Graphics, Multimedia and Animation-Malay K. Pakhira,PHI Learning

PVT Ltd,2010

REFERENCES:

1. Principles of Multimedia – Ranjan Parekh, 2007, TMH. (Unit I, Unit V)
2. Multimedia Technologies – Ashok Banerji, Ananda Mohan Ghosh – McGraw Hill Publication.
3. Encyclopedia of Multimedia and Animations-Pankaj Dhaka, Anmol Publications-2011

19BECSOE03	PC HARDWARE AND TROUBLE SHOOTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To study the basic parts of computer in detail
2. Introduce various peripheral devices available for computer and its detailed working concepts
3. Overview of various interfaces and other hardware overview
4. Assemble/setup and upgrade personal computer systems and discuss about power supplies and the skills to trouble-shoot various power-related problems.
5. To study basic concepts and methods in troubleshooting
6. To study the installation/connection and maintenance of computer and its associated peripherals.

COURSE OUTCOME:

Upon completion of this course, the student will be able to:

1. Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM devices and so on.
2. Identify various peripheral devices available and its working
3. Understand various concepts of hardware and its interface and control
4. Perform basic installation of PC. Importance of maintenance is understood
5. Understand Various faults and failures are identified and troubleshooting in detail
6. Understand overall PC hardware, interfacing, maintenance and troubleshooting

UNIT I Introduction

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques– Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II Peripheral Devices

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC Hardware Overview

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV Installation and Preventive Maintenance

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V Troubleshooting

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

TEXT BOOK:

1. B. Govindarajalu, "IBM PC Clones Hardware, Troubleshooting and Maintenance", 2/E, TMH, 2002.

REFERENCES:

1. Peter Abel, Niyaz Nizamuddin, "IMB PC Assembly Language and Programming", Pearson Education, 2007
2. Scott Mueller, "Repairing PC's", PHI, 1992

19BECSOE04	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand Object Oriented Programming concepts and basic characteristics of Java
2. To know the principles of packages, inheritance and interfaces
3. To define exceptions and use I/O streams
4. To develop a java application with threads, generics classes and swings
5. To explain the need for generic programming
6. To design and build simple Graphical User Interfaces

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes and swings
5. Understand various aspects for motivation of generic programming
6. Develop various interactive Java programs using OOP concepts of Java

UNIT I INTRODUCTION TO JAVA

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members –constructors – finalize method

UNIT II PACKAGES

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNIT III I/O STREAMS

The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes.

UNIT IV EXCEPTION HANDLING

Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – introduction to Swing – Model-View-Controller design pattern –buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions.

UNIT V MOTIVATION FOR GENERIC PROGRAMMING

Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics - Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – Executors – synchronizers.

TEXT BOOK:

1. Cay S. Horstmann and Gary Cornell Core Java: Volume I – Fundamentals Sun Microsystems Press 2008

REFERENCES:

1. K. Arnold and J. Gosling The JAVA programming language Third edition, Pearson Education, 2009
2. Timothy Budd Understanding Object-oriented programming with Java Updated Edition, Pearson Education 2002
3. C. Thomas Wu An introduction to Object-oriented programming with Java Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2008

WEBSITES:

1. http://elvis.rowan.edu/~kay/cpp/vc6_tutorial/
2. http://www.winprog.org/tutorial/msvc.html
3. http://www.tutorialized.com/tutorials/Visual-C/1
4. http://www.freeprogrammingresources.com/visualcpp.html

19BEEEOE01 ELECTRIC HYBRID VEHICLE 3 0 0 3

Course Objectives

1. To understand the basic concepts of electric hybrid vehicle.
2. To gain the knowledge about electric propulsion unit.
3. To gain the concept of Hybrid Electric Drive-Trains.
4. To gain the different Energy Management Strategies.
5. To study about the efficiency manipulation in drives
6. To understand and gain the knowledge about various energy storage devices

Course Outcomes:

1. Summarize the basic concepts in bioprocess Engineering.
2. Explain the concept of Hybrid Electric Vehicles.
3. Understand the concept of Hybrid Electric Drive-Trains.
4. Identify the different Energy Management Strategies.
5. Understand the concept of different Energy Storage devices.
6. Analyze the different motor drives used in Hybrid Electric Vehicles

UNIT I INTRODUCTION

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT IIIELECTRIC PROPULSION UNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT VENERGY MANAGEMENT STRATEGIES

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

TEXT BOOK

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Iqbal Hussein	Electric and Hybrid Vehicles: Design	CRC Press – 2nd edition	2010

REFERENCE BOOK

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Mehrdad Ehsani,	Modern Electric,	Standards media –	2009

	Yimi Gao, Sebastian E. Gay, Ali Emadi	Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	2nd edition	
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley – 2nd edition	2012

19BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING 3 0 0 3

Course Objectives:

1. To gain the knowledge about energy management.
2. To understand the basic concepts in economic analysis in energy management.
3. To understand the basic principles of energy audit.
4. To gain the knowledge about the basic concept of types of Energy Audit
5. To gain and Evaluate the different energy efficient motors
6. Understand the concept of Energy conservation.
7. To study about the behaviour changes of PF requirement in motor currents

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concept of Energy Management.
2. Analyze the different methods for economic analysis
3. Knowledge about the basic concept of Energy Audit and types.
4. Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. Investigate the different methods to improve power factor.

UNIT I ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II ECONOMIC ASPECTS AND ANALYSIS

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV ENERGY EFFICIENT MOTORS

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air-conditioning system- energy efficient transformers.

UNIT V POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice- lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

TEXT BOOK

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Murphy W.R. and G.Mckay Butter worth	Energy Management	Heinemann Publications	2007

REFERENCES

S. No.	Author(s) Name	Title of the Book	Publisher	Year of

				Publication
1	John.C.Andreas	Energy Efficient Electric Motors	Marcel Dekker Inc Ltd – 3rd edition	2005
2	W.C.Turner Steve Doty	Energy Management Handbook	Lulu Enterprises, Inc. - 8th Edition Volume II	2013

19BEEEOE03 PROGRAMMABLE LOGIC CONTROLLER L T P C 3 0 0 3

Course Objectives

1. To understand the basic principles of PLC systems.
2. To gain the knowledge about data handling functions.
3. To gain the knowledge of storage techniques in PLC
4. To acquire the knowledge about how to handle the data and functions
5. To study about flow charts of ladder and spray process system
6. To understand the principles of PID.

Course Outcome

1. At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
2. To acquire the knowledge of storage techniques in PLC
3. Students know how to handle the data and functions
4. Students known about advanced controller in PLC applications
5. Students gather real time industrial application of PLC
6. Students gathered and evaluate the flow charts of ladder and spray process system

UNIT I INTRODUCTION

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II PLC PROGRAMMING

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	JR Hackworth and F.D Hackworth – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006

REFERENCES

S.	Author(s) Name	Title of the Book	Publisher	Year of

No.				Publication
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	2004
2	W.Bolton	Programmable Logic controller	Elsevier Newnes Publications, 5^{tn} Edition	2009

WEBSITE

http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,-Introductionto programmable Logiccontroller

19BEEEOE04 RENEWABLE ENERGY RESOURCES L T P C 3 0 0 3

Course Objectives

1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. To gain the knowledge about hydro energy.

Course Outcomes

At the end of this course, students will demonstrate the ability to

1. Analyze the Energy Scenario in india
2. Understand the concept of Solar Energy
3. Understand the concept of Wind Energy
4. Understand the concept of Hydro Energy
5. Analyze the different energy sources
6. Students gathered the real time inter connected system modelling in wind power

UNIT I INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT IV HYDRO ENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

TEXT BOOKS

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Rai.G.D	Non-conventional sources of energy	Khanna publishers	2011
2	Khan.B.H	Non-Conventional Energy Resources	The McGraw Hills, Second edition	2009

REFERENCES

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Rao.S. &Parulekar	Energy Technology	Khanna publishers, Eleventh Reprint	2013
2	Godfrey Boyl	Renewable Energy: Power sustainable future	Oxford University Press, Third edition	2012
3	John W Twidell and Anthony D Weir	Renewable Energy Resources	Taylor and Francis – 3rd edition	2015

WEBSITES

1. www.energycentral.com
2. www.catelelectricpowerinfo.com

B.E Electronics and Communication Engineering **2019-2020**

Semester-__

19BEECOE01 **Real Time Embedded Systems** **3H-3C**

Instruction Hours/week: L: 3 T: 1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To study about task management
4. To learn about semaphore management and message passing
5. To study about memory management
6. To imparts knowledge on

Course Outcomes

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

1. Understand overview of embedded systems architecture
2. Acquire knowledge on embedded system, its hardware and software.
3. Gain knowledge on overview of Operating system
4. Discuss about task Management
5. Gain knowledge about semaphore management and message passing.
6. Gain knowledge about memory management.

UNIT-I INTRODUCTION TO EMBEDDED SYSTEM

Introduction- Embedded systems description, definition, design considerations & requirements-Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systems-embedded processor selection & tradeoffs- Embedded design life cycle -Product specifications-hardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

UNIT-II OPERATING SYSTEM OVERVIEW

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks-Real Time Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- Reentrant Functions–Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion– Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- Task Management–Memory Management-Time Management–Clock Ticks.

UNIT-III TASK MANAGEMENT

Introduction-µ C/OS-II Features-Goals ofµ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Under µC/OS-II –Clock Tick-µ C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks–StackChecking–Task'sPriority–SuspendingTask– esumingTask.TimeManagement: Delaying a Task–Resuming a Delayed Task–System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

UNIT-IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box– Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue– Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue– Flushing a Queue.

UNIT-V MEMORY MANAGEMENT

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block– Returning a Memory Block. Getting Started withμ C/OS-II–Installingμ C/OS-II–Portingμ C/OS-II: Development Tools–Directories and Files– Testing a Port -IAR Workbench withμ C/OS-II-μ C/OS- II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help ofμ C/OS-II.

SUGGESTED READINGS

1. Floyd JeanJ. Labrosse Micro C/OS–II The Real Time Kernel CMPBOOKS 2009
2. David Seal ARM Architecture Reference Manual.Addison-Wesley 2008
3. Steve Furbe, ARM System-on-Chip Architecture, Addison-Wesley Professional, California 2000.
4. K.V.K.K.Prasad Embedded Real-Time Systems: Concepts, Design & Programming Dream Tech Press 2005.
5. Sriram V Iyer, Pankaj Gupta Embedded Real Time Systems Programming Tata Mc Graw Hill 2004

Semester-__

19BEECOE02 **Consumer Electronics** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To study about various speakers and microphone
2. To learn the fundamental of television systems and standards
3. To learn the process of audio recording and reproduction
4. To study various telephone networks
5. To discuss about the working of home appliances
6. To familiarize with TV services like ISDN.

Course Outcomes

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

1. Understand working of various type of loud speakers
2. Acquire knowledge on various types of picture tubes
3. Demonstrate the working of various optical recording systems
4. Distinguish various standards for color TV system
5. Acquire knowledge on various telecommunication networks
6. Demonstrate the working of various home appliances

UNIT-I LOUDSPEAKERS AND MICROPHONES

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT-II TELEVISION STANDARDS AND SYSTEMS

Components of a TV system–interlacing–composite video signal. Colour TV– Luminance and Chrominance signal; Monochrome and Colour Picture Tubes- Color TV systems– NTSC, PAL, SECAM-Components of a Remote Control.

UNIT-III OPTICAL RECORDING AND REPRODUCTION

Audio Disc– Processing of the Audio signal–readout from the Disc –Reconstruction of the audio signal–Video Disc–Video disc formats- recording systems–Playback Systems.

UNIT-IV TELECOMMUNICATION SYSTEMS

Telephone services-telephone networks–switching system principles–PAPX switching–Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems.

UNITV HOME APPLIANCES

Basic principle and block diagram of microwave oven; washing machine hardware and software; Components of air conditioning and refrigeration systems.

SUGGESTED READINGS

1. S.P. Bali Consumer Electronics Pearson Education 2007
2. J.S.Chitode Consumer Electronics Technical Publications 2007
3. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998

Semester-__

19BEECOE03 **Neural Networks and its Applications** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To introduce the basic concepts of neural networks and its applications in various domain
2. To educate how to use Soft Computing to solve real-world problems
3. To have a solid understanding of Basic Neural Network.
4. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
5. To gain exposure in the field of neural networks and relate the human neural system into the digital world
6. To provide knowledge of computation and dynamical systems using neural networks

Course Outcomes

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

1. Understand the basic concepts of neural networks and its applications in various domains
2. Gain knowledge about learning process in Neural Networks
3. Apply perception concept in design
4. Design using ART phenomena
5. Gain knowledge on SOM concepts
6. Ability to develop the use of Soft Computing to solve real-world problems

UNIT-I INTRODUCTION TO NEURAL NETWORKS

Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT-II LEARNING PROCESS

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT-III PERCEPTION

Single layer Perception-Adaptive filtering-unconstrained Optimization-Least-mean square algorithm- Leaning Curve-Annealing Technique-perception convergence Theorem-Relationship between perception and Baye's Classifier-Back propagation algorithm

UNIT-IV ATTRACT OR NEURAL NETWORK AND ART

Hopfield model-BAM model -BAM Stability-Adaptive BAM -Lyapunov function-effect of gain- Hopfield Design-Application to TSP problem-ART-layer 1-layer 2-orienting subsystem-ART algorithm-ARTMAP.

UNIT-V SELF ORGANIZATION

Self-organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical Vector Quantization. Applications of self-organizing maps: The Neural Phonetic Type Writer

Learning Ballistic Arm Movements.

SUGGESTED READINGS

1. SimonHaykin Neural Networks and Learning Machines 3rd Edition Pearson/Prentice Hall 2009
2. SatishKumar Neural Networks: A Classroom Approach TMH 2008
3. Rajasekaran.S, Vijayalakshmi Pai.G.A Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications PHI, New Delhi 2003.
4. LaureneFausett Fundamentals of Neural Networks: Architectures, Algorithms, and Applications Pearson/Prentice Hall 1994
5. Wasserman P.D Neural Computing Theory & Practice Van Nortrand Reinhold 1989.
6. Freeman J.A, S kapura D.M Neural networks, algorithms, applications, and programming techniques AdditionWesley 2005.

Semester-__

19BEECOE04 **Fuzzy Logic and its Applications** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To introduce the basic concepts of Fuzzy logic and its applications in various domain
2. To educate how to use Fuzzy computation to solve real-world problems
3. To have a solid understanding of Basic fuzzy models.
4. Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
5. To learn about applications on Fuzzy based systems
6. To familiarize with fuzzy fiction and de fuzzy fiction procedures

Course Outcomes

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

1. Understand the basic concepts of Fuzzy logic and its applications in various domain
2. Gain knowledge on theory of Reasoning
3. Develop fuzzy controllers
4. Understand concepts of adaptive fuzzy control
5. Ability to develop how to use Fuzzy computation to solve real- world problems
6. Design fuzzy based model for any application

UNIT-I BASICS OF FUZZY LOGIC

Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT-II THEORY OF APPROXIMATE REASONING

Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT-III FUZZY KNOWLEDGE BASED CONTROLLERS

Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzy fiction and de fuzzy fiction procedures–Design of Fuzzy Logic Controller

UNIT-IV ADAPTIVE FUZZY CONTROL

Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT-V FUZZY BASED SYSTEMS

Simple applications of FKBC-washing machines-traffic regulations-lift control-fuzzy in medical Applications-Introduction to ANFIS.

SUGGESTED READINGS

1. D .Diankar ,H. Hellendoom and M .Rein frank An Introduction to Fuzzy Control Narosa Publishers India 1996
2. G.J. KlirandT.A. Folger Fuzzy Sets Uncertainty and Information PHI IEEE 1995
3. Timothy J. Ross Fuzzy Logic with Engineering Applications McGraw Hill1997
4. George. J Klir and Bo Yuan Fuzzy Sets and Fuzzy Logic Prentice Hall, USA 1995

Semester-__

19BEECOE05 Principles of Modern Communication System 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To provide students with an overview of communication systems
2. To provide an overview on mobile communication
3. To make students to have a better understanding on satellite and radar communication
4. To understand the basic communication techniques which in turn are used as the building blocks of the larger and more complex communication systems.
5. To acquire the basic engineering understanding to the modern communication systems and; the relevant theory and technique.
6. Design simple systems for landing and navigation.

Course Outcomes

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

1. Understand past, present and future trends in mobile communication.
2. Gain knowledge about mobile cellular communication
3. Understand various standards in use for wireless communication and its application.
4. Demonstrate some basic application of GPS.
5. Gain knowledge about RADAR working and its applications
6. Demonstrate how a simple radar system works and its applications.

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION

From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III WIRELESS COMMUNICATION

Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION

History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION

Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

SUGGESTED READINGS

1. S.Haykin, ―Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, ―Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson Education India, 2010
4. Vijay. K. Garg, ―Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.
5. T.Pratt, C. Bostian and J.Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried ―Avionics Navigation Systems, John Wiley & Sons 1997.

19BTBTOE01 **BIOREACTOR DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

1. To impart basic knowledge in bioprocess Engineering
2. To design the bioreactors for various operations.
3. To understand the principle and working of heat transfer equipments.
4. To extend the knowledge in principle of heat transfer inside a bioreactor
5. To construct the equipments used in mass transfer operations.
6. To learn the equipments used in separation process.

Course Outcomes:

1. Summarize the basic concepts in bioprocess Engineering.
2. Design the bioreactors for various operations.
3. Develop the heat transfer equipments for Bioprocess Engineering.
4. Elaborate the principle of heat transfer in bioreactor.
5. Construct the equipments used in mass transfer operations.
6. Categorize the equipments used in separation process.

UNIT I –INRODUCTION TO BIOPROCESS ENGINEERING

Introduction – Biotechnology and Bioprocess Engineering- Biologists and Engineers Differ in their approach to research-How Biologists and Engineers work Together- Bioprocesses: Regulatory constraints.

UNIT II - REACTOR DESIGN

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III - HEAT TRANSFER EQUIPMENTS

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

UNIT IV - MASS TRANSFER EQUIPMENTS

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

UNIT V - SEPARATION EQUIPMENTS

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotary drum drier and Swenson –walker crystallizer.

SUGGESTED READINGS:

1. James Edwin Bailey, David F. Ollis (2015) Biochemical Engineering Fundamentals, Second Edition. McGraw-Hill Education (India) private limited.
2. Don W. Green, Robert H.Perry (2008). Chemical Engineer Hand book. The McGraw-Hill Companies, Inc.
3. Pauline. M. Doran (2015). Bioprocess Engineering Principles Second Edition . Academic Press.

19BTBTOE02 FOOD PROCESSING AND PRESERVATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To learn the scope and importance of food processing.
2. To impart basic knowledge in different food processing methods carried out in the food tech companies.
3. To extend the brief knowledge in food conservation operations.
4. To study the methods of food preservation by cooling.
5. To familiarize the students on the concepts of preservation methods for fruits.
6. To create deeper understanding on preservation methods for vegetables.

Course Outcomes

1. Describe the scope and importance of food processing.
2. Outline the various processing methods for foods.
3. Extend the knowledge in food conservation operations.
4. Describe the methods of food preservation by cooling.
5. Summarize the preservation methods for fruits.
6. Demonstrate the preservation methods for vegetables.

UNIT I - SCOPE AND IMPORTANCE OF FOOD PROCESSING

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNIT II - PROCESSING METHODS

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning-additives- fermentation-extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing-Concepts and equipment used.

UNIT III - FOOD CONVERSION OPERATIONS

Size reduction – Fibrous foods, dry foods and liquid theory and foods – equipments - membrane separation- filtration- equipment and application.

UNIT IV - FOOD PRESERVATION BY COOLING

Refrigeration, Freezing-Theory, freezing time calculation, methods freezing of freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V - PRESERVATION METHODS FOR FRUITS AND VEGETABLES

Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation– Food irradiation- Combined preservation techniques.

SUGGESTED READINGS:

1. R. Paul Singh, Dennis R.Heldman (2014).Introduction to food engineering. Academic press.
2. P.Fellows.(2017). Food processing technology principles and practice, Fourth Edition. Wood head publishing Ltd.
3. Mircea Enachescu Dauthy. (1995). Food and vegetable processing.FAO agricultural services bulletin.
4. M.A. Rao, Syed S.H.Rizvi, Ashim K. Datta. (2014). Engineering properties of foods. CRC press.
5. B. Sivasankar. (2002). Food processing and preservation.PHI learning Pvt.Ltd.

19BTBTOE03 **BASIC BIOINFORMATICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. To understand the available tools and databases for performing research in bioinformatics.
2. To expose students to sequence alignment tool in bioinformatics.
3. To construct the phylogenetic trees for evolution.
4. To get familiar with the 3D structure of protein and classification.
5. To acquire basic knowledge in protein secondary structure prediction.
6. To extend the brief knowledge in Micro array data analysis.

Course Outcomes

1. Summarize the basic concepts and importance of Bioinformatics in various sectors.
2. Demonstrate the sequence alignment tool in bioinformatics.
3. Construct the phylogenetic trees for evolution.
4. Analyze the three dimensional protein structure and classification using various tools.
5. Illustrate the protein secondary structure prediction by comparative modeling.
6. Extend the knowledge in micro array technology and applications of bioinformatics in various sectors.

UNIT I - OVERVIEW OF BIOINFORMATICS

The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II - RETRIEVAL OF BIOLOGICAL DATA

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III - PHYLOGENETICS

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV - STRUCTURAL BIOINFORMATICS

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNIT V - MICROARRAY DATA ANALYSIS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma

informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

SUGGESTED READINGS:

1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. Pearson Education.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.
4. Jonathan Pevsner.(2015). Bioinformatics and functional genomics. wiley-Liss.
5. Michael J Koernberg. (2016).Microarray Data Analysis: Methods and applications. Humana Press

19BTBTOE04 FUNDAMENTALS OF NANOBIOTECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**
End Semester Exam:3 Hours

Course Objectives

1. To impart the skills in the field of nano biotechnology and its applications.
2. To acquire knowledge in the nano particles and its significance in various fields.
3. To extend the knowledge in types and application of nano particles in sensors.
4. To define the concepts of biomaterials through molecular self assembly.
5. To equip students with clinical applications of nano devices.
6. To describe deeper understanding of the socio-economic issues in nanobiotechnology.

Course Outcomes

1. Develop skills in the field of nano biotechnology and its applications.
2. Summarize the nanoparticles and its significance in various fields.
3. Extend the knowledge in types and application of nano particles in sensors.
4. Define the concepts of biomaterials through molecular self assembly.
5. Outline the clinical applications of nano devices.
6. Describe the socio-economic issues in nanobiotechnology.

UNIT I - INTRODUCTION

Introduction, Scope and Overview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

UNIT II - NANO PARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

UNIT III – MEDICAL NANOTECHNOLOGY

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine.

UNIT IV - NANOBIOTECHNOLOGY

Clinical applications of nanodevices. Artificial neurons. Real-time nanosensors- Applications in cancer biology. Nanomedicine.Synthetic retinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nano carbontubules.Nanosurgical devices.

UNIT V - ETHICAL ISSUES IN NANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

SUGGESTED READINGS:

1. Niemeyer, C.M. and Mirkin, C.A (2005). Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH.

2. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
3. Shoseyov, O.and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materials of the Future. Humana Press.
4. Bhushan, B.(2017). Springer Handbook of Nanotechnology. Springer-Verlag Berlin Heidelberg.
5. FreitasJr R.A (2006) Nanomedicine. Landes Biosciences.
6. Kohler, M. and Fritzsche, W. (2008). Nanotechnology – An Introduction to Nanostructuring Techniques. Wiley-VCH.

19BEMEOE01 **COMPUTER AIDED DESIGN** **3 H – 3 C**

Instruction hours / week L : 3 T : 0 P : 0 **Marks:** Internal **: 40** External **: 60** Total**: 100**

End Semester Exam : 3 Hours

COURSE OBJECTIVE

1. To provide an overview of how computers are being used in mechanical component design
2. To study about the various computer graphics concepts
3. To get basic knowledge on geometric modeling
4. to study about the basics of parametric design and object representation
5. To get basic knowledge in product design and development.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

1. Give the overview of the cad systems and its importance
2. Explain the ideas and principles behind the computer graphics
3. Explain the process involved in graphic transformations
4. Understand the operations involved in the geometric modeling.
5. Describe the concepts of parametric design
6. Understand the basics of the product design and development.

UNIT I OVERVIEW OF CAD SYSTEMS

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNIT II INTERACTIVE COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, Boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

UNIT IV PARAMETRIC DESIGN AND OBJECT REPRESENTATION

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids - manipulations.

UNIT V PRODUCT DESIGN AND DEVELOPMENT

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

SUGGESTED READINGS

1. Vera B Anand, Computer Graphics and Geometric Modeling for Engineers,1st edition, John Wiley & Sons, New York, 2000
2. Radhakrishnan P and Subramanyan S, CAD/CAM/CIM, 2nd edition, New Age International Pvt. Ltd, 2008
3. Ibrahim Zeid, CAD/CAM Theory and Practice,2nd edition, McGraw Hill Inc., New York, 2009
4. Barry Hawhes, The CAD/CAM Process,1st edition, Pitman Publishing, London, 2007(digital)
5. William M Newman and Robert Sproul, Principles of Interactive Computer Graphics,1st edition, McGraw Hill Inc., New York, 2001
6. Sadhu Singh, Computer-Aided Design and Manufacturing,1st edition, Khanna Publishers, New Delhi, 1998

19BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT 3 H – 3 C

Instruction hours / week L : 3 T : 0 P : 0 **Marks:** Internal **: 40** External **: 60** Total**: 100**

End Semester Exam : 3 Hours

COURSE OBJECTIVE

1. To get the basic introduction on logistics
2. To study the basics of supply chain and its concepts.
3. to know the various phases involved in supply chain
4. to study about different supply chain models
5. to know the various activities involved in supply chain management.

COURSE OUTCOMES

Upon completion of this course, the students can be able to

1. Understand the role of logistics
2. Understand the phases of supply chain
3. Get the knowledge on various supply chain models
4. Link the supply chain concepts with customer
5. Perform various activities involved in supply chain
6. Understand the management system of supply chain and the information system followed for managing the same.

UNIT I INTRODUCTION TO LOGISTICS

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II PHASES OF SUPPLY CHAIN

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

UNIT IV SUPPLY CHAIN ACTIVITIES

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V SCM ORGANISATION AND INFORMATION SYSTEM

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERP Software's

SUGGESTED READINGS

1. Shari.P.B and Lassen.T.S, Managing the global supply chain, 1st edition, Viva books, New Delhi, 2000
2. Ayers.J.B, Hand book of supply chain management,1st edition, The St. Lencie press, 2001
3. Nicolas.J.N, Competitive manufacturing management - continuous improvement, Lean production, customer focused quality,1st edition, McGrawHill, New York, 2008
4. Steudel.H.J and Desruelle.P, Manufacturing in the nineties - How to become a mean, lean and world class competitor,1st edition, Van No strand Reinhold, New York, 2007(digital)

19BEMEOE03 **TRANSPORT PHENOMENA** **3 H – 3 C**

Instruction hours / week L : 3 T : 0 P : 0 **Marks:** Internal **: 40** External **: 60** Total**: 100**

End Semester Exam : 3 Hours

COURSE OBJECTIVE

1. To provide the basics of transport phenomena and its applications.
2. To provide the knowledge over the properties of the systems and unit systems used.
3. To understand the basics and mathematics involved in momentum transport.
4. To provide the basics and applications of energy transport.
5. To give basics and principles involved in the mass transport phenomena.

COURSE OUTCOMES

Upon completion of this course, the students can be able to

1. Understand the basic concepts of transport phenomena
2. Understand the essentiality of properties of a system and unit systems used.
3. Understand the basic concepts involved in momentum transport.
4. Apply the mathematics involved in fluid flow problems.
5. Explain the various energy transport phenomena.
6. Understand the basics of mass transport phenomena.

UNIT I INTRODUCTION AND BASIC CONCEPTS

General overview of transport phenomena including various applications, Transport of momentum, heat and mass , Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNIT II PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNIT IV ENERGY TRANSPORT

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heat transfer

UNIT V MASS TRANSPORT

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion-Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

SUGGESTED READINGS

1. Geankoplis, C. J, Transport Processes and Separation Processes Principles, 4th edition, Prentice Hall, 2013
2. R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, Transport Phenomena, 1st edition, John Wiley & Sons, 2007.
3. Edwin N. Lightfoot, Transport phenomena and living systems: biomedical aspects of momentum and mass transport, 1st edition, Wiley, 1973, 2007 (digital)

19BEMEOE04 INTRODUCTION TO BIOMECHANICS 3 H – 3 C

Instruction hours / week L : 3 T : 0 P : 0 **Marks:** Internal **: 40** External **: 60** Total**: 100**

End Semester Exam : 3 Hours

COURSE OBJECTIVE

1. Biomechanics provides key information on the most effective and safest movement patterns, equipment, and relevant exercises to improve human movement.

COURSE OUTCOMES

Upon completion of this course, the students will be able to,

1. Understand the basics and importance of biomechanics.
2. Present the nine fundamentals of biomechanics and its need.
3. Explain the nine principles used for application of biomechanics.
4. Describe the human anatomy
5. Explain the need for biomechanics in muscle actions
6. Understand the basics of the mechanics involved in musculoskeletal system.

UNIT I INTRODUCTION

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

UNIT IV ANATOMICAL DESCRIPTION

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch-Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

SUGGESTED READINGS

1. Duane Knudson, Fundamentals of Biomechanics, 1st edition,Springer Science+ Business Media, LLC, 2013
2. C. Ross Ethier Craig A. Simmons, Introductory Biomechanics,1st edition, Cambridge University Press, 2008

19BEAEOE01 AUTOMOBILE ENGINEERING 3 0 0 3 100

Course Objectives:

1. To impart knowledge on the constructional details and principle of operation of various automobile components.
2. To learn the function and working of various components in transmission and drive lines.
3. To study the concept and working of steering and suspension systems in an automobile.
4. To give knowledge on the wheels, tyres and brakes of automobiles.
5. To provide information on the current and future trends in automobiles.
6. Explain the function and working of components in transmission and drive lines.

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Demonstrate the operating principles and constructional details of various automobile components.
2. Explain the function and working of components in transmission and drive lines.
3. Identify and explain the types of steering system.
4. Identify and explain the types of suspension system.
5. Classify and describe the types of wheels, tyres and brakes of automobiles.
6. Discuss the current and future trends in the automobiles.

UNIT I ENGINE AND FUEL FEED SYSTEMS

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburettor working principle, requirements of an automotive carburettor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

UNIT II TRANSMISSION SYSTEMS

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles.Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propeller Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

UNITIII SUSPENSION SYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

UNITIV BRAKES

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory, Brake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

UNITV ELECTRICAL SYSTEM

Principle and construction of lead acid battery. Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.Starting System and charging system.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION

1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2003
3.	Dr.Kirpal Singh	Automobile Engineering	Standard Publisher	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
2.	Crouse.W.H	Automobile Electrical Equipment, 3rd Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001

19BEAEOE02 BASICS OF TWO AND THREE WHEELERS 3 0 0 3 100

Course Objectives:

1. To impart technical knowledge on construction and working of the power train and drive train of two and three wheeler vehicles.
2. To familiarise with maintenance procedures of the engine and subsystems of two and three wheelers.
3. To impart knowledge on types of transmission systems
4. To impart knowledge on types of steering and suspension systems
5. To impart knowledge on types of wheels, tyres and brakes for two and three wheelers
6. To make the students conversant on servicing of two and three wheelers.

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Construct the frames of two and three wheelers of different layouts.
2. Demonstrate the constructional details and principle of operation of various engine components.
3. Identify and explain the types of transmission systems.
4. Identify and explain the types of steering and suspension systems.
5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
6. Explain the servicing of two and three wheelers.

UNIT I INTRODUCTION

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION

Types of clutches for 2 and 3 wheelers. Design of clutch system.Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength Torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988

REFERENCES:

SL. NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Griffin.M.M	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2.	Bruce A. Johns, David D. Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

19BEAEOE03 AUTOMOBILE MAINTENANCE 3 0 0 3 100

Course Objectives:

1. To understand the need for vehicle maintenance and its importance.
2. To familiarise the maintenance procedure for various components of an automobile.
3. To familiarize the students to understand servicing of transmission and driveline components.
4. To make the students conversant on the procedure for steering and suspension
5. To make the students conversant on the procedure for wheel and brake maintenance.
6. To Study and acquire knowledge on the fault diagnosis in the electrical and air conditioner systems.

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Describe and differentiate the types of maintenance.
2. List the procedure for dismantling, servicing and assembling of engine components.
3. Demonstrate the servicing of transmission and driveline components.
4. Discuss the procedure for steering and suspension
5. Discuss the procedure for wheel and brake maintenance.
6. Explain the fault diagnosis in the electrical and air conditioner systems.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts, Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION

1.	John Doke	Fleet Management	McGraw Hill Co	1984
2.	James D Halderman	Advanced Engine Performance Diagnosis	Prentice Hall Publications	2011
3.	Service Manuals from Different Vehicle Manufacturers			

19BEAEOE04 INTRODUCTION TO MODERN VEHICLE TECHNOLOGY 3 0 0 3 100

Course Objectives:

1. To impart knowledge on trends in the vehicle power plants.
2. To learn the various advanced driver assistance systems.
3. To study the working of advanced suspension and braking systems in an automobile.
4. To give information about motor vehicle emission and noise pollution control.
5. To provide knowledge of the vehicle telematics.
6. To give information about the noise control techniques

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Distinguish and describe the various modern vehicle power plant systems.
2. List and explain the various driver assistant mechanisms.
3. Identify and describe the working of advanced suspension and braking systems.
4. Apply the knowledge of motor vehicle emission and noise pollution control.
5. Describe the noise control techniques
6. Describe the vehicle telematics and its applications.

UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNIT II DRIVER ASSISTANCE SYSTEMS

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

UNIT III SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT IV NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT V TELEMATICS

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

TEXT BOOKS

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	LjuboVlacic, Michael Saren and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001
2.	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems –Progress in Technology	Automotive Electronics Series,SAE, USA.	1998

REFERENCES

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION

1.	William B Riddens	Understanding Automotive Electronics, 5th Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold,	Understanding Automotive Electronics	SAE	1998
3.	Robert Bosch	Automotive HandBook, 5th Edition	SAE	2000

19BEAEOE05 COMMERICAL FLEET OPEARTION 3 0 0 3 100

Course Objectives:

1. To impart knowledge on the personnel management, selection process, training methods and motor vehicle act.
2. To plan the vehicle routes, scheduling of vehicles and fare structure.
3. To design the vehicle maintenance systems.
4. To Study and acquire knowledge on fare structure and analyse the methods of fare collection
5. To introduce the concepts of vehicle parts, supply management and data processing
6. To Study and acquire knowledge on electronically controlled vehicle maintenance system

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Apply the knowledge of personnel management and analyse the selection process and training methods.
2. Apply the motor vehicle act in terms of registration and describe the various vehicles and conduct the test of competence to drive.
3. Construct a fare structure and analyse the methods of fare collection.
4. Analyse the vehicle parts, supply management and data processing.
5. Describe the scheduled and unscheduled maintenance
6. Demonstrate an electronically controlled vehicle maintenance system and analyse the work schedule.

UNIT I ORGANISATION AND MANAGEMENT

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

UNIT II VEHICLE MAINTENACE

Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.

UNIT III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses - Fleet management and data processing - Data processing systems - Software. Model - Computer controlling of
fleet activity - Energy management.

UNIT IV SCHEDULING AND FARE STRUCTURE

Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, fare structure – Fare concessions - Methods of fare collection - Preparation of fare table.

UNIT V MOTOR VEHICLE ACT

Schedules and sections - Registration of motor vehicles - Licensing of drivers and conductors - Control of permits - Limits of speed - traffic signs - Constructional regulations - Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle.

REFERENCE BOOKS

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John Dolu	Fleet Management	McGraw-Hill Co.	1984
2.	Rex W. Faulks	Bus and Coach Operation	Butterworth.	1987
3.	Kitchin L.T.D	Bus operation, 3rd Edition	iliffe and Sons Ltd., London.	1992

19BTCEOE01 ENERGY MANAGEMENT IN CHEMICAL INDUSTRIES 3 0 0 3 100

COURSE OBJECTIVE

1. Teaching the basic concepts and fundamental aspects of industrial and domestic thermal systems' design.
2. Prepare the students for the positions of energy management in energy intensive industries

COURSE OUTCOME

After completion of the course, students are able to

1. Plan to optimize energy using systems and procedures to meet energy demand
2. Describe the movement of substances in the entire globe
3. Examine the relationship between energy systems and society
4. Use optimization techniques for conservation of energy in chemical industries
5. Evaluate the production rate and analyze the cost from economic balance for energy consumption.

Unit-I PLANNING FOR ENERGY NEEDS

Forecasting techniques; energy demand; magnitude and pattern; input and output analysis; energy modelling and optimal mix of energy sources.

Unit-II ENERGY AND ENVIRONMENT

Energy; various forms; energy storage; structural properties of environment; bio-geo-chemical cycles; society, environment population and technology.

Unit-III ENERGY AND SOCIETY

Energy and evolution; growth and change; patterns of consumption in developing and advanced countries; commercial generation of power requirements and benefit.

Unit-IV MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES

Chemical industries; classification; conservation in unit operations such as separation; cooling tower; drying; conservation applied to refineries, petrochemical, fertilizers, cement, pulp and paper, food and chlor-alkali industries; conservation using optimization techniques.

Unit-V ECONOMIC BALANCE IN ENERGY CONSUMPTION

Cost analysis; capacity; production rate; system rate; system cost analysis; corporate models; production analysis and production using fuel inventories; input-output analysis; economics; tariffs

TOTAL: 45 Hrs

SUGGESTED READINGS

- Jerrold H Kertz, Energy Conservation and Utilization, Allyn and BacurInc, 1976.
- Gemand M Gramlay, Energy, Macmillion publishing Co, Newyork, 1975
- Krentz J. H., Energy Conservation and Utilization, Allyn and Bacur Inc., 1976.
- Gramlay G. M., Energy, Macmillan Publishing Co., New York, 1975.
- Rused C. K., Elements of Energy Conservation, McGraw-Hill Book Co., 1985

COURSE OBJECTIVE

1. 1.To enable the students to learn the fertilizer manufacturing including new or modified fertilizer products and new techniques.
2. Understand, interpret and prepare project reports.
3. Understand safety goals, waste control and waste treatment (effluent control)
4. Understand the energy conservation and balance.
5. Develop attitude for safety consciousness
6. State the importance of fertilizers in agriculture

COURSE OUTCOME

1. After completion of the course, students are able to
2. Illustrate chemical, organic fertilizers and nutrients
3. Develop the flow chart for manufacture of nitrogenous fertilizers
4. Analyze the various processes and develop the flow chart for the manufacture of phosphatic fertilizers.
5. Develop the flow chart for the manufacture of potassic fertilizer and analyze the unit operations involved in the process.
6. Illustrate the quality and pollution standards permissible in fertilizer industry.

Unit-I INTRODUCTION

Chemical Fertilizers and Organic Manures - Types of chemical Fertilizers. Secondary nutrients, micro nutrients.

Unit-II NITROGEN FERTILIZERS

Nitrogenous Fertilizers - Methods of production of Ammonia and Urea. Nitric acid, Ammonium sulphate, Ammonium Nitrate, Calcium Ammonium Nitrate, Ammonium Chloride - Their methods of production, characteristics, storage and handling specifications.

Unit-III PHOSPHATIC FERTILIZERS

Raw materials, phosphate rock, Sulphur pyrites -Process for the production of Sulphuric and Phosphoric acids. Ground phosphate rock, bone meal. Single Super Phosphate, Triple Super phosphate -Methods of production, characteristics and specifications.

Unit-IV POTASSIC FERTILIZERS

Potassium chloride, Potassium sulphate, Potassium schoenite - Methods of production, specification, characteristics. Complex Fertilizers, NPK Fertilizers, Mono ammonium phosphate, Diammonium phosphate, Nitro phosphate Methods of production.

Unit-V FERTILIZERS IMPACTS AND STANDARDS

Fluid fertilizers.Controlled Release of fertilizers. Solid, Liquid and Gaseous pollution from ammonia urea and NPK fertilizer industries and standards laid down for them. Fertilizer production in India.

SUGGESTED READINGS

- GopalaRao M., Marshall Sittig, Dryden's Outlines of Chemical Technology, Third Edition, WEP East-West Press, New Delhi, 2010.

- George T. Austin., Shreve's Chemical Process Industries, Fifth Edition, McGraw Hill Professional, 2012
- Vincent Sauchelli., The Chemistry and Technology of Fertilizers, Reinhold Pub. Corp., 1960
- Editorial Committee - FAI Seminar on Fertilizer in India in the Seventies (Proceedings), The Fertilizer Association of India,New Delhi, 1973.
- Editorial Committee - Seminar on Recent Advances in Fertilizer Technology, The Fertilizer Association of India, New Delhi,1972.
- Sauchelli V., Manual on Fertilizer Manufacture, Industry Publication Inc, New Jersy, 1963.
- CHEMTECH - II - (Chapter on Fertilizers by Chari, K.S.), Chemical Engineering Education Development Centre, I.I.T.,Madras, 1977.
- Menon M.G., Fertilizer Industry - Introductory Survey, Higginbothams, Madras, 1973

19BTCEOE03 INDUSTRIAL WASTEWATER TREATMENT 3 0 0 3 100

COURSE OBJECTIVE

1. To introduce students to the principles of wastewater and solid waste treatment and management.

2. The students will learn the fundamental concepts in water and wastewater treatment technologies, hazardous solid waste disposal and management issues related to sludge treatment and disposal.

COURSE OUTCOME

After completion of the course, students are able to

1. Examine the constituents of waste water and its effects.
2. Separate the contaminants from the effluent for treatability.
3. Determine the biomass yield and substrate utilization rate for biological treatment process and design of activated sludge process.
4. Develop a flow sheet for the waste water treatment from dairy, sugar, pulp and paper, textile and pharmaceutical industries.
5. Develop process flow diagram for water reuse and sludge disposal

UNIT I INTRODUCTION TO WASTE WATER ENGINEERING

Waste Water Engineering - Overview, inorganic non-metallic constituents and metallic constituents, physical and biological Characteristics.

UNIT II UNIT OPERATIONS AND UNIT PROCESS

Screening, Flow Equalization, Mixing, Flocculation, Grit removal, Sedimentation, Coagulation, Precipitation, Oxidation and Neutralization

UNIT III FUNDAMENTALS OF BIOLOGICAL TREATMENT

Introduction, Microbial growth kinetics, types of biological process for wastewater treatment - aerobic and anaerobic oxidation, Biological Nitrification and De-nitrification, biological phosphorous removal, activated sludge process (with design Considerations), trickling filters and lagoons.

UNIT IV WASTE WATER TREATMENT IN SPECIFIC INDUSTRIES

Dairy, Sugar, Pulp and Paper, Textile and Pharmaceutical Industries.

UNIT V WATER REUSE

Wastewater reclamation technologies and reuse, Solid processing flow diagrams, sludge and scum pumping, grinding, screening, degritting, blending, anaerobic digestion, composting, conditioning, dewatering and incineration.

TOTAL : 45 Hrs

SUGGESTED READINGS

- Metcalf Eddy, Wastewater Engineering -Treatment and Reuse, Fourth Edition, Tata McGraw Hill, New Delhi, 2002.
- Mark J. Hammer, Water and Wastewater Technology, Seventh Edition, Prentice Hall of India Pvt Limited, New Delhi, 2012.
- James M. Montgomery, Water Treatment Principles and Design, First Edition, A Wiley Interscience publication, New York,1985

COURSE OBJECTIVE

1. To provide an understanding of solid and hazardous waste engineering principles and management issues

2. This course is designed to provide students with the necessary background and knowledge pertaining to the engineering design of solid and hazardous waste facilities

COURSE OUTCOME

1. After successful completion of the course, student will be able to
2. Outline the salient features of solid waste management and handling.
3. Deduce the source reduction, recycling and reuse techniques of solid waste.
4. Analyze the collection systems and method of transfer of solid waste.
5. Describe the processing techniques for solid and hazardous waste.
6. Select the suitable methods for disposal of solid and hazardous waste.
7. Interpret the legislation for management, handling and disposal of solid and hazardous waste.

UNIT I CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological properties of solid wastes - Percapita generation rates - Sampling and characterization of solid waste - Source reduction of wastes -Waste exchange - Recyclingand reuses - Salient features of Indian legislations on management and handling of municipal solid wastes.

UNIT II COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary containersystem (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer stationlocation- Means and methods of transfer.

UNIT III PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes.

UNIT IV HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design ofhazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management – AtomicEnergy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation -Nuclear power plants in India.

UNIT V NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear wastevitrification, ion exchange, synroc – long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse ofwaste - nuclear safety and waste regulation - case study on nuclear disaster - source of e-waste - material composition ofe-waste - recycling and recovery - integrated approaches to e-waste recycling - socio economic factors - treatment option -disposal option - e-waste legislation.

TEXT BOOKS

- Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York, 1993.
- Ronald E. Hester, Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.
- Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition, 1985.
- Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publication, 2002

B.TECH FOOD TECHNOLOGY **2019-2020**

19BTFTOE01 **PROCESSING OF FOOD MATERIALS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

1. Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds
2. Summarize the production and processing methods of fruits and vegetables
3. Discuss the chemical composition, processing, production, spoilage and quality of milk and milk products
4. Outline the overall processes involved in the production of meat, poultry and fish products
5. Review the production and processing methods of plantation and spice products

Course Outcomes:

1. Discuss the various processing technologies involved in cereal, pulses and oilseed technology
2. Demonstrate the major operations applied in fruits and vegetable processing
3. Illustrate the techniques involved in the processing of dairy products
4. Infer the production of different types of milk
5. List the overall processing of meat, poultry and fish processing
6. Outline the processing of spices and plantation products

Unit I - CEREAL, PULSES AND OIL SEEDS TECHNOLOGY

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies - Pasta products -Tortilla - Method of manufacture.

Unit II - FRUITS AND VEGETABLE PROCESSING

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

Unit III - DAIRY PROCESSING

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Icecream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

Unit IV - MEAT, POULTRY AND FISH PROCESSING

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing .

Unit V - PLANTATION PRODUCT TECHNOLOGY

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

SUGGESTED READINGS

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.
2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.
3. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

B.TECH FOOD TECHNOLOGY **2019-2020**

19BTFTOE02	**Nutrition and Dietetics**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives

1. Explain the basic concepts of food and nutrition
2. Define the overall classification, function, and source of carbohydrates, lipids and proteins
3. Discuss the overall aspects of vitamins
4. Outline the role of health and nutritional importance of micro and macro minerals
5. Summarize the recent trends in nutrition

Course outcomes

1. Discuss the basics in the area of nutritional assessment in health and disease
2. Categorize the recommended dietary allowances for different age groups
3. Express the classifications, functions and sources of carbohydrates, lipids and proteins
4. List the various attributes of fat and water soluble vitamins
5. Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals
6. Recognize the diets and concepts of foods suggested for nutrional, chronic and acute disorders

UNIT I - HUMAN NUTRITION

Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II - BIOMOLECULES

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

UNIT III - VITAMINS

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

UNIT IV - MINERALS

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNIT V - RECENT TRENDS IN NUTRITION

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

SUGGESTED READINGS

1. Gordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.
2. Shubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016.
3. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017.
4. Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003.
5. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2019.

B.TECH FOOD TECHNOLOGY **2019-2020**

19BTFTOE03 **Ready to Eat Foods** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Outline the current status of snack food Industry
2. Describe the production, processing and marketing trends of potato and tortilla chips
3. Outline the overall processing of popcorn
4. Explain the production and processing of fruits involved in snack food preparation
5. Summarize the sensory analysis methods and packaging techniques of snack foods

Course Outcomes (COs)

1. Review the overall aspects of snack food industry
2. Develop ready to eat foods from potato and maize flour
3. Demonstrate the various unit operations involved in the production of potato and tortilla chips
4. Illustrate the overall aspects of popcorn production
5. List the production, processing and manufacturing of fruit based snacks
6. Recognize the sensory analysis and packaging methods of snack foods

UNIT I SNACK FOOD INDUSTRY

Introduction-History-Past innovations- Outline of snack food industry- Nutrition-Total Quality Management of Technology-Domestic Snack Food Market-Global Market-Snack Food Association Future Considerations

UNIT II POTATO AND TORTILLA CHIPS PROCESSING

Potato Production- Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato.

Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations.

UNIT III POPCORN PROCESSING

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT IV FRUIT BASED SNACKS

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits.

UNIT V SENSORY EVALUATION AND PACKAGING

Introduction- Analytical methods-Sensory methods- Sensory Aspect of Processing- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Current Issues in Snack Foods Packaging

SUGGESTED READING

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
3. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

B.TECH FOOD TECHNOLOGY **2019-2020**

19BTFTOE04	**Agricultural Waste and Byproducts Utilization**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

1. Categorize the types of agricultural wastes
2. Outline the production and utilization of biomass
3. Explain the various parameters considered to be important in the designing of biogas units
4. Review the various methods employed in the production of alcohol from the byproducts of agricultural wastes
5. Summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes

Course Outcomes

1. List and group the types of agricultural wastes
2. Develop a number of value added products from agriculture wastes
3. Discuss the techniques and production involved in the utilization of biomass
4. Assess the various parameters considered to be important in the designing of biogas units
5. Illustrate the various methods employed in the production of alcohol from the byproducts of agricultural wastes
6. Choose the appropriate materials to produce paperboards and particle boards from agricultural wastes

UNIT 1-TYPES OF AGRICULTURAL WASTES

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT 2-BIOMASS PRODUCTION AND UTILIZATION

Biomass Gasifier, Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

UNIT 3-BIOGAS DESIGN AND PRODUCTION

Biogas: Definition, composition, history of biogas, Production of biogas; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogas plant.

UNIT 4-PRODUCTION OF ALCOHOL FROM WASTE MATERIALS

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT 5-PRODUCTION OF PAPERBOARDS AND PARTICLEBOARDS FROM AGRICULTURAL WASTE

Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps- Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

SUGGESTED READINGS

1. K M Sahay and K K Singh. Unit Operations of Agricultural Processing. Vikas Publishing House Pvt Ltd, Noida, Uttar Pradesh. 2nd Edition 2013.
2. Beggs C. Energy Management and Conservation. Elsevier Pulication. 2nd Edition 2009.
3. Chaturvedi P. 2009. Energy Management: Challenges for the Next Millennium. Concept Publishing Co. 1st Edition 2000.
4. Fardo SW, Patrick DR, Richardson RE and Fardo BW. Energy Conservation Guidebook. The Fairmont Press. 3rd Edition 2014.
5. Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press. 2000.

19BEBMEOE01 ROBOTICS IN MEDICINE 3 0 0 3 100

OBJECTIVES

The goal of this course is for students

1. To understand the basics of Robotics, Kinematics.
2. To understand the basics of Inverse Kinematics.
3. To explore various kinematic motion planning solutions for various Robotic configurations.
4. To study the trajectory planning for robot.
5. To understand the task level programming
6. To explore various applications of Robots in Medicine

OUTCOMES

Upon completion of this course, students will be able to:

1. Explain various kinds robotics techniques, vision, planning and applications.
2. Outline the basic concept of robotics
3. Identify and discuss the Robot Vision
4. Describe about manipulators and kinematics.
5. Demonstrate Task level programming
6. Discuss the applications of robotic systems in medical field.

UNIT I INTRODUCTION

Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot

UNIT II KINEMATICS

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

UNIT III ROBOT VISION

Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured illumination, Camera calibration.

UNIT IV PLANNING

Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation.

UNIT V APPLICATIONS

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical
– Gynecology, Orthopaedics, Neurosurgery

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Robert Schilling	Fundamentals of Robotics-Analysis and control	Prentice Hall	2003

2	J.J.Craig	Introduction to Robotics ,	Pearson Education	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Staugaard, Andrew C	Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning	Prentice Hall Of India	1987
2	Grover, Wiess, Nagel, Oderey	Industrial Robotics: Technology, Programming and Applications	McGraw Hill	1986.
3	Wolfram Stadler	Analytical Robotics and Mechatronics	McGraw Hill,	1995
4	Saeed B. Niku,	Introduction to Robotics: Analysis, Systems, Applications	Prentice Hall	2001
5	K. S. Fu, R. C. Gonzales and C. S. G. Lee	Robotics	McGraw Hill	2008

19BEBMEOE02 VIRTUAL REALITY AND AUGMENTED REALITY 3 0 0 3 100

OBJECTIVES:

1. To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
2. To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
3. To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I INTRODUCTION

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback..

UNIT II VR DEVELOPMENT PROCESS

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR ON THE WEB & VR ON THE MOBILE

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT V APPLICATIONS

Medical applications-military applications-robotics applications- Advanced Real time Tracking other applications- games, movies, simulations, therapy.

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	C. Burdea & Philippe Coiffet	Virtual Reality Technology	1. Second Edition,	2008
2	Jason Jerald	. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool	New York, NY, US	-

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Dieter Schmalstieg & Tobias Hollerer	Augmented Reality: Principles and Practice (Usability)	Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States	2016
2	Steve Aukstakalnis,	Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)	Addison-Wesley Professional 1 edition,	2016
3	Robert Scoble & Shel Israel	The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything	, Patrick Brewster Press	2016
4	Tony Parisi,	2. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile	O'Reilly Media; 1 edition	2015
5	Tony Parisi	Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages	O'Reilly Media; 1 edition	2014
6	Jos Dirksen	Learning Three.js: The JavaScript 3D Library for WebGL	Packt Publishing - ebooks Account; 2nd Revised ed. Edition	2015

19BEBMEOE03 ARTIFICIAL ORGANS AND IMPLANTS 3 0 0 3 100

OBJECTIVES

The goal of this course is for students:

1. To discuss the overview of artificial organs &transplants
2. To extend the principles of implant design with a casestudy
3. To explain the implant design parameters and solution inuse
4. To simplify about various blood interfacingimplants
5. To know the biocompatibility of artificial organs
6. To learn about the implantable medical devices

OUTCOMES

Upon completion of this course, students will be able to:

1. Explain the implant design parameters and solution inuse
2. Analyze about various blood interfacing implants
3. Evaluate response of biomaterials in living system
4. Perceive knowledge about artificial organs &transplants
5. Demonstrate different types of soft tissue replacement and hard tissuereplacement
6. Assess biocompatibility of artificial organs

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS

ARTIFICIAL ORGANS:-Introduction, outlook for organ replacements, design consideration, evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN

Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication

1	Kopff W.J	Artificial Organs	John Wiley and sons, New York, 1st edition	1976
2	Park J.B.,	Biomaterials Science and Engineering	Plenum Press	1984

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	J D Bronzino	Biomedical Engineering handbook Volume II	CRC Press / IEEE Press	2000
2	R S Khandpur	Handbook of Biomedical Instrumentation	Tata McGraw Hill	2003
3	Joon B Park	Biomaterials – An Introduction	Plenum press, New York	1992
4	Yannas, I. V	Tissue and Organ Regeneration in Adults	New York, NY: Springer	2001
5	Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino	Clinical Engineering	CRC Press, 1st edition	2010
6	Myer Kutz	Standard Handbook of Biomedical Engineering & Design	McGraw- Hill	2003

19BECEOE01 HOUSING PLAN AND MANAGEMENT 3 0 0 3 100

COURSE OBJECTIVES

1. To examine the role and tasks of basic housing policies and building bye laws
2. Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
3. Analyze the Innovative construction methods and Materials
4. Analyze city management strategies and strengthen the urban governance through a problem solving approach
5. To know the Importance of basic housing policies and building bye laws
6. To use Housing Programmes and Schemes

COURSE OUTCOME

The students will be able to

1. Know the Importance of basic housing policies and building bye laws
2. Use Housing Programmes and Schemes
3. Plan and Design of Housing projects
4. Examine Innovative construction methods and Materials
5. Know Housing finance and loan approval procedures
6. Understand Construction as well as managing techniques

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 2001.

REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 2000.

19BECEOE02 BUILDING SERVICES 3 0 0 3 100

COURSE OBJECTIVES

1. Defining and identifying of eng. services systems in buildings.
2. The role of eng. services systems in providing comfort and facilitating life of users of the building.
3. The basic principles of asset management in a building & facilities maintenance environment
4. Importance of Fire safety and its installation techniques
5. To Know the principle of Refrigeration and application
6. To Understand Electrical system and its selection criteria

COURSE OUTCOME

The students will be able to

1. Machineries involved in building construction
2. Understand Electrical system and its selection criteria
3. Use the Principles of illumination & design
4. Know the principle of Refrigeration and application
5. Importance of Fire safety and its installation techniques
6. Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled

liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

TEXT BOOKS

1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 2002.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCES

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
2 A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 2005.
3 National Building Code.

19BECEOE03 REPAIR AND REHABILITATION OF STRUCTURES 3 0 0 3 100

COURSE OBJECTIVES

1. To learn various distress and damages to concrete and masonry structures
2. To know the influence of corrosion in durability of structures
3. To understand the importance of maintenance of structures
4. To study the various types and properties of repair materials
5. To learn various techniques involved in demolition of structures
6. To Assessing damage of structures and various repair techniques

COURSE OUTCOME

By the end of this course students will have the capability/knowledge of

1. Various distress and damages to concrete and masonry structures
2. Durability of structures and corrosion mechanism
3. The importance of maintenance of structures, types and properties of repair materials etc
4. Assessing damage of structures and various repair techniques
5. Modern technique and equipment being adopted for the demolition of structures
6. Influence of corrosion in durability of structures

UNIT – I INTRODUCTION

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNIT – II DURABILITY OF STRUCTURES

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT - III MAINTENANCE AND REPAIR STRATEGIES

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT - IV MATERIALS FOR REPAIR

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

UNIT - V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES

Non-destructive Testing Techniques, Corrosion protection techniques , Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies

TEXT BOOK

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Repair of Concrete Structures	R.T.Allen and S.C.Edwards	Blakie and Sons, UK,	2011

REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Rehabilitation of concrete structures	Dr.B.Vidivelli	Standard publishers, Chennai.	2011

WEBSITES:

- http://www.icivilengineer.com
- http://www.engineeringcivil.com/
- http://www.aboutcivil.com/
- http://www.engineersdaily.com
- http://www.asce.org/
- http://www.cif.org/
- http://icevirtuallibrary.com/
- http://www.ice.org.uk/
- http://www.engineering-software.com/ce/

19BECE0E04 COMPUTER-AIDED CIVIL ENGINEERING DRAWING 3 0 0 3 100

COURSE OBJECTIVES

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically/ visually
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings
5. to produce designs using a combination of 2D and 3D software.
6. Get a Detailed study of an engineering artifact

COURSE OUTCOME

The students will be able to

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically/ visually
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact
6. Planning and designing of structures

UNIT 1:*INTRODUCTION*; Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards. 9

UNIT 2: *SYMBOLS AND SIGN CONVENTIONS*: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards 9

UNIT 3: *MASONRY BONDS:* English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall 9

UNIT 4: *BUILDING DRAWING*: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity 9

UNIT 5: *PICTORIAL VIEW*: Principles of isometrics and perspective drawing. Perspective view of building. 9

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows.
2. Single storey RCC building
3. Multistorey RCC building

Text/Reference Books:

1. Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing" , Standard Publishers
2. Ajeet Singh (2002), " Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham Tickoo Swapna D (2009), " AUTOCAD for Engineers and Designers" , Pearson Education,
4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.,
5. Balagopal and Prabhu (1987), " Building Drawing and Detailing", Spades publishing KDR building, Calicut